PART II: HAZARD SPECIFIC INFORMATION

- Earthquake
- Wildfire
- Climate Change
- Energy Disruption
- Landslide, Mudflows, and Debris Flows
- Windstorm
- Flood / Severe Winter Storm
- Pandemic
- Terrorism and Mass Violence

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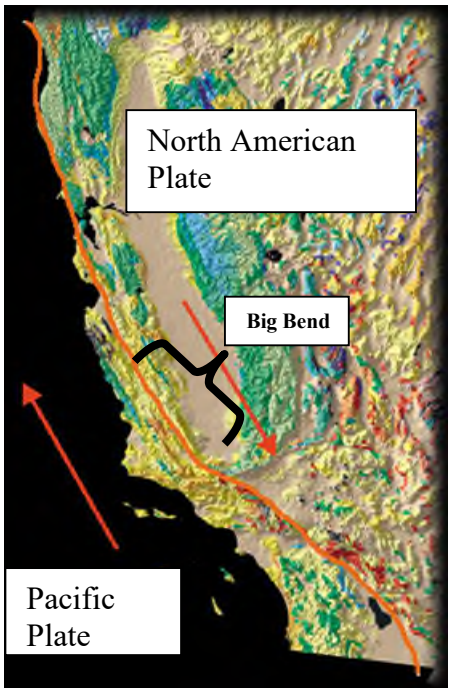
SECTION 6. EARTHQUAKE

THE NATURE OF THE EARTHQUAKE THREAT

Earthquakes occur at the boundaries of the Earth's tectonic plates as they move relative to one another. The tectonic boundary between the Pacific Plate and the North American Plate in California is along the San Andreas Fault. The fault is a transform boundary where the plates are sliding horizontally past one another.

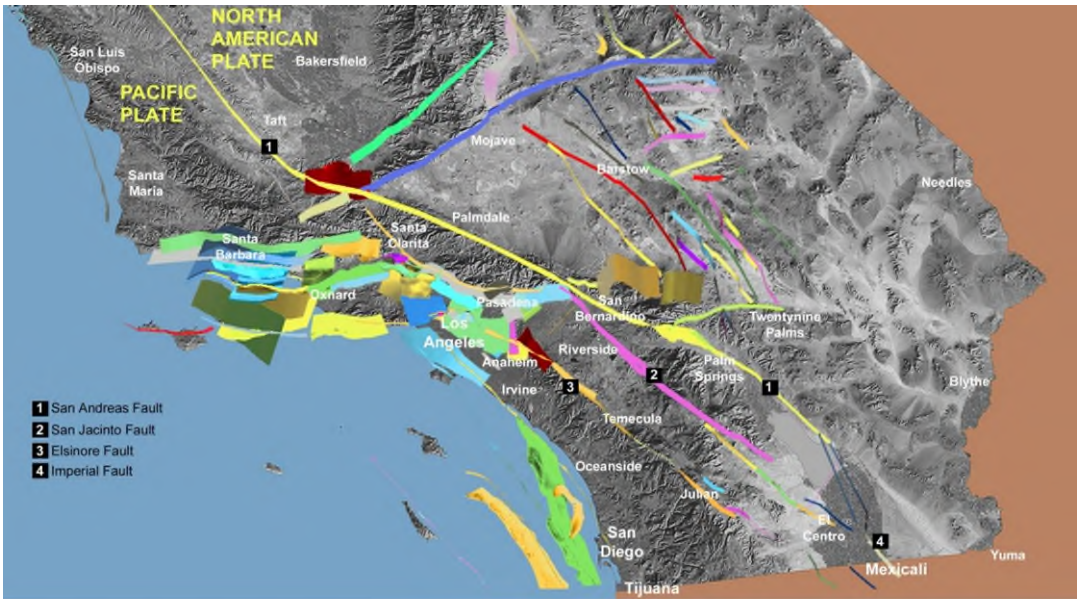
The risk of earthquakes in southern California is exacerbated by the fact that the two plates are inhibited in their motion by what is known as the "Big Bend". In this section of the San Andreas the fault curves to the west then curves back to the north. This creates a barrier to simple lateral motion. This bend is a convergent (restraining) bend, creating a localized collision of tectonic plates, generating a tremendous amount of compression stress.

To release this stress, additional faults have formed over time. The "Big Bend" of the San Andreas Fault is thought to be responsible for much of the complexity of faulting in Southern California



Map 40: San Andreas Fault "Big Bend"

The map below depicts several parallel faults to the San Andreas Fault. These four faults are considered to be responsible for approximately half of the significant earthquakes in the region.

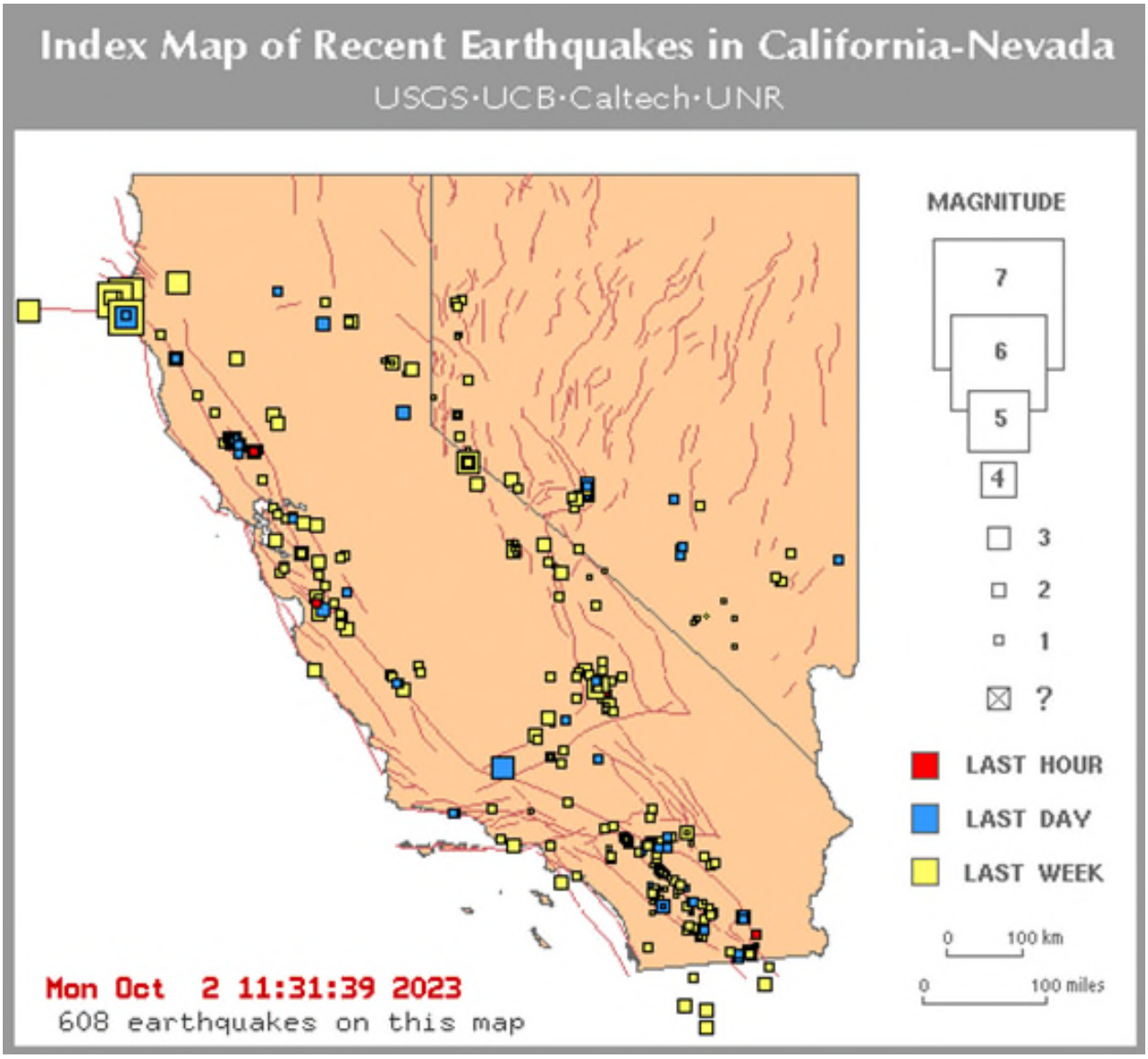


Map 41: Parallel Faults to the San Andreas Fault

SOURCE: Southern California Earthquake Center (SCEC)

HISTORICAL RECORD OF EARTHQUAKES IN SOUTHERN CALIFORNIA

Earthquakes occur *every* day in Southern California. Most are small with a magnitude less than M1. The below map depicts major faults in the Southern California region and recent seismic activity.



Map 42: Los Angeles County Earthquakes for the Past 7 Days

SOURCE: USGS-Caltech Seismic Net

History of Significant Earthquakes in Southern California

The chart below provides examples of 37 significant earthquakes (5.0M or above) in Southern California since 1857.

Date	Time	Location	Magnitude
01.09.1857	8:24 AM	Fort Tejon	7.9
02.24.1892	11:20 PM	Laguna Salada	7.3
12.25.1899	4:25 AM	San Jacinto/Hemet	6.7
04.21.1918	2:31 PM	San Jacinto	6.8
06.29.1925	7:42 AM	Santa Barbara	6.8
11.4.1927	5:51 PM	Offshore Lompoc	7.1
03.10.1933	5:54 PM	Long Beach	6.4
05.18.1940	8:37 PM	Imperial Valley	6.9
04.10.1947	7:58 AM	Manix	6.5
07.21.1952	3:52 AM	Kern County	7.5
04.9.1968	6:29 PM	Borrego Mountain	6.6
02.9.1971	6:01 AM	San Fernando	6.6
10.15.1979	4:16 PM	Imperial Valley	6.4
07.8.1986	2:21 AM	North Palm Springs	5.7
10.1.1987	7:42 AM	Whittier Narrows	5.9
11.24.1987	5:15 AM	Superstition Hills	6.6
06.28.1991	7:43 AM	Sierra Madre	5.8
04.22.1992	9:50 PM	Joshua Tree	6.1
06.28.1992	4:57 AM	Landers	7.3
06.28.1992	8:05 AM	Big Bear	6.3
01.17.1994	4:30 AM	Northridge	6.7
10.16.1999	2:46 AM	Hector Mine	7.1
12.22.2003	11:15 AM	San Simeon	6.5
07.29.2008	11:42 AM	Chino Hills	5.4
12.30.2009	10:48 AM	Northern Baja	5.8
07.7.2010	11:53 PM	Borrego Springs	5.4
08.26.2012	7:31 PM	Brawley	5.3
08.26.2012	8:57 PM	Brawley	5.4
12.14.2012	10:36 AM	Avalon	6.3
03.29.2014	4:09 AM	Brea	5.1
06.10.2016	1:04 PM	Borrego Springs	5.2
04.5.2018	12:29 PM	Santa Cruz Is	5.3
07.4.2019	10:33 AM	Searles Valley	6.4
07.5.2019	8:19 PM	Ridgecrest	7.1
06.3.2020	6:32 PM	Searles Valley	5.5
06.24.2020	10:40 PM	Lone Pine	5.8
06.5.2021	10:55 PM	Calipartria	5.3

Table 132: Significant Southern California Earthquakes Since 1857

SOURCE: Southern California Earthquake Center (SCEC) and Southern California Seismic Network

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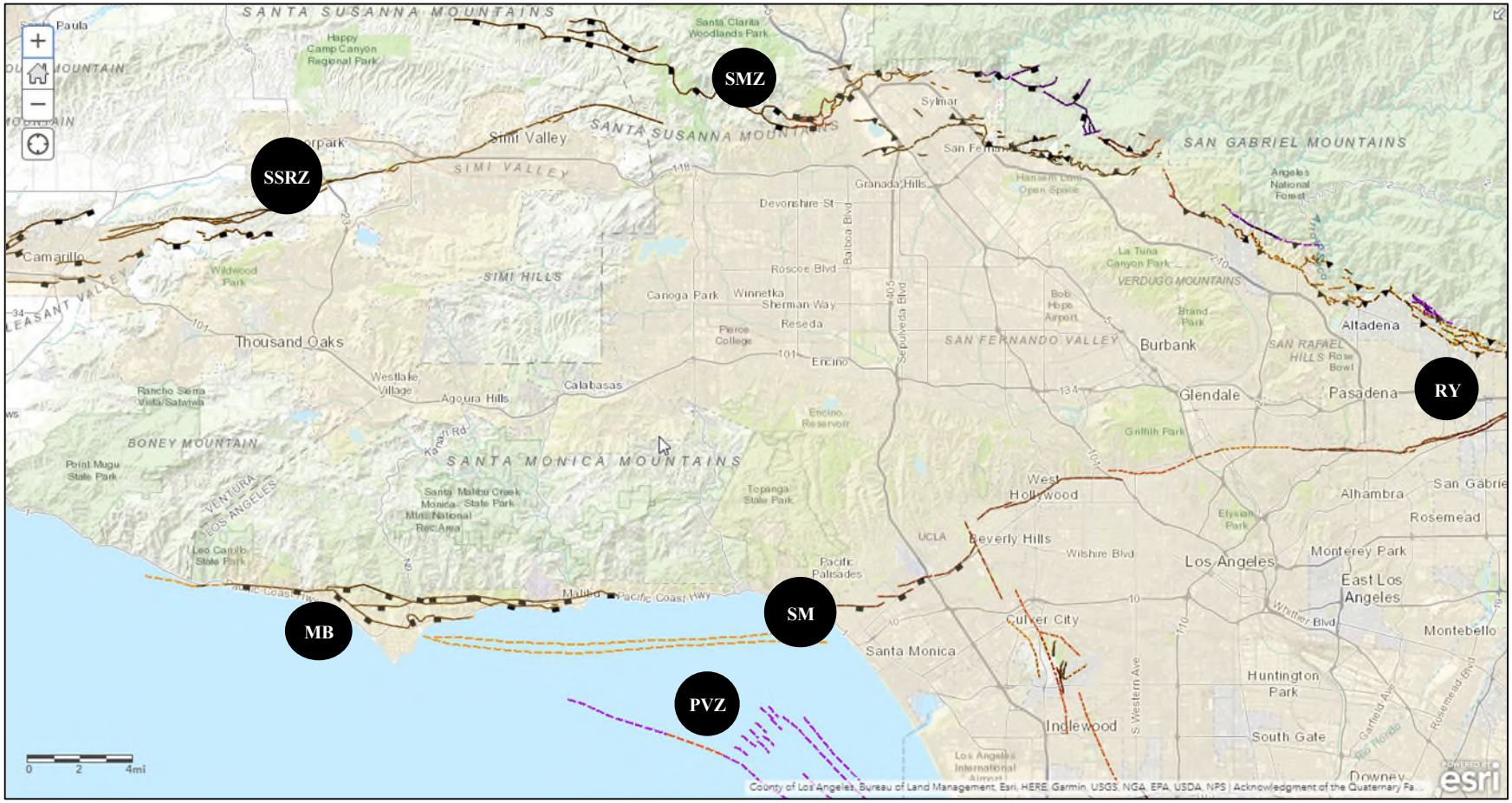
CAUSES AND CHARACTERISTICS OF EARTHQUAKES

Earthquake Faults In or Near the Las Virgenes-Malibu Region

There are multiple fault zones in proximity to the Las Virgenes-Malibu Region.



Map 43: Earthquake Faults in the LVMCOG Region

Fault Map Code	Fault Name	Probable Magnitude	Length	Distance to LVMCOG	Direction from the LVMCOG
MB	Malibu Coast Fault	6.0 – 7.0 M_w	21.1 miles	0 miles	S
SM	Santa Monica Fault	6.0 – 7.0 M_w	15.0 miles	10 miles	SE
PVZ	Palos Verdes Fault Zone	6.0 – 7.0 M_w	49.7 miles	4 miles	S
SSRZ	Simi-Santa Rosa Fault Zone	6.5 – 7.0 M_w	24.9 miles	8 miles	NW
SMFZ	Sierra Madre Fault Zone	6.0 – 7.0 M_w	46.6 miles	10 miles	N/NE
RY	Raymond Fault	6.0 – 7.0 M_w	16.2 miles	25 miles	E

SOURCE: U.S. Geological Survey and California Geological Survey, 2006, Quaternary fault and fold database for the United States, accessed 1/7/2010, from USGS web site: http//earthquakes.usgs.gov/regional/qfaults/

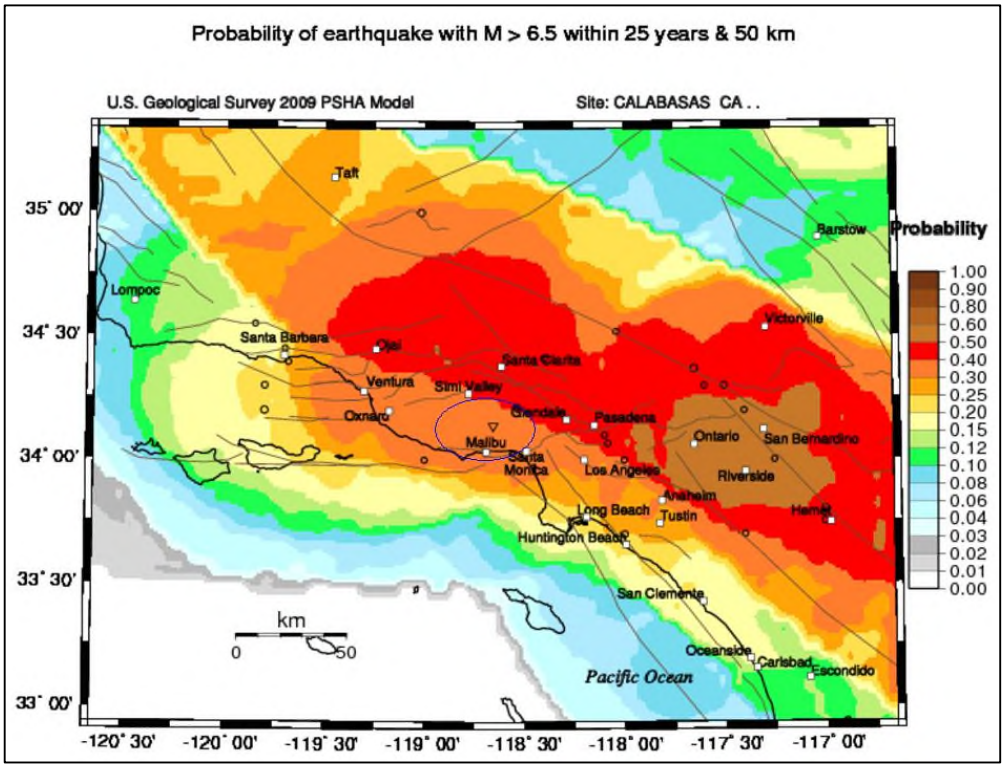
Las Virgenes-Malibu Region Earthquake Probability

According to the U.S. Geological Survey the probability within the next 30 years for the Los Angeles Region is:

93% that an earthquake measuring magnitude 6.7
75% that an earthquake measuring magnitude 7
36% that an earthquake measuring magnitude 7.5

Southern California region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	0.24	(0.7)	100%	(1.0)	1.0
6	2.3	(0.9)	100%	(1.0)	1.0
6.7	12	(1.5)	93%	(1.0)	1.0
7	25	(1.4)	75%	(0.9)	1.1
7.5	87	(1.2)	36%	(0.9)	1.2
8	522	(0.4)	7%	(2.5)	1.3

In addition, according to the Earthquake Probabilistic Seismic Hazard Assessment (PSHA) model, there is a 30 to 40% chance that the Las Virgenes-Malibu Region will experience an earthquake of magnitude 6.5 or greater within the next 25 years.



Map 44: Southern California PHSA Model (USGS)

An earthquake of M6.5 or larger could cause a considerable number of casualties, as well as extensive damage to buildings, infrastructure, and critical facilities. The effects would be aggravated by aftershocks and secondary effects such as fire and landslides. In the event of a catastrophic earthquake, the capacity of the region to respond on its own would quickly become overwhelmed and assistance from surrounding municipalities, as well as the state and federal governments would be needed.

Following a major earthquake:

- Extensive search and rescue operations would be required
- The demand for emergency medical care would increase
- Food and temporary shelter would have to be provided for displaced individuals

Furthermore, it is likely emergency operations would be hampered by the loss of critical infrastructure and roads, damage to critical facilities, disruption of utilities, and communications disruptions. During the recovery period, extensive efforts would be required to remove debris, clear roadways, demolish unsafe structures, restore public utilities, and provide continuing care for the affected population including temporary shelters for displaced people. Finally, secondary issues such as hazardous materials releases and civil unrest could further strain resources.

ShakeMap Scenarios

Predicted ground shaking patterns throughout southern California for hypothetical scenario earthquakes are available from the United States Geological Survey as part of their on-going "ShakeMap" program. These maps are provided in terms of Instrumental Intensity, which is essentially Modified Mercalli Intensity (MMI) estimated from instrumental ground motion recordings. The following scenarios depict strong ground shaking patterns for the 1994 Northridge Earthquake and three hypothetical scenario events:

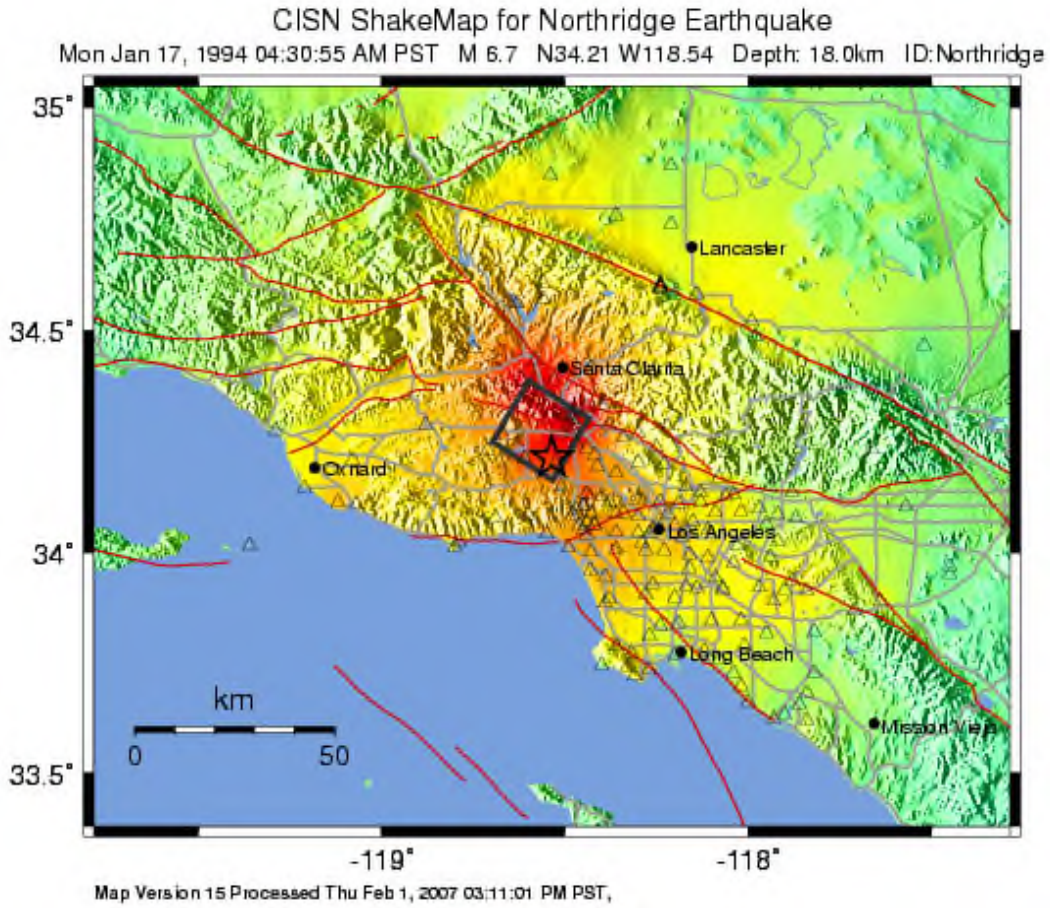
- M 6.7 1994 Northridge Earthquake
- M 6.6 Earthquake on the Santa Monica Fault Scenario
- M 6.9 Earthquake on the Newport-Inglewood Fault Scenario
- M 7.8 San Andreas Fault ShakeOut Scenario

Modeling various scenarios is useful in estimating the likely impact to local populations, infrastructure, and facilities. This information can be used to assist emergency managers and the public to better prepare for future events. Further, these studies and scenarios were used to further refine the estimated vulnerabilities and consequences of a major earthquake in the region for this HMP.

1994 Northridge Earthquake

The most recent significant seismic event in the area was the 1994 Northridge Earthquake. In terms of human impact, sixty people were killed, more than 7,000 injured, and 20,000 were left homeless.

- The shaking heavily damaged communities throughout the San Fernando Valley, Simi Valley, and the areas north and west of Los Angeles. It is estimated that the event resulted in $20 billion in losses (USGS).
- More than 1,600 buildings were "red-tagged" as unsafe to enter and another 7,300 buildings were "yellow-tagged" and restricted to limited entry. Thousands of other structures experienced minor damage.
- The impact to local infrastructure included sink holes in local roads, damaged water lines, ruptured gas lines, electrical power outages, pipeline distribution system damage, and communications disruptions.
- Seven major freeway bridges in the area collapsed and 170 were damaged - disrupting traffic in the Ventura-Los Angeles region for weeks following the earthquake.

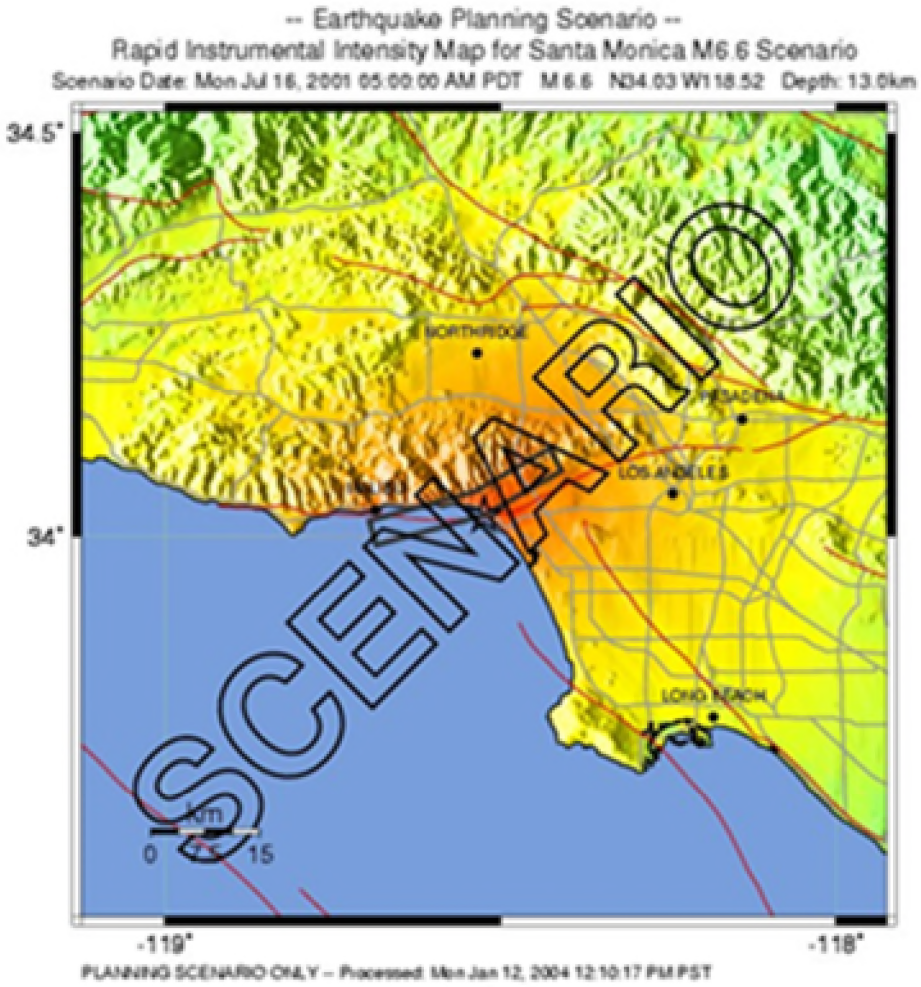


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Map 45: Northridge Earthquake ShakeMap

Santa Monica Fault Scenario

A M6.6 earthquake on the Santa Monica fault reflects a scenario that would result in Strong to Very Strong shaking in the Las Virgenes-Malibu Region with light to moderate potential damage.

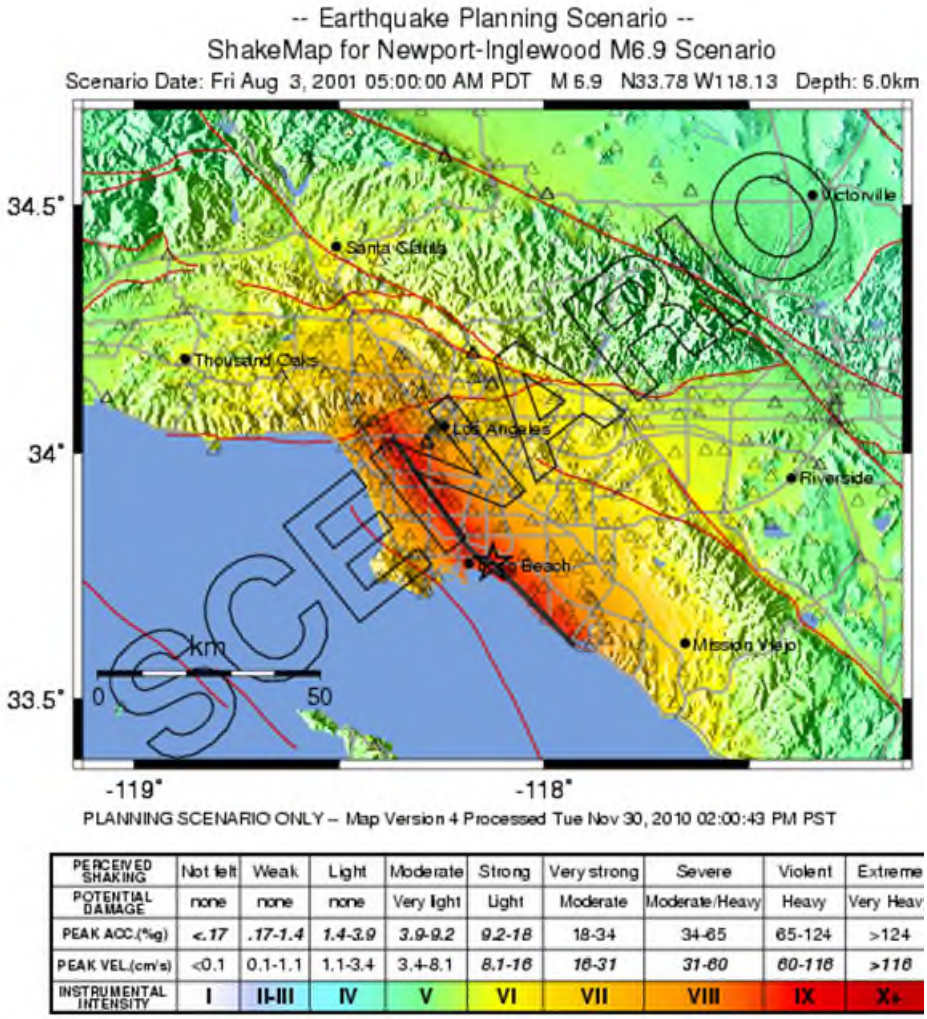


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Map 46: Santa Monica Fault Scenario ShakeMap

Newport-Inglewood Fault Scenario

A M6.9 earthquake on the Newport-Inglewood fault would result in parts of the Las Virgenes-Malibu Region experiencing very Strong to Severe shaking and potential damage could range from Moderate to Moderate/Heavy.

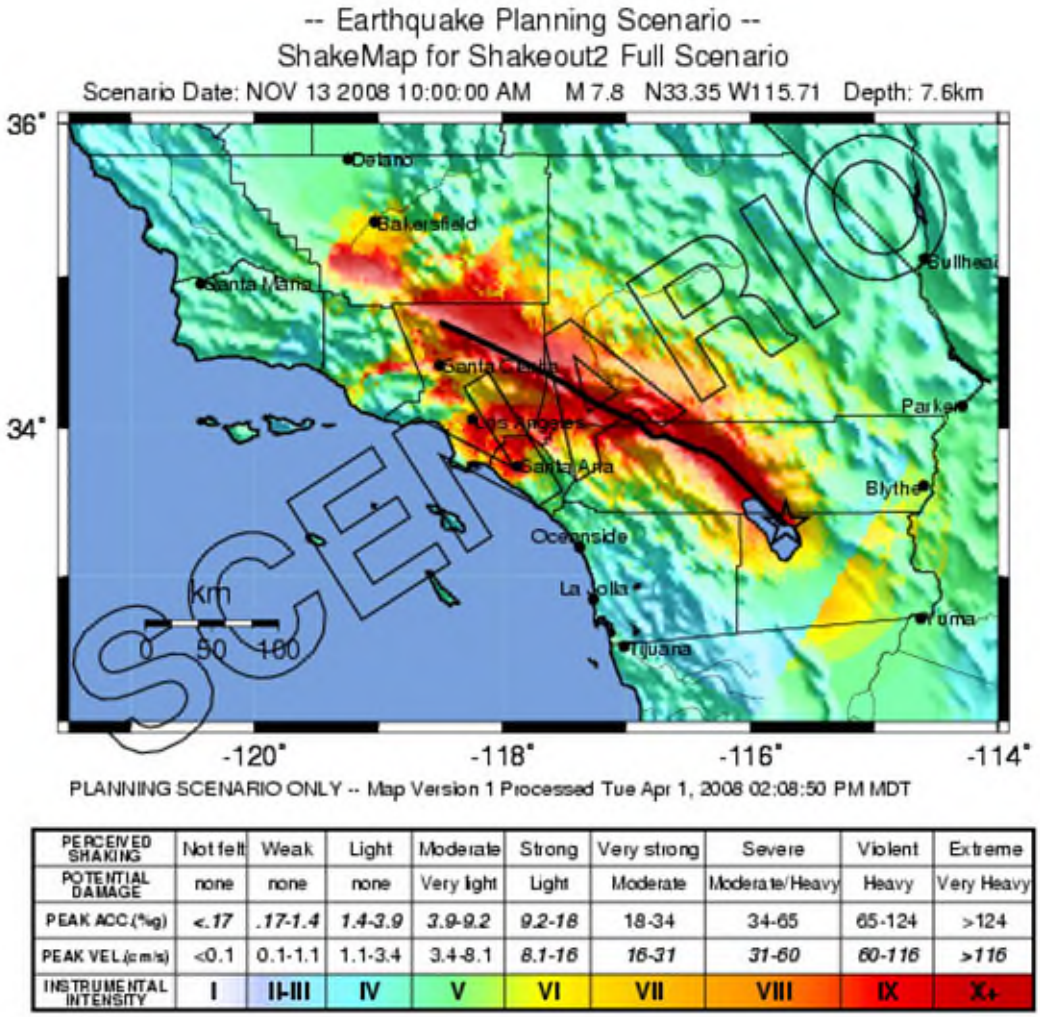


Map 47: Newport-Inglewood Fault Scenario ShakeMap

San Andreas Fault ShakeOut Scenario

A San Andreas earthquake has been used as the scenario for the annual ShakeOut Earthquake exercise and serves a basis for statewide emergency response exercises. Over 300 scientists, engineers, and others developed the San Andreas ShakeMap to study the likely consequences of a M7.8 earthquake on the San Andreas Fault.

The scenario estimates over 1,800 deaths, 50,000 injuries, $200 billion in damages and other losses, and severe, long lasting disruptions with regional implications



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Map 48: San Andreas Fault Scenario ShakeMap

EARTHQUAKE HAZARD IDENTIFICATION

A major earthquake impacting the Las Virgenes-Malibu area will likely result in casualties, damage to structures, and disruptions to critical infrastructure (roads, bridges, lifelines, etc.). In addition, the long-term impact to the local economy can be significant. The examples listed below provide brief descriptions of the types of damage that can be anticipated.

Casualties

Collapsed structures or falling debris can kill or injure hundreds of people and trap others. Trained search and rescue teams will be needed to pull many of the injured from badly damaged or partially collapsed structures. However, it may take rescuers many hours, perhaps days after the earthquake to free trapped people.

Additionally, damage to the transportation infrastructure could impede emergency responders. Furthermore, hospitals may not be able to provide care to the injured due to overcrowding and damage to their facilities.

Structures

In most California communities (including areas in the Las Virgenes-Malibu Region) many buildings were built before 1993 when building codes were not as strict as after the 1994 Northridge Earthquake. In addition, retrofitting is not required except under certain conditions and can be expensive. Therefore, the number of buildings at risk in the Southern California area remains a concern.

Transportation Infrastructure

Residents in the Las Virgenes-Malibu Region commute frequently by automobiles and public transportation. An earthquake can greatly damage bridges, tunnels, roads, and freeways. Although Caltrans has retrofitted numerous freeway bridges in California, there are still some that are not retrofitted. The Federal Highway Administration requires that bridges listed on the National Bridge Inventory be inspected every 2 years.

The resulting disruption caused by a major earthquake can hamper emergency response efforts and the normal movement of people and goods. Life and commerce within the region is highly dependent on the transportation infrastructure and the economic recovery of the region depends on how quickly repairs are completed. Recovery would begin with inspectors from local and state transportation agencies evaluating damage and recommending closures, scheduling immediate repairs, and studying more extensive repairs and replacement.

Lifelines

Lifelines include water, natural gas, electric power generation and distribution systems, fuel pipelines, sewer, and telecommunications systems. Ground shaking and amplification can cause pipes to break, power and telephone lines to fall, and damage cell phone and radio towers. A disruption to lifelines will hamper rescue, recovery, and rebuilding efforts as well as interrupt the distribution of important information to the public. Examples include:

- Ground shaking and ground deformation can damage pipelines and may rip many apart. Further, if soils liquefy pipelines may float or move laterally with the blocks of soil displaced by lateral spreading.
- Water pumping stations and wells are dependent on electrical power that may be unavailable in the days following an event.
- Damage to sewage pipelines can result in waste spills and failures.
- Damage to natural gas lines can result in fires or explosions as well as service disruptions.
- Power used in the Las Virgenes-Malibu Region is transported via a system of high-voltage transmission lines. Electrical transmission lines (overhead lines, power poles, and underground utility conduits) and distribution facilities (substations) can be disrupted or damaged. Ground failures such as landslides could damage lines and may take months to repair depending on accessibility. In addition, large porcelain insulators, bushings, and transformers are vulnerable to moderate ground motions and damaged transformers may take months to replace. Redundancies built into the electrical grid should mitigate some of the impact; however, a major earthquake will almost certainly disrupt the local electrical grid.
- Communications systems are vulnerable to overload in the minutes and hours following a major event. The communications infrastructure is comprised in part of hard-wired telephone and cable TV systems, microwave transmission stations, cellular telephone systems, and radio systems. Cellular systems are dependent on the hardwired connections between cell towers and land-based telephone systems. Hardwired systems and the cell phone infrastructure are owned and operated by private companies such as AT&T, Verizon, and Charter.

Fire

Downed power lines or broken gas pipelines can trigger fires. Furthermore, multiple fire emergencies may occur simultaneously. Major incidents will demand a larger share of resources and smaller fires may receive little or insufficient resources. Also, it may be more difficult for fire departments to respond to fire emergencies if fire stations suffer building damage. Finally, loss of electricity may cause pump failures resulting in a loss of water pressure in some communities, further hampering firefighting efforts.

Economy

Economic impacts include direct property damage, lost business output and productivity, business failures, business relocations, and a long term reduction in the economic base of the community. Damage to roads, bridges and buildings can impact the private sector's ability to conduct business as well as reduce consumer traffic. Consequently, companies that experience only minimal physical loss could suffer significant customer and revenue loss. Small businesses are especially vulnerable since they generally have fewer resources and are less likely to have prepared or planned for such an event.

Estimated Impact of an Event

If a major or great earthquake were to occur, the consequences to local populations, employment, and housing will be significant. The table below provides the estimated impact of a disaster using a 10% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 10% Loss Occurs
Population*	20,362	23,410	2,182	10,915	8,081	6,495
Total City Employment	11,100	11,800	5	6,483	3,700	3,309
Economy**	$621,000	$1,011,348	N/A	$578,443	$576,306	$278,710
Total Housing Units	7,799	9,401	692	6,936	3,273	2,810
Median Home Value	$857,700	$1,141,600	More than $2,000,000	More than $2,000,000	$1,029,100	More than $3.9B

Table 133: Estimated Population and Economic Loss of an Earthquake
*U.S. Census – American Community Survey 2021
**2017 U.S. Economic Census (in thousands)

Based on a 10% loss projection, more than 6,400 people would be displaced or significantly impacted, and more than 3,300 jobs could be lost (either temporarily or permanently) causing nearly $278M in economic losses. Also, more than 2,800 homes could be damaged or destroyed resulting in over $3.9 billion in losses (see Community Profile section for population, housing, and economic data).

Risk of Future Earthquake

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 9.28 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

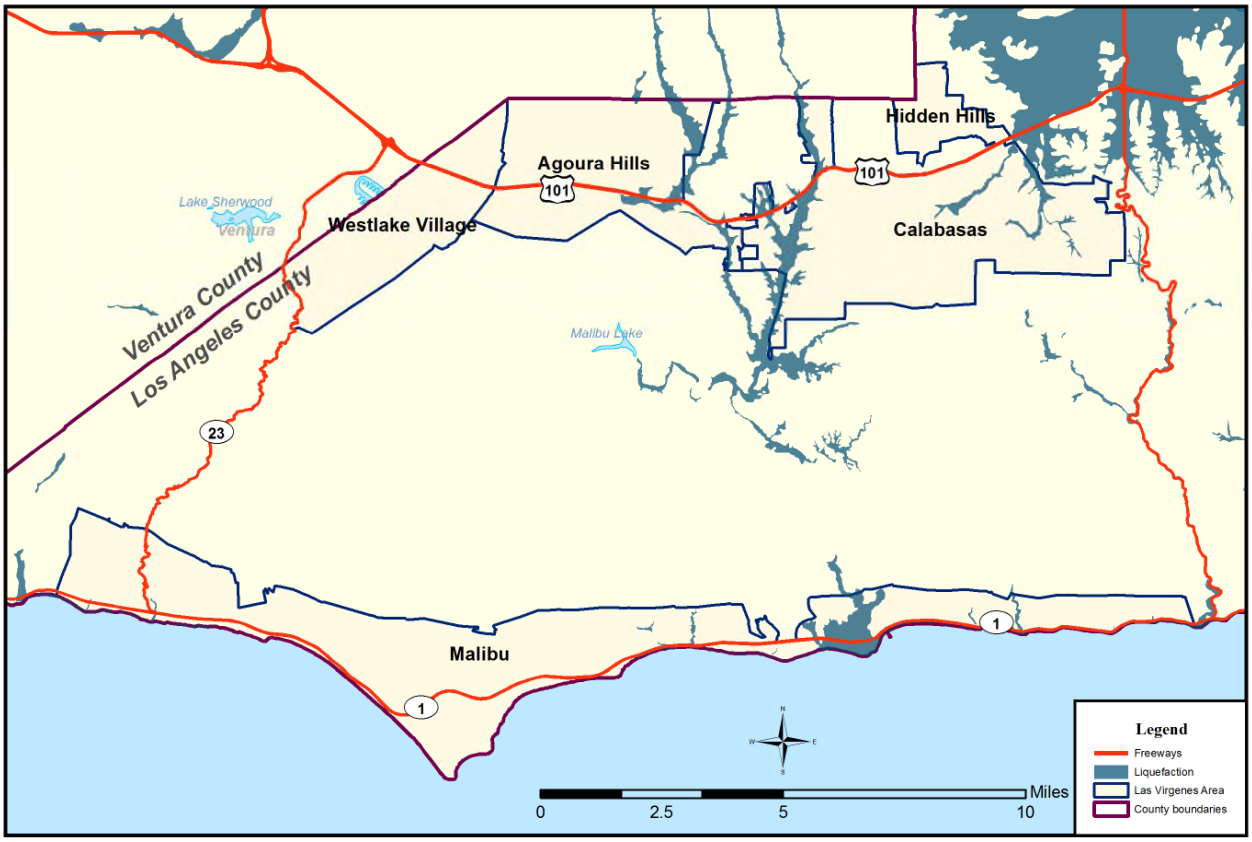
Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Earthquake	8.5	5	20	9.5	9.28

EARTHQUAKE VULNERABILITIES

Liquefaction

Buildings above liquefiable soils may settle or tip due to a loss of bearing capacity of the soil. Liquefaction occurs when soil grains in loose, saturated silty, sandy, or gravel soils attempt to rearrange themselves in a denser configuration when subjected to strong earthquake ground motions. The resulting increase in pressure of the water in the voids of the soil temporarily transforms the soil into a fluid, causing the soil to lose much of its strength. As the pore-water pressure builds, ground water and liquefied soil may find their way to the surface, creating sand boils on the ground surface. Several types of damaging ground failures can occur due to liquefaction including lateral spreading, ground settlement and sink holes.

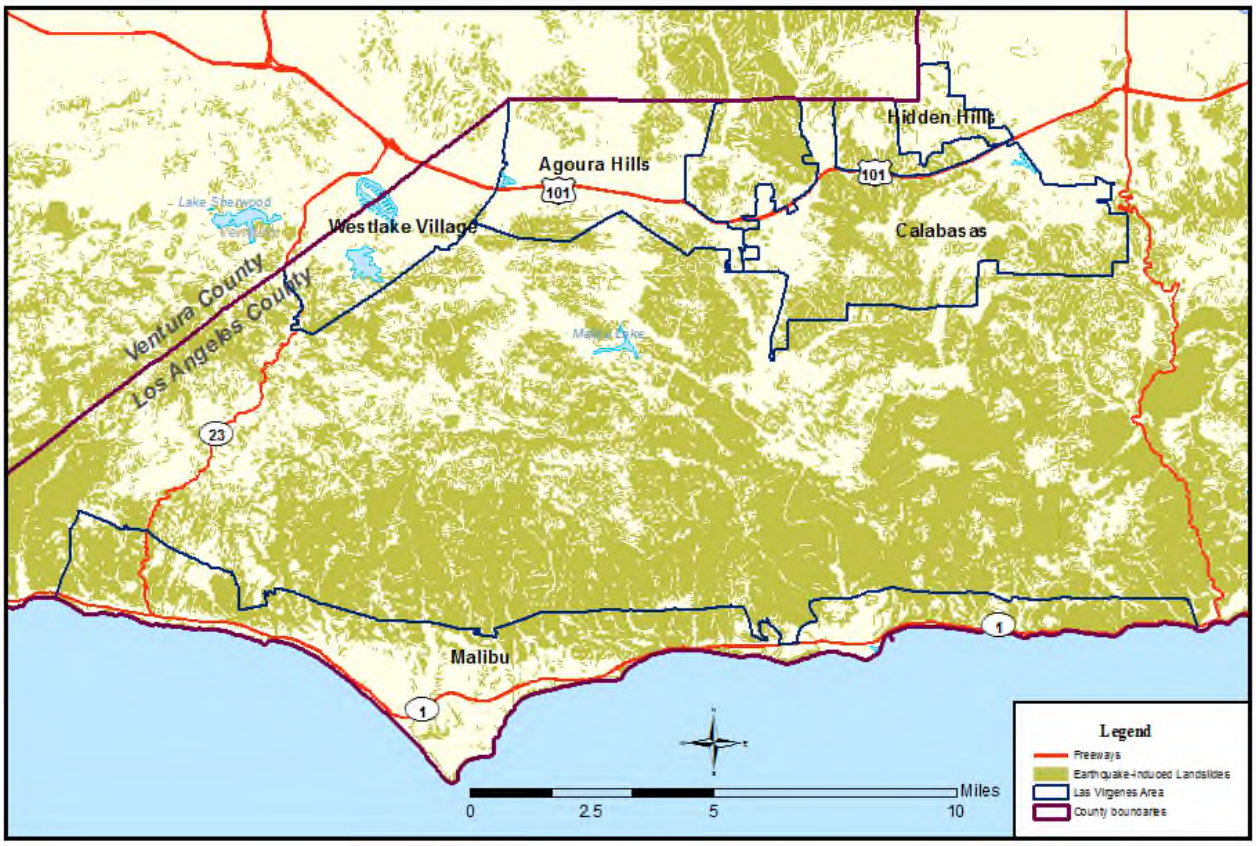
Lateral spreading occurs when the subsurface soil liquefies. Gravity and inertial forces from the earthquake cause the mass to move downslope. Lateral spreading can occur on very shallow slopes (nearly flat ground) and they can cause ground displacements ranging from inches to tens of feet. This type of movement can damage utilities and structures supported by shallow or deep foundations. In the Las Virgenes-Malibu Region portions of Calabasas, Agoura Hills, and Malibu are in liquefaction zones.



Map 49: Liquefaction Zones

Landslide

The severity of seismically induced landslides and related damage is dependent on the level of ground shaking and groundwater conditions at the time of the earthquake. The map below depicts areas prone to earthquake induced landslides.



Map 50: Potential Earthquake Induced Landslide Areas

EARTHQUAKE MITIGATION STRATEGIES

California Earthquake Mitigation Legislation

Code Development

Earthquakes often result in revisions and improvements in building codes. The 1933 Long Beach Earthquake resulted in the Field Act, affecting school construction. The 1971 Sylmar Earthquake brought another set of increased structural standards. Similar re-evaluations occurred after the 1989 Loma Prieta and 1994 Northridge Earthquakes. These code changes have resulted in stronger and more earthquake resistant structures.

The Alquist-Priolo Special Studies Zone Act requires the State Geologist to delineate "special studies zones" along known faults in California. Cities and counties affected by the zones must regulate certain development "projects" within the zones. The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This state law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures (SOURCE: California Geological Survey).

The 1990 Seismic Hazards Mapping Act requires the California State Geologist to identify and map zones prone to seismically induced liquefaction, ground-shaking, landslides and other forms of ground failure resulting from earthquakes. The State Department of Conservation operates the Seismic Mapping Program for California.

The California Legislature has passed laws to strengthen the built environment and protect citizens. There are over 200 laws in the State Code related to earthquake safety. All new development within each of the individual cities within the Las Virgenes-Malibu Region comply with all current State and Los Angeles County Building Codes. The following table provides a partial list of California laws on earthquake safety.

Reference	Description
Government Code Section 8870-8870.95	Creates Seismic Safety Commission.
Government Code Section 8876.1-8876.10	Established the California Center for Earthquake Engineering Research.
Public Resources Code Section 2800-2804.6	Authorized a prototype earthquake prediction system along the central San Andreas fault near the City of Parkfield.
Public Resources Code Section 2810-2815	Continued the Southern California Earthquake Preparedness Project and the Bay Area Regional Earthquake Preparedness Project.
Health and Safety Code Section 16100-16110	The Seismic Safety Commission and State Architect will develop a state policy on acceptable levels of earthquake risk for new and existing state-owned buildings.
Government Code Section 8871-8871.5	Established the California Earthquake Hazards Reduction Act of 1986.
Health and Safety Code Section 130000-130025	Defined earthquake performance standards for hospitals.

Reference	Description
Public Resources Code Section 2805-2808	Established the California Earthquake Education Project.
Government Code Section 8899.10-8899.16	Established the Earthquake Research Evaluation Conference.
Public Resources Code Section 2621-2630 2621.	Established the Alquist-Priolo Earthquake Fault Zoning Act.
Government Code Section 8878.50-8878.52 8878.50.	Created the Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990.
Education Code Section 35295-35297 35295.	Established emergency procedure systems in kindergarten through grade 12 in all the public or private schools.
Health and Safety Code Section 19160-19169	Established standards for seismic retrofitting of un-reinforced masonry buildings.
Health and Safety Code Section 1596.80-1596.879	Required all child day care facilities to include an Earthquake Preparedness Checklist as an attachment to their disaster plan.

Table 134: Partial List of California Laws on Earthquake Safety

Source: http://www.leginfo.ca.gov/calaw.html

California Residential Mitigation Program

The California Residential Mitigation Program (CRMP) is an initiative aimed at enhancing the seismic resilience of residential structures in the state of California. Recognizing the seismic vulnerabilities of many homes in this region, the program offers resources and guidance to homeowners seeking to retrofit their properties to withstand earthquakes. CRMP provides valuable information on seismic hazards, engineering standards, and financial incentives available for retrofitting projects. By promoting proactive measures to reinforce residential structures, CRMP endeavors to mitigate potential damages and safeguard the well-being of Californian communities in the event of a seismic event.

LVMCOG Mitigation Activities

The cities of Agoura Hills, Calabasas, Malibu and West Lake Village have implemented the Los Angeles Region Uniform Code Program (LARUCP) Seismic Zone 4 requirements. These are more restrictive standards than required by the State of California Building Code.

Agoura Hills

The City of Agoura Hills General Plan (adopted in 2010 and updated in 2022) includes specific sections related to earthquake mitigation and preparedness. The Seismic Hazards Community Safety section of the General Plan, states,

> *Agoura Hills', significant seismic hazard is caused by potential ground shaking on the Simi–Santa Rosa Fault, Oak Ridge Fault, and San Cayetano Fault. The Simi–Santa Rosa Fault is approximately 7 miles from Agoura Hills and the Oak Ridge Fault and San Cayetano Fault are located 17 miles and 18 miles from the City respectively.*
>
> *The Alquist-Priolo Special Studies Zone Act requires the State Geologist to delineate "special studies zones" along known active faults in California. Cities and counties affected by the zones must regulate certain development "projects" within the zones. No Alquist-Priolo Special Studies Zones have been identified within the City of Agoura Hills.*

To minimize the adverse effects to residents, public and private property, and essential services caused by seismic and geologic hazards, the City of Agoura Hills has enacted the following policies:

- Enforcement of Building Code. Review all structures for compliance with the latest edition of the California Building Code (CBC). This code addresses all provisions associated with geologic and seismic regulations and the city requires the review of plans and inspection of all such structures considering the best management practices in site design and building construction methods.
- Geotechnical Investigations. Per City of Agoura Hill Building Code, any new structure could be subject to soils/geotechnical investigations and report to determine the potential for liquefaction, ground rupture, ground shaking, and soil bearing pressure in order to better design the structure for structural integrity.
- Slope Restrictions. Besides the hillside ordinance which has been in effect for years, and the regular CBC requirements, the City of Agoura Hills has more restrictive slope set back requirements. Slope failure repairs are subject to conditional use permit review with conditions for slope maintenance.
- Residential Footings. Due to the location of the City in relations with active faults, the City of Agoura Hills modified sections of the Governing California Residential Code (CRC) in order to provide higher standards for residential buildings in case of a seismic event by requiring continuous footings and better concrete reinforcements.
- Retrofit Critical Facilities. Encourage the upgrade, retrofitting, and/or relocation of all existing critical facilities (e.g. schools, police stations, fire stations, and medical facilities) and other important public facilities that do not meet current building code standards and are within areas susceptible to seismic or geologic hazards.

- Emergency Preparedness. At the time of any natural disaster, including an earthquake, the City staff and its consultants are trained to facilitate rapid recovery.
- The City of Agoura Hills is very involved with International Code Council (ICC) and its local chapters, California Building Officials (CALBO), and the State Building Standard Commission for the adoption, and implementation of the Building Code and all the seismic safety regulations. Additionally, every 3 years during the Code adoption process, the City has adopted more restrictive requirements than those of the State.

The following Goal and the specific policies related to earthquake mitigation included in the General Plan are described below.

Goal S-2 Protection from Geologic Hazards. Minimized adverse effects to residents, public and private property, and essential services caused by seismic and geologic hazards.
Policies

Policy	Description
S-2.1	Review Safety Standards. Regularly review and enforce all seismic and geologic safety standards, including the City's Building Code, and require the use of best management practices (BMPs) in site design and building construction methods. (Imp S-4)
S-2.2	Geotechnical Investigations. Require geotechnical investigations to determine the potential for ground rupture, ground shaking, and liquefaction due to seismic events, as well as expansive soils and subsidence problems on sites, including steep slopes, where these hazards are potentially present. (Imp S-4)
S-2.3	Retrofit Critical Facilities. Encourage the upgrade, retrofitting, and/or relocation of all existing critical facilities (e.g., schools, police stations, fire stations, and medical facilities) and other important public facilities that do not meet current building code standards and are within areas susceptible to seismic or geologic hazards. (Imp S-5)
S-2.4	Funding Programs. Pursue federal and state programs to provide additional protection against seismic activity. (Imp S-6)

The following table lists the California Building and Residential Codes (CBC and CRC) which were amended by the City of Agoura Hills in order to achieve better strengthening of structures in the community.

Amended 2022 CA Building Standards Code Section	Title
CBC 1613.5	Seismic design provisions for hillside buildings
CBC 1807.1.4	Permanent wood foundation systems
CBC 1807.2	Retaining walls
CBC 1809.3	Stepped footings
CBC 1809.7	Prescriptive footings for light-frame construction
CBC 1809.12	Timber footings
CBC 2304.10.2	Fastener requirements
CBC 2304.12.2.8	Wood used in retaining walls and cribs
CBC 2306.2	Wood-frame diaphragms
CBC 2306.3	Wood-frame shear walls
CBC 2308.6.8.1	Foundation requirements
CRC R403.1.2	Continuous footing in Seismic Design Categories D0, D1or D2
CRC R403.1.3.6	Isolated concrete footings
CRC R403.1.5	Slope
CRC R404.2	Wood foundation walls

Calabasas

The City of Calabasas 2030 General Plan, Safety Element includes specific policies to mitigate the threat of earthquakes and other hazards. For example:

Policy	Description
VII-1	Incorporate adequate mitigation measures into proposed development projects to achieve an acceptable level of risk from potential seismic hazards resulting from ground motion or fault rupture.
VII-2	Emphasize prevention of physical and economic loss associated with earthquakes and other geologic disasters through early identification of potentially hazardous conditions prior to project approval.
VII-3	Facilitate rapid physical and economic recovery following an earthquake, geologic disaster, or wildland fire through early investigation of the event and implementation of effective new standards for design of structures.
VII-4	Incorporate the analysis and mitigation of seismic risks into the analysis and design of water supply infrastructure.
VII-5	Discourage development within potential landslide areas and areas with severe soils limitations as the City's preferred management strategy, and as a higher priority than attempting to implement engineering solutions.
VII-6	Where engineering solutions to slope stability constraints are required, implement landform grading programs so as toto recreate a natural hillside appearance.
VII-7	Include projected climate change impacts of slope stability changes after wildfires and develop mitigation strategies for new areas deemed at risk to slope instability.
VII-8	Prior to approval of development projects within the liquefaction or landslide hazard zones depicted on Figure VII-2 or other areas identified by the City Engineer as having significant liquefaction or landslide hazards, require applicants to prepare site-specific liquefaction and/or landslide studies and mitigation. Such studies shall be subject to review and approval by the City Engineer.
VII-9	Work cooperatively with the Las Virgenes Municipal Water District to eEnsure that water supplies are not interrupted by seismic events such as surface rupture, ground shaking, ground failure, tsunami, seiche, or dam failure. Encourage residents, homeowners, and landlords to maintain an on-site emergency supply of water for 3-days in case a seismic event damages water lines.
VII-10	Prepare a bridge preventative maintenance plan that is regularly updated in conformance with the findings from Caltrans' annual bridge inspection reports. Implement maintenance recommendations by seeking funding from Caltrans and the Federal Highway Administration, and prioritize bridges that are part of critical evacuation routes.

These policies are intended to minimize the adverse effects to residents, public and private property, and essential services caused by seismic and geologic hazards. Specific policy implementation activities include:

- Incorporate adequate mitigation measures into proposed development projects to achieve an acceptable level of risk from potential seismic hazards resulting from ground motion or fault rupture.
- Emphasize prevention of physical and economic loss associated with earthquakes and other geologic disasters through early identification of potentially hazardous conditions prior to project approval.

- Facilitate rapid physical and economic recovery following an earthquake, geologic disaster or wildland fire through early investigation of the event and implementation of effective new standards for design of structures.
- Discourage development within potential landslide areas and areas with severe soils limitation as the City's preferred management strategy, and as a higher priority than attempting to implement engineering solutions.
- Where engineering solutions to slope stability constraints are required, implement landform grading programs so as to recreate a natural hillside appearance.
- Prior to approval of development projects within the liquefaction or landslide hazard zones or other areas identified by the City Engineer as having significant liquefaction and/or landslide hazards, require applicants to prepare site specific liquefaction and/or landslide studies and mitigation. Such studies shall be subject to review and approval by the City Engineer.

In March 2010, the City of Calabasas through the Department of Public Works published guidelines provide the minimum standards and recommended format for engineering geologic and geotechnical engineering reports submitted to the City of Calabasas. Further, in September 2010, the City of Calabasas amended its building codes to the California Building Code Standards which include Seismic design as of January 1, 2011. Finally, the City recently adopted the tri-annual CA Building Codes, which went into effect on January 1, 2023.

Hidden Hills

The Safety Element of Hidden Hill's General Plan (1995) includes a focus on, "the reduction and/or prevention of injuries, loss of life, property damage, and economic and social disruption due to fires, floods, seismic activities, and other natural disasters."

The City of Hidden Hills Safety Element serves three key functions:

- Provide a framework by which safety considerations are introduced into the planning and development process;
- Identify and evaluate natural hazards; and
- Establish goals and policies which minimize potential adverse effects related to natural hazards

In addition, the city implements an Emergency Evacuation Plan. The Emergency Evacuation Plan is an important aspect since there are limited means of ingress and egress to the community.

The City of Hidden Hills includes specific goals and policies related to natural hazards and the risk of earthquakes:

Goal 1: Protect life and property from geologic and seismic hazards in the City.

Policy	Description
1.1	Require that all new buildings in Hidden Hills comply to the current building standards.
1.2	Protect areas of potential slope instability from future residential developments.
1.3	Require a "slope stability assessment" to be conducted prior to taking action on future single family residential subdivisions which are located in areas of potential slope instability.

The Housing and Land Use Elements of the General Plan ensure that structures in Hidden Hills comply with standards for design, building materials, and are not subject to undue hazard based on their location. The City of Hidden Hills has included several mitigation requirements under Title 5, Land Use and Develop. They are:

3319.2 Geologic Hazard.

- No building or grading permit shall be issued under the provisions of this Section when the Building Official finds that property outside the site of the proposed work could be damaged by activation or acceleration of a geologically hazardous condition and such activation or acceleration could be attributed to the proposed work on, or change in use of, the site for which the permit is requested. For the purpose of this subsection, geologically hazardous condition does not include the hazard of surface displacement due to earthquake faults.
- Work requiring a building or grading permit by this Code is not permitted in an area determined by the City Engineer to be subject to hazard from landslide, settlement or slippage. These hazards include those from loose debris, slope wash and the potential for mud flows from natural slopes or graded slopes. For the purpose of this subsection, landslide, settlement or slippage does not include surface displacement due to the earthquake faults.

Malibu

The City of Malibu General Plan, Safety and Health Element includes goals and measures to mitigate the risk of earthquakes.

5.3.1 S Goal 1: A Community that is Free from All Avoidable Risks to Safety, Health and Welfare from Natural and Man-Made Hazards

Objective	Policy	Description
S Objective 1.1: Losses to Life and Property from Natural and Man-Made Hazards Greatly Reduced from Historic Levels.	S Policy 1.1.1	The City shall protect people and property from environmental hazards.
S Objective 1.2: Risks to residents and businesses from development in Hazardous areas are minimized.	S Policy 1.2.1	The City shall require development to provide for analyses of site safety related to potential hazards of fault rupture, earthquake ground shaking, liquefaction, and rockfalls.

Specific measures related to earthquake mitigation include:

S Implementation Measure	Description
39	Develop and maintain a development geo-hazard database to incorporate findings from site specific and area hazard-related studies.
40	Adopt and update as appropriate maps of extreme fire danger areas, 100- year flood plains, landslide and debris flow danger, active and potentially active faults, tsunami, and any other hazard areas; and inform residents of those areas of risks and possible mitigation measures.
41	Require that all new construction be designed to be earthquake resistant to maximum probable earthquakes.
42	Apply all restrictions and investigation requirements mandated by the State under the Alquist-Priolo Special Studies Zones Act for faults classified as “active” to development on properties crossed by or adjacent to the Malibu Coast Fault.
45	Require that all critical use facilities (hospitals, police and fire stations) be earthquake resistant designed for the effects of a maximum credible earthquake.
47	To protect slope stability, restrict grading or development related vegetation clearance where the slope exceeds 2:1, except as required for fire safety, driveways and utilities and where there is no reasonable alternative.
50	Require that soils, geologic and structural evaluation reports with appropriate mitigation measures be prepared by registered soils engineers, engineering geologists, and/or structural engineers and that all recommended mitigation measures be implemented.
51	Evaluate proposed development for its impact on, and from, geologic hazards, flood and mud flow hazard, and fire hazard.

The City also implements a comprehensive Emergency Operations Plan and has developed a Mass Evacuation Plan.

Westlake Village

The Los Angeles County Department of Public Works oversees Westlake Village's Building and Safety Department. The Building and Safety Division is the enforcement, through the plan check and inspection process, of the Building, Plumbing, Mechanical, and Electrical Codes, as well as other local and State requirements relevant to the construction and occupancy of public and private structures. Other pertinent State and local requirements enforced by Building and Safety include zoning requirements, general hazards mitigation, geology, disabled access, and environmental protection.

Prior to development on certain soils such as thicker alluvium where liquefaction may occur, the City of Westlake Village requires a soils report. Additionally, if a hillside development is planned on an area located on sediments or volcanic rock, an engineering geology and soil investigation is required.

In addition, the City of Westlake Village General Plan (1993) contains specific goals, objectives, and policies to address the risk of earthquakes and other hazards within the city.

Goal	It shall be the goal of the City of Westlake Village to minimize hazards to public health, safety and welfare which may result from geologic conditions, seismic activity and flooding.
Policies & Objectives	Objective It shall be the objective of the City of Westlake Village to: 1. Provide for an efficient and safe evacuation of the community in the event of a major disaster. Policies It shall be the policy of the City of Westlake Village to: 1.1. Maintain an effective Citywide Emergency Preparedness Plan (I-1 and 1-2). Objective It shall be the objective of the City of Westlake Village to: 2. Ensure that construction and development activities within the community does not expose residents to avoidable natural hazards. Policies It shall be the policy of the City of Westlake Village to: 2.1. Require the preparation of a detailed geologic and soils report to accompany each grading permit application in all hillside management areas (I-4). 2.2. Prohibit the placement of structures for human habitation within flood prone areas unless the flood hazard is eliminated by measures that do not impair the carrying capacity of the watercourse (I-5). 2.3. Enforce the provisions of the Uniform Building Code, specifically Chapters 23 and 70 as they relate to earthquake-resistant design and excavation and grading (I-6).

The City of Westlake Village Implementation Program includes:

I-1	Continue to update the Citywide Emergency Preparedness Plan as new information becomes available.
I-2	Periodically distribute an updated pamphlet which informs individual residents of their responsibilities for emergency preparedness.
I-3	Support training programs to train volunteers to assist police, fire protection and civil defense personnel during and after a seismic, fire or flooding event.
I-4	Continue to implement the provisions of the Hillside Management ordinance and coordinate with the Los Angeles County Building and Safety Department so all applicable grading and development standards are implemented.
I-5	Coordinate with the Los Angeles County Flood Control district to ensure that potential flooding hazards associated with proposed new development are fully mitigated.
I-6	Coordinate with the Los Angeles County Building and Safety Department in the review of all development proposals, ensuring Chapters 23 and 70 of the Uniform Building Code are enforced.

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SECTION 7. WILDFIRE

THE NATURE OF THE WILDFIRE THREAT

Fire is a natural part of the ecosystem in Southern California. However, wildfires present a substantial hazard to life and property in communities such as the Las Virgenes-Malibu Region that are built within or adjacent to hillsides and mountainous areas. Consequently, there is a significant potential for losses due to fire in the Region (including wildland and urban fires).

HISTORICAL RECORD OF SIGNIFICANT FIRES

The table below provides a summary of the Top 20 Most Destructive Wildfires in California according to the California Division of Forestry and Fire Protection (CAL FIRE) as of September 2023.

Top 20 Most Destructive California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	**CAMP** *(Powerlines)*	November 2018	Butte	153,336	**18,804**	85
2	**TUBBS** *(Electrical)*	October 2017	Napa & Sonoma	36,807	**5,636**	22
3	**TUNNEL - Oakland Hills** *(Rekindle)*	October 1991	Alameda	1,600	**2,900**	25
4	**CEDAR** *(Human Related)*	October 2003	San Diego	273,246	**2,820**	15
5	**NORTH COMPLEX** *(Lightning)*	August, 2020	Butte, Plumas, & Yuba	318,935	**2,352**	15
6	**VALLEY** *(Electrical)*	September 2015	Lake, Napa & Sonoma	76,067	**1,958**	4
7	**WITCH** *(Powerlines)*	October 2007	San Diego	197,990	**1,650**	2
8	**WOOLSEY** *(Electrical)*	November 2018	Ventura	96,949	**1,643**	3
9	**CARR** *(Human Related)*	July 2018	Shasta County, Trinity	229,651	**1,614**	8
10	**GLASS** *(Undetermined)*	September 2020	Napa & Sonoma	67,484	**1,520**	0
11	**LNU LIGHTNING COMPLEX** *(Lightning/Arson)*	August 2020	Napa, Solano, Sonoma, Yolo, Lake, & Colusa	363,220	**1,491**	6
12	**CZU LIGHTNING COMPLEX** *(Lightning)*	August 2020	Santa Cruz, San Mateo	86,509	**1,490**	1
13	**NUNS** *(Powerlines)*	October 2017	Sonoma	44,573	**1,355**	3
14	**DIXIE** *(Powerlines)*					
15	**THOMAS** *(Powerline)*	December 2017	Ventura & Santa Barbara	281,893	**1,063**	2
16	**CALDOR** *(Human Related)*	September 2021	Alpine, Amador, & El Dorado	221,835	**1,005**	1
17	**OLD** *(Human Related)*	October 2003	San Bernardino	91,281	**1,003**	6
18	**BUTTE** *(Powerlines)*	September 2015	Amador & Calaveras	70,868	**965**	2
19	**JONES** *(Undetermined)*	October 1999	Shasta	26,200	**954**	1
20	**AUGUST COMPLEX** *(Lightning)*	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	1,032,648	**935**	1

"Structures" include homes, outbuildings (barns, garages, sheds, etc) and commercial properties destroyed.
This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.
*Numbers not final

10/24/2022

Table 135: CAL FIRE Top 20 Most Destructive Wildfires

Source: CAL FIRE (https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/featured-items/top20_destruction.pdf?rev=ee6ea855632a4b56a46adea1d3c8022f&hash=5B8B3A1A35CBB52CB0ED7A010F0B52E0)

History of Fire Events in the Las Virgenes-Malibu Region

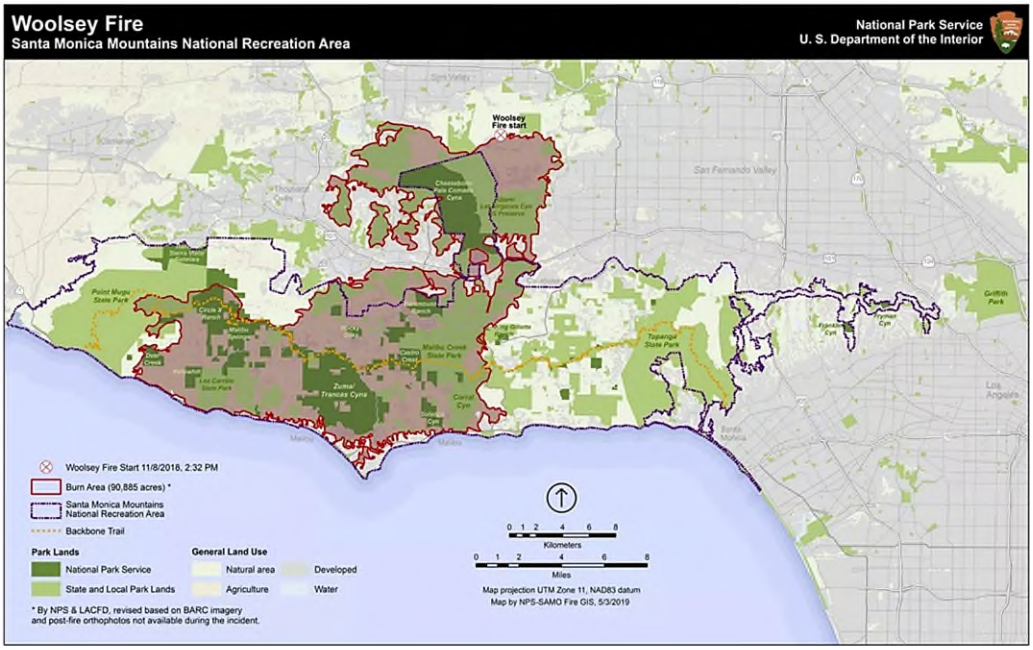
The Las Virgenes-Malibu COG Region has a long history of wildland fires. In fact, over the past 110 years nearly the entire Las Virgenes Malibu Region has been impacted by fire. Major fires since 2005 in the Las Virgenes-Malibu Region include the following events:

Name	Year	Estimated Acres	Structure Loss
Woolsey Fire	2018	96,949	1,643
Lost Fire	2008	167	0
Corral Fire	2007	4,901	53
Malibu Canyon Fire	2007	4,565	22
Sherwood Fire	2006	168	0
Topanga Fire	2005	24,175	323

Table 136: Major Fires Near of / In the Las Virgenes-Malibu Region

The map below outlines the burn area and starting location of the 2018 Woolsey Fire. The fire which burned almost 100,000 acres, included 3 casualties, and prompted evacuations of nearly 300,000 people was primarily fueled by dry conditions, strong Santa Ana winds, and parched vegetation. Per California Public Utilities Commission, Cal Fire's investigation report states that the fire was caused by "electrical equipment associated with the Big Rock 16kV circuit, owned and operated by Southern California Edison (SCE)", as well as a series of other events. The Woolsey Fire ultimately led to widespread destruction of homes, wildlife habitats, and natural landscapes, prompting extensive emergency response efforts and a substantial recovery process for affected communities.

Figure 87: Woolsey Fire Smoke Plume
Credit: U.S. Forest Service



Map 51: Woolsey Fire Perimeter
Source: National Park Services (https://www.nps.gov/samo/learn/management/2018-woolsey-fire.htm)

CAUSES AND CHARACTERISTICS OF WILDFIRES

Southern California has two distinct areas of risk for wildland fire. First, the foothills and lower mountainous areas which are often covered with scrub brush or chaparral. Second, the higher elevation mountains which are contain large forest areas. In fact, the magnitude of the 2003 fires that struck Southern California were the result of three primary factors: (1) severe drought, accompanied by a series of storms that produced thousands of lightning strikes and windy conditions; (2) an infestation of bark beetles that has killed thousands of mature trees; and (3) the effects of wildfire suppression over the past century that led to a build-up of brush and small diameter trees in the forests.

WILDFIRE HAZARD IDENTIFICATION

Urban/Wildland Interface Fires

The Las Virgenes-Malibu Region is like many Southern California communities that are challenged by the increasing number of houses being built on the urban/wildland interface. The National Wildland Coordinating Group defines urban/wildland interface as "the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel.

In terms of urban/wildland interface fires, there are three categories of concern:

- The classic urban/wildland interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas;
- The mixed urban/wildland interface is characterized by isolated homes, subdivisions and small communities situated predominantly in wildland settings;
- Occluded urban/wildland interfaces exist where islands of wildland vegetation occur inside a largely urbanized area.

Figure 88: Woolsey Fire – Overlooking King Gillette Ranch

Figure 89: Woolsey Fire - Peter Strauss Ranch

Source: National Park Service

Very High Fire Hazard Severity Zones

For the purposes of describing the severity of fire hazard areas, the Los Angeles County Fire Department classifies areas according to criteria established in the State legislation commonly referred to as the "Bates Bill". The Bates Bill Process determines **V**ery **H**igh **F**ire **H**azard **S**everity **Z**ones (VHFHSZs) including Local Responsibility Areas (LRAs).

Very High Local Responsibility Areas (LRA)	Government Code 51175-89 directs the California Department of Forestry and Fire Protection (CAL FIRE) to identify areas of very high fire hazard severity zones within Local Responsibility Areas (LRA). Mapping of the areas, referred to as Very High Fire Hazard Severity Zones (VHFHSZ), is based on data and models of, potential fuels over a 30-50 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. Public Resources Code 4201-4204 directs the California Department of Forestry and Fire Protection (CAL FIRE) to map fire hazard within State Responsibility Areas (SRA) based on fuel loading, slope, fire weather, and other relevant factors present, including areas where winds have been identified by the department as a major cause of wildfire spread. These zones, referred to as Fire Hazard Severity Zones (FHSZ), classify a wildland zone as Moderate, High, or Very High fire hazard based on the average hazard across the area included in the zone.
Very High State Responsibility Areas (SRA)	The State Board of Forestry and Fire Protection classify areas in which the primary financial responsibility for preventing and suppressing fires is that of the state. These include: lands covered wholly or in part by timber, brush, undergrowth or grass, whether of commercial value or not; lands which protect the soil from erosion, retard run-off of water or accelerated percolation; lands used principally for range or forage purposes; lands not owned by the Federal government; and lands not incorporated. By Board regulations, unless specific circumstances dictate otherwise, lands are removed from SRA when housing densities average more than 3 units per acre over an area of 250 acres.
Very High Federal Responsibility Areas (FRA)	The State and Federal Agencies jointly develop and review the Annual Operating Plan for the protection of Federal Responsibility Areas (FRA) located within State DPAs. As identified in the Annual Operating Plan, the State provides wildland fire protection at a level, which is most nearly equivalent to the wildland fire protection that would be provided directly by the Federal Agencies on FRA of equal hazard, risk, and value. Federal Agencies retain all land management responsibilities except for wildland fire protection on FRA within the area where the State has direct protection responsibility. This does not preclude the Federal Agencies from conducting fire prevention activities on these lands.

In order to comply with the Bates Bill, the cities within the Las Virgenes-Malibu Region completed an evaluation of the following factors to determine the areas of the Region which would qualify as a Very High Wildland Fire Hazard Severity Zones.

- Fuel
- Topography
- Dwelling density
- Weather
- Infrastructure
- Fire codes and ordinances as they relate to brush issues

Each factor was given a value of 1-4 with a 4 being the highest danger rating. Any total score over 10 qualified the area as being one of VHFHSZ. Each of the three areas evaluated rated 10 or above with the highest area receiving a 12.

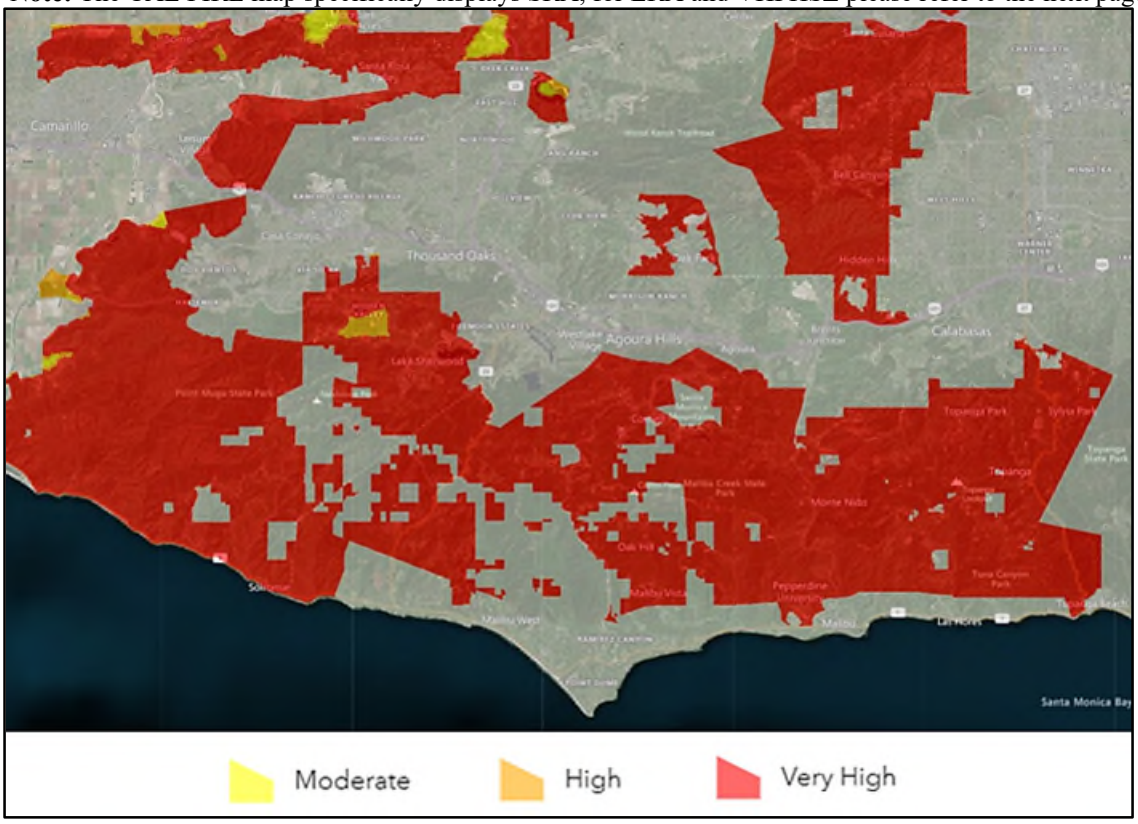
All five cities within the Las Virgenes-Malibu Region have been designated as VHFHSZs. Fire zone areas are rated on a scale of I – IV, with IV representing the most severe fire hazard zone. The Region contains both Zone III and Zone IV areas.

Identifying the hazard area as set forth above is the first step in assessing each city's vulnerability to wildland fires. Other key factors in assessing wildfire risk include:

- Ignition sources
- Building materials and design
- Community design
- Structural density
- Slope
- Vegetative fuel
- Fire occurrence
- Weather, as well as occurrences of drought

The CAL FIRE map below depicts the Fire Hazard Severity Zones State Responsibility Areas (SRA) for the LVMCOG Region.

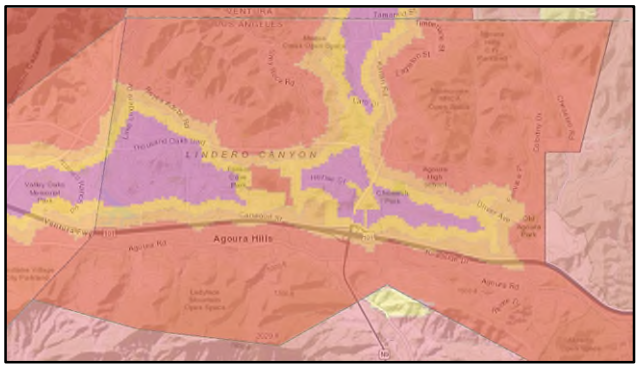
Note: The CAL FIRE map specifically displays SRA, for LRA and VHFHSZ please refer to the next page.



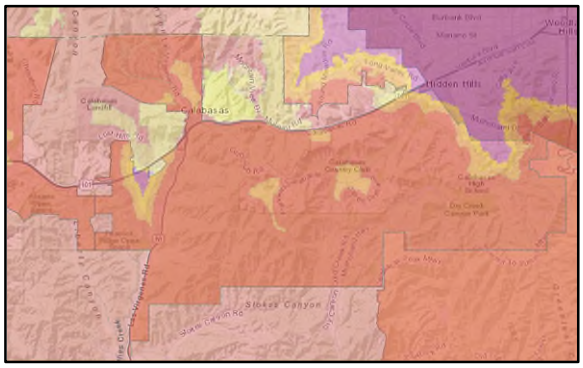
Map 52: FHSZ SRA for the LVMCOG Region (currently in the regulatory process as of September 29, 2023)

The following maps depict the Fire Hazard Severity Zones (SRA and LRA) for each city within the LVMCOG, per County of Los Angeles Bureau of Land Management, Esri, Garmin, USGS, NGA, EPA, USDA, NPS, HERE (pending adoption as of 9/29/23):

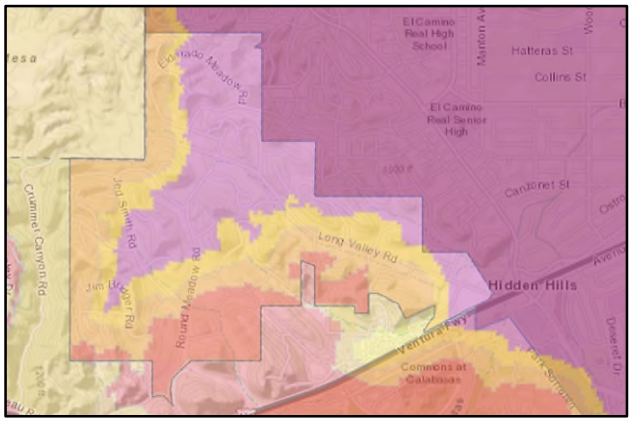
Agoura Hills



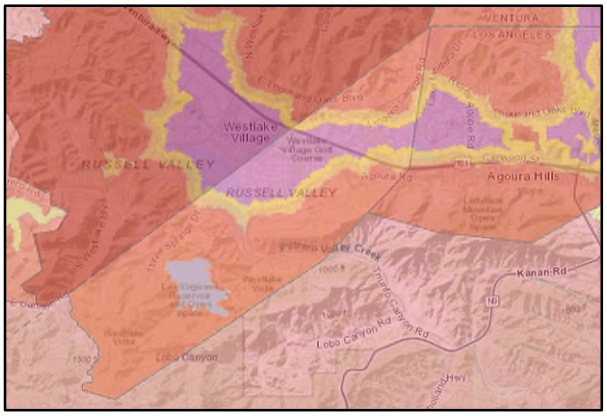
Calabasas



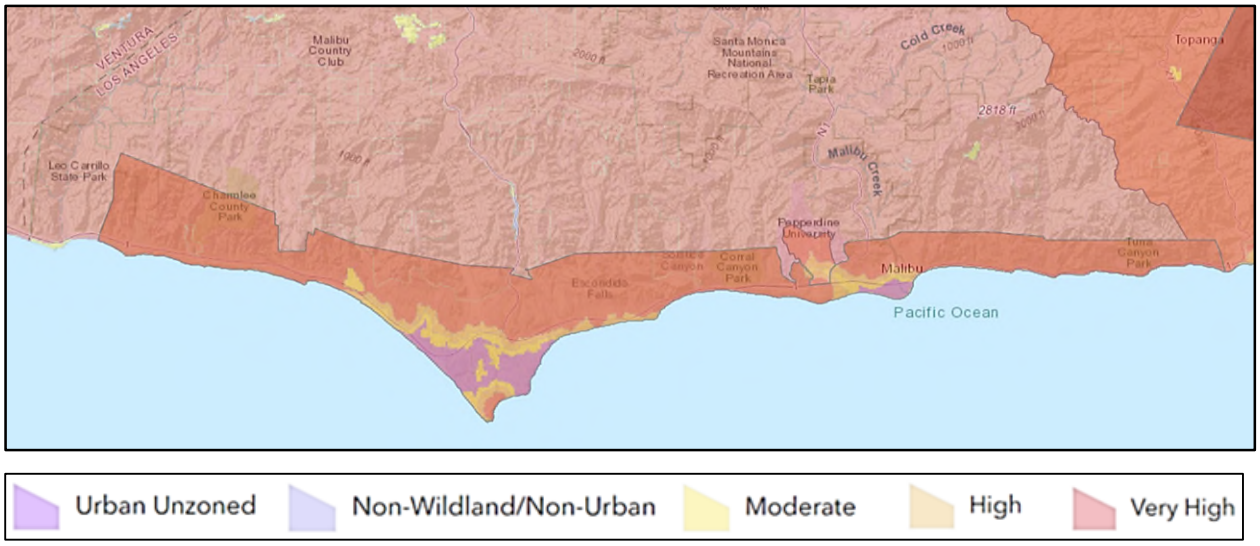
Hidden Hills



Westlake Village



Malibu



Urban Unzoned | Non-Wildland/Non-Urban | Moderate | High | Very High

Estimated Impact of an Event

If a major wildfire were to occur, the consequences to local populations and housing in urban interface areas will be significant. The table below provides the estimated impact of a disaster using a 5% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 5% Loss Occurs
Population*	20,362	23,410	2,182	10,915	8,081	3,248
Total City Employment	11,100	11,800	5	6,483	3,700	1,654
Economy** (in thousands)	$621,000	$1,011,348	N/A	$578,443	$576,306	139,355
Total Housing Units	7,799	9,401	692	6,936	3,273	1,405
Median Home Value	$857,700	$1,141,600	More than $2,000,000	More than $2,000,000	$1,029,100	More than $1.9B

Table 137: Estimated Population and Economic Loss of a Wildfire
*U.S. Census – American Community Survey 2021
**2017 U.S. Economic Census (in thousands)

Based on a 5% loss projection, more than 3,200 residents and more than 1,600 jobs would be displaced or significantly impacted resulting in more than $139M in economic losses, and more than 1,400 homes could be damaged or destroyed resulting in over $1.9 billion in losses (see Community Profile section for population, housing, and economic data).

Risk of Future Wildfire

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 9.43 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Wildfire	9.5	9	3	20	**9.43**

WILDFIRE VULNERABILITIES

Base Hazard Factors

In order to determine the "base hazard factor" of specific wildfire hazard sites and interface areas, several factors must be considered. Categories used to assess the base hazard factor include:

- Topography (location, characteristics and
- Fuels
- Development (site/building construction and design, landscaping, defensible space, accessibility, etc.)
- Weather

Topography

Topography influences the movement of air, thereby directing a fire's course. In general, if the percentage of uphill slope doubles the rate of fire spread doubles. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Unfortunately, hillsides with hazardous topographic characteristics are also desirable, residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas. Numerous canyons, saddles, and ridges in the VHFHSZ will also contribute to erratic fire behavior due to the funnel and subsequent acceleration effect it will have on wind traveling through the area.

Fuels

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression "dog-hair" thickets have accumulated, which enable high intensity fires to flare and spread rapidly.

In addition, fuel is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading," or the amount of available vegetative fuel. In the Las Virgenes- Malibu Region, there are several types of fuel including a large amount of chaparral and woodland vegetation that is a catalyst for fire activity.

Like much of Southern California, chaparral is a primary fuel prevalent in the Las Virgenes-Malibu Region along with grasses, non-native vegetation and large trees such as junipers, palm, eucalyptus, pines, and locally prevalent oaks.

Added to this is the fact that a large percentage of the fuel beds in the Santa Monica Mountains contain dead and downed vegetation. This "die back" condition is due largely to drought conditions. These fuel beds are extremely receptive to ignition and spread of wildfires more quickly than live vegetation. This type of fuel mode is of particular concern when fires are wind driven, which can lead to short and long range spotting - which can affect the entire Region.

Development

Growth and development in scrubland and forested areas is increasing the number of structures in the Las Virgenes-Malibu interface areas. Wildfire has an effect on development, yet development can also influence wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation and use natural materials. There are many types of these homes within the Region that use vegetation as privacy barriers. A private setting may be far from public roads, or hidden behind a narrow, curving driveway. These conditions make evacuation and firefighting difficult. Similarly, narrow and winding roads in these developed areas tend to make evacuation of civilians slow and difficult especially when fire resources are trying to gain access to the area utilizing the same roads.

Wildfire hazard areas are commonly identified in Regions of the urban/wildland interface. Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control such as the surrounding fuel load, weather, topography, and property characteristics. Generally, hazard identification rating systems are based on weighted factors of fuels, weather and topography.

Within the cities in the Las Virgenes-Malibu Region, increased development in and adjacent to naturally vegetated areas exposes additional structures to potential wildland fires. With sound construction practices, sufficient water flows, brush clearance and provision of adequate access the risk can be reduced.

Weather

Drought

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible. This is a definite classification of the Las Virgenes-Malibu Region. Recent concerns about the effects of climate change (particularly drought) have contributed to concerns about wildfire vulnerability (see **Climate Change** section for additional details).
Drought also leads to less frequent irrigation which can contribute to wildfires. From 2007 to 2009 and again from 2012 to 2016 Southern California experienced severe drought conditions. This corresponds to the most recent years when significant wildfires have occurred.

Wind

High-risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The "Santa Ana" winds, which are heated by compression as they flow down to Southern California from Utah, create a particularly high risk, as they can rapidly spread what might otherwise be a small fire.

The Las Virgenes-Malibu Region experiences Santa Ana Wind conditions typically in the fall months. This poses a threat in two ways. A fire starting in the Las Virgenes-Malibu Region will spread rapidly and has the potential of overwhelming initial attack forces and destroying structures within minutes of ignition. A fire starting adjacent to the Las Virgenes-Malibu Region could quickly burn into the area either by direct flame contact or by fire brands being carried by the winds and spotting onto structures or combustible vegetation.

Wind bends the flames to pre-heat the fuel ahead and can carry fire brands up to a quarter mile or more ahead of the flame front. The majority of catastrophic fires that Southern California has experienced have occurred in the months of September, October, and November when Santa Ana Winds typically occur. Wind is considered to be the primary factor that influences fire spread. Furthermore, in the City of Malibu, severe wind gusts can occur through local canyons and valleys, propelling and increasing the intensity of wildfires.

SCE Public Safety Power Shutoffs

High winds combined with severe wildfire risk increase the threat of power line related fires. Trees can fall onto power lines sparking a fire and wind-blown debris can cause sparks and ignite. In response, Southern California Edison (SCE) has issued public notices that it may de-energize selected power lines during these high risk periods. The SCE website states, "In alignment with its operational safety practices, we may proactively shut off power in high fire risk areas when extreme weather conditions present a clear and imminent danger to public safety. We take pride in service reliability; de-energizing customers is not something we take lightly and is only sparingly used in the most extreme conditions. This will only occur after exhausting a number of other operational practices." Most cities within LVMCOG have experienced a PSPS multiple times and are constantly working to refine response procedures to support the community and manage infrastructure outages.

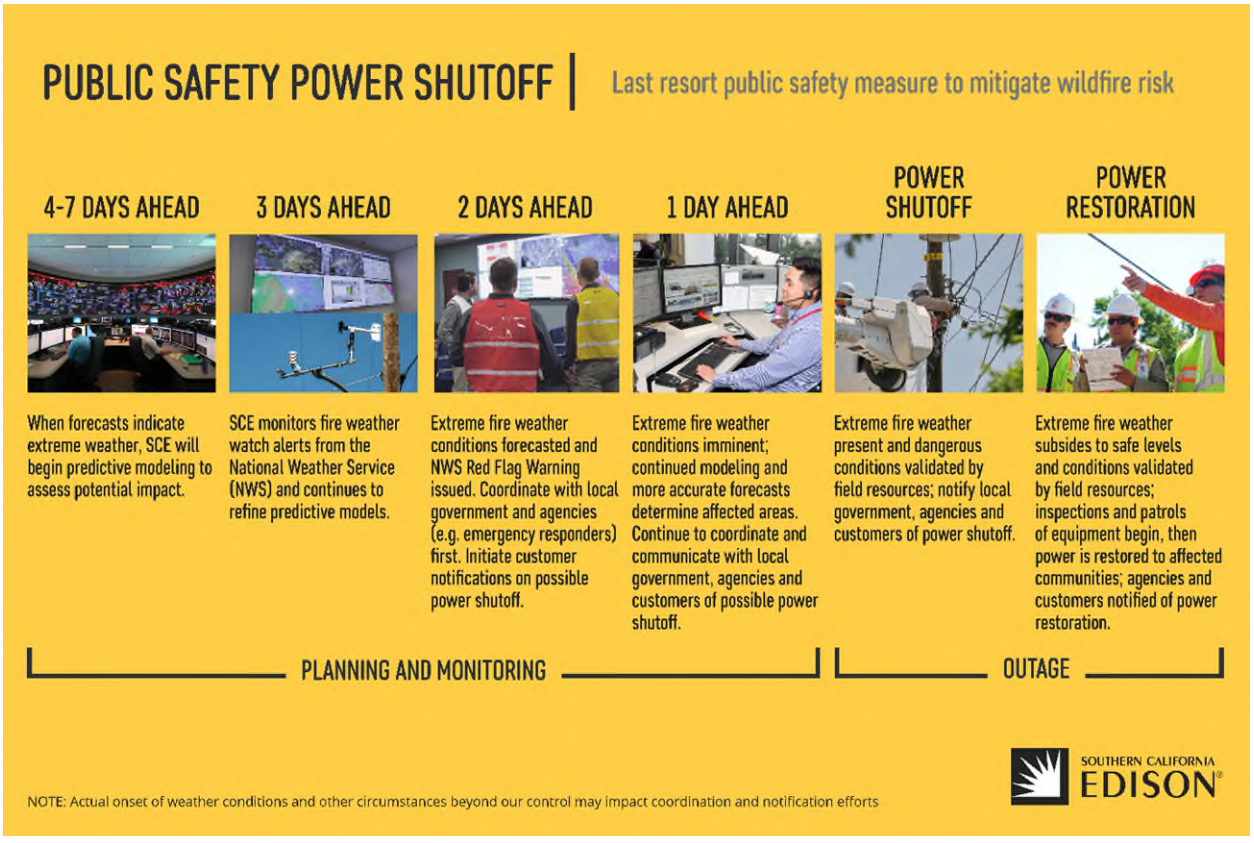


Figure 90: SCE Public Safety Power Shutoff Process

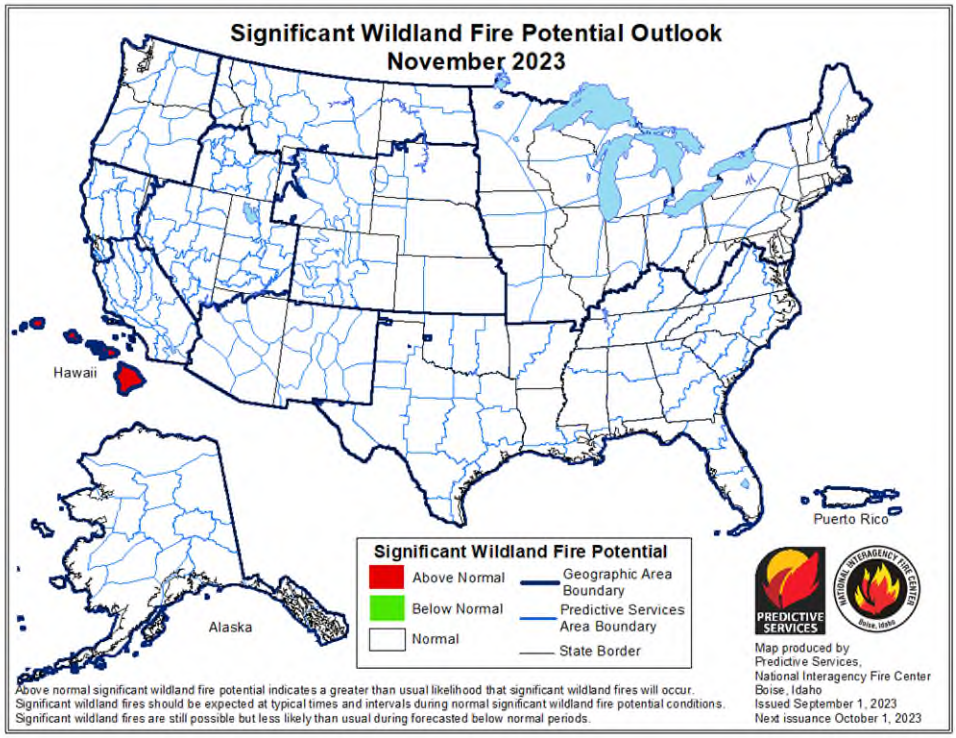
The Threat of Urban Conflagration

An urban conflagration could start either as a result of a lightning strike, arson, human error, earthquake or other phenomenon. Possible scenarios include a fire in planned community that quickly spreads to nearby homes due to a combination of high winds and high temperatures.

Business structures are also at risk however this threat is mitigated by requirements for commercial sprinkler systems. Nevertheless, there is still a risk of widespread fire if local water supplies are disrupted due to extremely high demand, power outage, or line breaks (cause by an earthquake or other damage). Examples include high rise offices, large hotels, and retail centers.

Wildfire Probabilities

Southern California and the cities within the LVMCOG are perennially under threat of wildfire. This situation will worsen as the impacts of climate change continue (see Climate Change section for details). Further, the National Interagency Coordination Center lists the potential outlook of fire for the Southern California region as "Normal" as of November 2023, which can be attributed to increased rainfall and the influence of Hurricane Hillary during August 2023. However, it is expected that the potential of a wildland fire will return to above normal levels, primarily due to accelerated vegetation growth.



Map 53: Significant Wildland Fire Potential Outlook – November 2023

WILDFIRE MITIGATION STRATEGIES

Genasys Protect (Zonehaven) Aware Program

The Genasys Protect (Zonehaven) AWARE is a mapping tool used by all LVMCOG cities and is designed to work in combination with public alert and warning systems such as ALERT LA County and local City emergency alert systems. This tool ensures that both first responders and residents have access to the same Zone maps for efficient evacuation planning. Currently implemented in the Santa Monica Mountain region, residents can easily identify their specific "Zone" and access vital information about emergency services, real-time zone status updates, available shelters, and more. In the event of significant incidents requiring evacuations, the Zone map is continuously updated in real time.

Los Angeles County Fire Department

First Responders

The Las Virgenes-Malibu Region is located at the Central Operations Bureau, Division of the Los Angeles County Department (LACoFD). Battalion 5 of the LACoFD serves the Las Virgenes-Malibu Region with a total of 12 stations assigned to serve five cities and over 68,000 residents. The cities include Agoura Hills, Calabasas, Hidden Hills, Malibu, Westlake Village. Battalion 5 headquarters are located at 29575 Canwood St. Agoura Hills CA 91301.

Operating 9 divisions and 22 battalions, LACoFD answers approximately 400,000 emergency calls annually. The Department currently has 177 fire stations, 75 paramedic squads, 9 wildland fire suppression camps, 10 bulldozers, 10 helicopters, 23 Prevention Offices, 12 Forestry Units and numerous other response vehicles and facilities. It serves 58 incorporated cities, as well as the unincorporated areas of the County. Additionally, the Department has Planning, Information Management, Lifeguard, and Health Hazardous Materials Divisions which provide valuable services to the more than 4.0 million people who reside in the 1.2 million housing units located throughout the Department's 2,311 square mile area. The LACoFD is one of six Contract Counties that maintain a contractual relationship with California Department of Forestry and utilizes the California Fire Plan within Los Angeles County as the primary wildland fire protection plan.

Other Agencies

It is important to work with other organizations and agencies to create a more comprehensive Hazard Mitigation Plan. There are numerous agencies with which Division VII of the LACoFD works closely, including but not limited to:

Political Entity	Jurisdiction
Los Angeles County Sheriff's Department	Local Government/ Law Enforcement
City of Los Angeles	Local Government/LRA Fire Protection
Ventura County Fire Department	LRA and SRA Fire Protection
National Park Service	Public Land Ownership, DPA Fire Protection
CAL FIRE	Contract
City of Agoura Hills	Tax Share
City of Hidden Hills	Tax Share
City of Malibu	Tax Share
City of Westlake Village	Tax Share
City of Calabasas	Tax Share
California State Parks	Public Land Ownership, SRA Fire Protection
Santa Monica Mountains Conservancy	Public Land Ownership, Recreational Use
Public Utility Companies	State/County
California Department of Forestry and Fire Protection	State/County

Table 138: Political Entities that Coordinate with the LACoFD to Mitigate the Threat of Fire

Fire Prevention Division

The Las Virgenes-Malibu area is part of the LACoFD Fire Prevention Central Region. Fire prevention and code enforcement in this area historically requires concentrated efforts related to water supplies for fire protection and vehicular access for fire apparatus. Geographic and terrain limitations as well as the lack of water supply in mountainous terrain present challenges that LACoFD Inspectors review and inspect, often times providing alternative solutions for the owners/occupants to consider.

Fire Prevention Programs

The Los Angeles County Fire Department manages an active effort in order to prevent the possibility of a wildfire occurring within the Las Virgenes-Malibu Region. The following list provides a sample of the programs, activities and practices.

Prescribed Burning

The health and condition of brush will determine the magnitude of wildfire. The LACoFD does practice prescribed burning. If fuels (slash, dry or dead vegetation, fallen limbs and branches) are allowed to accumulate over long periods of time without being methodically cleared, fire can move more quickly and destroy everything in its path. The results are more catastrophic than if the fuels are periodically eliminated. Prescribed burning is the most efficient method to remove these fuels.

Pre-Fire Management Plan

As a preventative measure, the LACoFD also implements a Pre-Fire Management Plan whose overall goal is to reduce the total cost and losses from wildland fires in California by protecting assets at risk through focused pre-fire management prescriptions and increased initial attacks.

Fuel Modification Plan

The Fuel Modification Plan is part of the Forestry Division of the LACoFD. This publication was prepared to establish a set of guidelines and landscape criteria for all new construction relating to fuel modification planning that will reduce the threat of fire in high hazard areas.

Vegetation Management Program

The Vegetation Management Program (VMP) is a cost-sharing program that focuses on the use of prescribed fire, mechanical, biological and chemical means for addressing wildland fire fuel hazards and other resource management issues on State Responsibility Area (SRA) and Local Responsibility Area (LRA) lands. The use of prescribed fire mimics natural processes, restores fire to its historic role in wildland ecosystems, and provides significant fire hazard reduction benefits that enhance public and firefighter safety.

The Los Angeles County Fire Department created the Vegetation Management Program in 1979 to develop strategies for responding to the growing fire hazard problem. These include:

- An ongoing effort to analyze the history of wildland fires in Los Angeles County
- Experimentation with different methods of reducing and removing fuels in fire prone areas
- Evaluation of the environmental impacts and effects of these practices

Brush Clearance Inspection Program

Mandated by the LA County Fire Code, all property owners in the region are presently required to maintain a firebreak around and adjacent to all buildings and structures by removing all flammable vegetation or other combustible growth for a minimum distance of 200 feet from the structure or to the property line, whichever is closer.

The Brush Clearance Program is a joint effort between the Los Angeles County Fire Department and the County of Los Angeles Department of Agricultural Commissioner/Weights and Measures, Weed Hazard and Pest Abatement Bureau (Weed Abatement Division). This unified enforcement legally declares both improved and unimproved properties a public nuisance, and where necessary, requires the clearance of hazardous vegetation. These measures create "Defensible Space" for effective fire protection of property, life and the environment. The Department's Brush Clearance Unit enforces the Fire Codes as it relates to brush clearance on improved parcels, coordinates inspections and compliance efforts with fire station personnel, and provides annual brush clearance training to fire station personnel.

Fire Retardant Foam

All the Los Angeles County Fire Department fire engines are equipped with fire retardant foam capability. This type of program demonstrates the value of pre-suppression and prevention efforts when combined with property owner support to mitigate hazards within the wildland/urban interface.

Federal Programs

The role of the federal land managing agencies in the wildland /urban interface is to reduce fuel hazards on the lands they administer; cooperate in prevention and education programs; provide technical and financial assistance; and develop agreements, partnerships and relationships with property owners, local protection agencies, states and other stakeholders. These relationships focus on activities before a fire occurs, which render structures and communities safer and better able to survive a fire occurrence.

Federal Emergency Management Agency (FEMA) Programs

FEMA is directly responsible for providing fire suppression assistance grants and, in certain cases, major disaster assistance and hazard mitigation grants in response to fires. The role of FEMA in the wildland /urban interface is to encourage comprehensive disaster preparedness plans and programs, increase the capability of state and local governments and provide for a greater understanding of FEMA programs at the federal, state and local levels.

Fire Management Assistance Grant (FMAG)

The Fire Management Assistance Grant (FMAG) program extends support to local, state, and tribal authorities for the purpose of mitigating, managing, and containing fires on both publicly and privately owned forests or grasslands. This aid is provided when such fires pose a significant threat of devastation on a scale that could qualify as a major disaster.

Fire Suppression Assistance Grants

Fire Suppression Assistance Grants may be provided to a state with an approved hazard mitigation plan for the suppression of a forest or grassland fire that threatens to become a major disaster on public or private lands. These grants are provided to protect life and improved property as well as encourage the development and implementation of viable multi-hazard mitigation measures. The grant may include funds for equipment, supplies and personnel. A Fire Suppression Assistance Grant is the form of assistance most often provided by FEMA to a state for fires. The grants are cost-shared with states. FEMA's Fire Administration (USFA) provides public education materials addressing wildland/urban interface issues and the USFA's National Fire Academy provides training programs.

Hazard Mitigation Grant Program

Following a major disaster declaration, the FEMA Hazard Mitigation Grant Program provides funding for long-term hazard mitigation projects and activities to reduce the possibility of damages from all future fire hazards and to reduce the costs to the nation for responding to and recovering from the disaster.

National Wildland/Urban Interface Fire Protection Program

Federal agencies can use the National Wildland/Urban Interface Fire Protection Program to focus on wildland/urban interface fire protection issues and actions. The Western Governors' Association (WGA) can act as a catalyst to involve state agencies, as well as local and private stakeholders, with the objective of developing an implementation plan to achieve a uniform, integrated national approach to hazard and risk assessment and fire prevention and protection in the wildland/urban interface. The program helps states develop viable and comprehensive wildland fire mitigation plans and performance-based partnerships.

U.S. Forest Service

The U.S. Forest Service (USFS) is involved in a fuel-loading program implemented to assess fuels and reduce hazardous buildup on forest lands. The USFS is a cooperating agency and, while it has little to no jurisdiction in the lower valleys, it has an interest in preventing fires in the interface, as fires often burn up the hills and into the higher elevation US forest lands.

Fire Codes

Fire codes have been amended throughout the years to assist fire department personnel with wildland firefighting in the rural/urban interface zones. Building construction in these areas may have additional requirements for non-combustible construction components and water supplies. Inspectors assigned to these regional offices provide developers and homeowners with information for fire safe construction and fire protection systems.

Building Codes

All five Malibu-Las Virgenes COG cities are located within the Very High Fire Hazard Severity zone (VHFHSZ). Class A roofing material and one-hour rated exterior construction of structures is required by Fire and Building Codes.

Public Education and Involvement

The Fire Prevention Division within the Los Angeles County Fire Department (LACoFD) focuses on educating the community about the benefits of proper safety practices and identifying and eliminating all types of hazardous conditions, which pose a threat to life, the environment and property.

Ready Set Go!

The Los Angeles County Fire Department promotes wildfire prevention, loss mitigation, and preparedness via its website, through public information campaigns, and neighborhood inspections. As part of this effort, the LACoFD has published a personal wildfire action plan for residents living in the interface region called Ready Set Go! The plan describes the actions and tools necessary to successfully prepare for a wildfire. It gives guidance on retrofitting houses with fire-resistive features and describes how to create the necessary defensible space around the home. This publication also helps families prepare well ahead of time so that they are ready to quickly evacuate from an area endangered by a fast-approaching wildfire.

Additionally, the County Fire Department makes a variety of Safety Handouts available on their website and at various fire stations in the Las Virgenes-Malibu Region. These documents include but are not limited to:

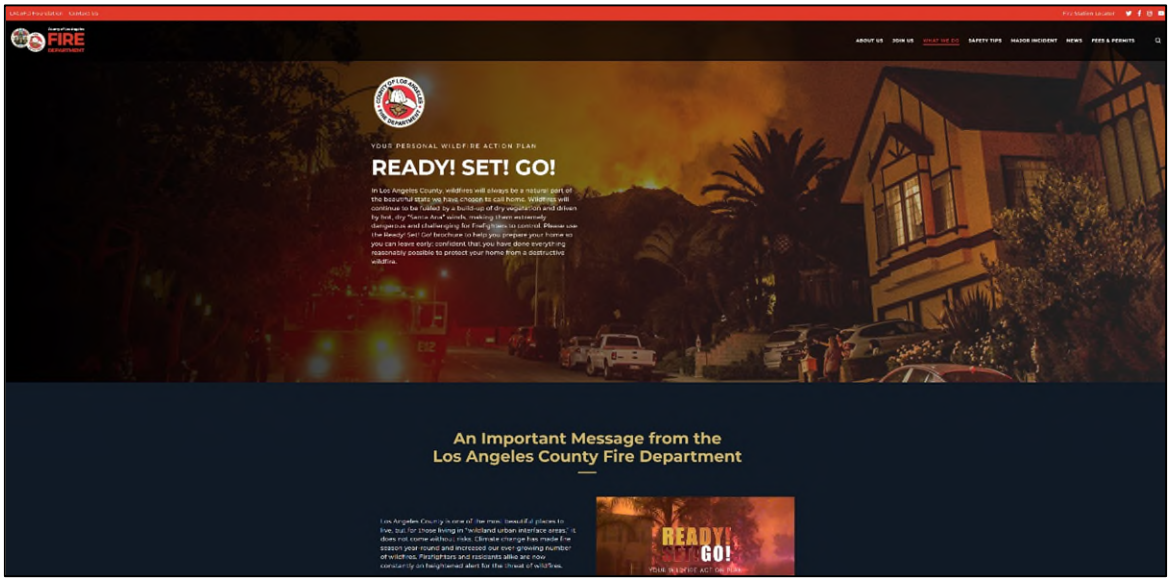


Figure 91: LACoFD Ready Set Go Web Page

- Home Fire Safety Tips
- Brush Clearance Tips
- Exit Drills in the Home
- Storm Safety Guidelines
- Rolling Electric Outage Safety
- Link to Southern California Gas Company for safety tips on gas appliances

A Road Map to Fire Safety

The Santa Monica Mountains Fire Safety Alliance developed a booklet on how to create a defensible space for residents of the Santa Monica Mountains. *A Road Map to Fire Safety* includes fire hazard reduction guidance, FAIR Plan insurance material, environmental considerations, topography and vegetation facts, and fire prevention organization information. The booklet is distributed by the Los Angeles County Fire Department and each LVMCOG city in hardcopy and softcopy formats.

Figure 92: A Road Map to Fire Safety Booklet

Community Education

The cities within the Las Virgenes-Malibu Region provide ongoing community education on fire hazards through the following programs:

- CERT (Citizen Emergency Response Team) training
- The City of Calabasas offers Calabasas Emergency Response Program (CERP) and Volunteers on Patrol program.
- The City of Malibu offers an Emergency Preparedness Program and Home Ignition Zone Assessment. Additionally, the City of Malibu Fire Liaisons serve as official contacts for Firewise Communities in the City and work to assist new neighborhoods in achieving Firewise Recognition.
- The City of Westlake has a CERT Program and Volunteers on Patrol Team.

The Las Virgenes-Malibu Regional cities along with the LACoFD educate the public in terms of fire and life Safety by providing the following special programs upon request. Fire Safety Education Programs that consist of the following:

- Local cable television education and informational programs are shown throughout the year, but most often during the months considered being fire season.
- Informational brochures have also been prepared and are distributed informing citizens about the need for evacuation plans and tips on home protection.

Connect-CTY, Code Red, and Alert LA County Emergency Mass Notification System

Many residents of the Las Virgenes- Malibu COG (excluding Malibu residents who utilize Everbridge) participate in the *Connect*-CTY service (Finalsite Connect Inc and Code Red) which allows authorized civic leaders to create and rapidly disseminate time-sensitive messages to every telephone number stored in the notification database. With the *Connect*-CTY and Code Red service, authorized users can send thousands of messages in minutes. Only authorized officials are allowed access to the system.

In addition, Los Angeles County has implemented an emergency mass notification system that will be used to contact County residents and businesses via recorded phone messages, text messages or e-mail messages in case of emergency. The system, called **Alert LA County**, will be used by the County's Emergency Operations Center to notify residents and businesses of emergencies or critical situations and provide information regarding necessary actions such as evacuations.

ALERT LA COUNTY
ALERT.LACOUNTY.GOV

BAER (Burned Area Emergency Rehabilitation)

The Los Angeles County Fire Department working in cooperation with the U.S. Forest Service, surveys burned areas after wildfires in order to determine what mitigation efforts are necessary to avoid mudslides in the event of a large rainfall (ex. strategically placing K-rails to deter mudslides) and to begin re-vegetation.

LVMCOG Mitigation Activities

All cities within the Las Virgenes-Malibu Council of Governments provide information regarding wildfire mitigation along with other emergency information on their websites. Wildfire mitigation planning advice can be downloaded or viewed online.

Agoura Hills

The City of Agoura Hills has implemented local fire codes to supplement County and State requirements. Additionally, during the code adoption process the City adopted more restrictive provisions by requiring construction in the city to comply with the Very High Fire Hazard Severity Zone Construction Standards. This provision requires that all structures built in Agoura Hills meet the more restrictive sections of the code including the method and material used for construction (i.e. Roof, Deck, Patio, Eave materials, window types, etc.).

The City has agreement with the Los Angeles County Fire Department for all Fire Services including Fire Prevention. In addition to the fire suppression and LA County Fire Prevention reviews plans and inspects construction projects for brush clearance, fire sprinkler and access to and around the project site. The City of Agoura Hills staff and its consultants are also trained and ready to assist its community for a fast recovery from all natural disasters including but not limited to fire. Codes Sections specific to Agoura Hills which were modified to provide better protection against fire, include:

Section	Title
2022 CBC Sec. 701A.1	Scope for Fire Severity Zone Wildland-Urab Interface (WUI) Construction Standards
2022 CBC Sec. 701A.3.1	Exception #5 – Roof Repair New, Additions, Alterations, Repair
2022 CBC Sec. 705A.2	Roof Covering
2022 CBC Sec. 903.2	Fire Sprinklers – Where Required

In addition, the City of Agoura Hills General Plan (2010) includes objectives, strategies, and policies related to wildfire mitigation. Specifically, Goal S-3 Protection from Fire Hazards. Minimize risks to persons and property in Agoura Hills from urban and wildland fires.

Reference #	Title	Strategy and Policy
S-3.1	Coordination with the Los Angeles County Fire Department	Cooperate with the Los Angeles County Fire Department in periodically evaluating services and service criteria to ensure that the City continues to receive adequate fire protection and prevention services. (Imp CS-26)
S-3.2	Wildfire Mitigation	Coordinate with the Los Angeles County Fire Department on appropriate wildland fire mitigation. (Imp CS-26)
S-3.3	New Development	Continue to ensure that all new development incorporates current state, county, and City, fire safe building code requirements, as appropriate. (Imp CS-32)

Reference #	Title	Strategy and Policy
S-3.4	Fire Protection Systems	Require all new commercial and multiple-unit residential developments to install fire protection systems, as required by the state and City buildings and fire codes, and encourage the use of automatic sprinkler systems in existing structures. (Imp CS-32)
S-3.5	Funding	Ensure that new developments pay a pro-rata share for increased fire protection as necessitated by that particular development. (Imp S-7, CS-26)
S-3.6	Fire Inspection	Work with the County Fire Department to ensure an ongoing fire inspection program to reduce fire hazards associated with critical facilities, public assembly facilities, industrial buildings, and nonresidential buildings. (Imp CS-26)
S-3.7	SEMS Plan	Incorporate and periodically review fire prevention and protection procedures in the City's Standardized Emergency Management Systems (SEMS) Plan. (Imp S-2)
S-3.8	Fire Department Review	Continue review by the Los Angeles County Fire Department of proposed structures and developments within the community, as applicable, to assure adequacy of structural fire protection, access for firefighting, water supply, and vegetation management. (Imp CS-26, CS-30)
S-3.9	Disaster Communication	Improve disaster coordination and communication with other public agencies. (Imp S-19, CS-26, CS-27)
S-3.10	Emergency Evacuation	Plan for emergency evacuation, including identifying standards for evacuation, and maintain adequate departure paths especially in areas that do not have at least two emergency evacuation routes (i.e., points of ingress and egress). (Imp S-20)
S-3.11	Emergency Access	Ensure new development has adequate emergency access through sufficient road widths according to the Los Angeles County Fire Department standards, which are currently 26 feet wide for single-story structures and 28 feet wide for multi-story structures, as well as adequate, visible street address signage to identify buildings. (Imp CS-30)
S-3.12	Fuel Load	Work to minimize fuel loads, or the amount of material that can be burned, within the wildland/urban interface within the City to the extent feasible, in coordination with the County Fire Department and other relevant agencies. (Imp S-22)
S-3.13	Public Education	Limit risk of wildfire through public education and planning, including working with community groups, including at risk populations, and other agencies to present information and training about evacuation, wildfire prevention and awareness, and defensible space. (Imp S-23)
S-3.14	Siting of Critical Facilities and Infrastructure	Encourage the location and development of new essential public services, such as health care facilities, emergency shelters, fire stations, and infrastructure outside of the Very High Fire Hazard Severity Zone, to the extent feasible. (Imp S-17)

Reference #	Title	Strategy and Policy
S-3.15	Local Hazard Mitigation Plan	Implement measures of the Las Virgenes-Malibu Council of Governments Multi-Jurisdictional Hazard Mitigation Plan relevant to the City, and work to ensure the Hazard Mitigation Plan is periodically updated. (Imp S-21)
S-3.16	Building Code	Continue to update the City's Building Code as necessary by incorporating structural hardening measures, such as fire rated roofing and fire resistant construction materials, and other measures to protect structures in a fire. (Imp S-24)
S-3.17	Communication Systems	Continue to evaluate and update communications systems in the City to provide early warning and notification about wildfire threats. (Imp S-16)
S-3.18	Maintain Availability of Fire Hazard Maps	Maintain collection of maps relating to fire hazards to help educate and assist builders and homeowners in mitigating against wildfire. Imp S-21, S-25)
S-3.19	Home Hardening	Promote the use of home hardening techniques that increase a structure's resistance to heat, flames, and embers through education and training. (Imp S-23)
S-3.20	Water Supply and Fire Flow	Work cooperatively with the Las Virgenes Municipal Water District and the Los Angeles County Fire Department, as appropriate, to ensure adequate water supply and facilities, including fire flow, for fire-fighting to serve all areas and populations of the City. (Imp U-5, CS-26)
S-3.21	Site Specific Fire Protection	Require applicants for new and re - development projects in the Very High Fire Hazard Severity Zone (VHFHSZ) to prepare a project-specific fire protection plan as part of initial application submittal. The fire protection plan shall at a minimum identify site ingress/egress, evacuation routes, emergency vehicle access, visible home addressing and signage, and fuel modification zones. (Imp S-26)
S-3.22	Existing Non-Conforming Development	Work with owners of developed property that does not meet current fire safety standards for access, water supply and fire flow, signage and vegetation clearance in the VHFHSZ, and provide guidance on how to meet the standards. (Imp S-30, S-23, CS-26)

The City of Agoura hills has strategically placed fire-resistant Beacon Boxes around the city which display critical information for public safety personnel such as water resources, road networks, egress areas, safe refuge areas, and high burn risk areas. The locations within Agoura Hills include:

1) Liberty Canyon
2) Amistosa
3) Old Agoura Park
4) Foothill Dr.
5) Sumac Park
6) Willow Elementary
7) Grey Rock Rd.
8) Reyes Adobe Rd.
9) Reyes Adobe Park
10) City Hall

The City of Agoura Hills has acquired a communications vehicle which will serve as a mobile Emergency Operation Center, if needed, to allow the city to continue to communicate with other public safety partners during an event.

The City has implemented a Home Hardening Grant Program for eligible property owners to promote Home Hardening of properties. The City partnered with the Resource Conservation District of the Santa Monica Mountains to provide home ignition zone evaluations as part of the process. One time grant funds are provided as an incentive for residents to take action on the Post Home Ignition Zone Evaluation Report.

The City has also implemented & completed an emergency evacuation plan, in addition to updating its Emergency Operations Plan (EOP).

Calabasas

The City of Calabasas 2030 General Plan, Safety Element includes specific policies to mitigate the threat of wildfires and other hazards. City of Calabasas Policies involving wildfire mitigation include:

Policy	Description
VII-17	Actively collaborate with regional, state and federal fire agencies to coordinate and implement wildfire mitigation measures and fuel load modifications / reduction zones, including load clearing, prescribed burns, fire breaks, livestock grazing, and public and private road clearance and other mitigation activities for areas proximal to the city, particularly potential wildfire approach pathways identified as high risk areas located to the north and south of the city as identified in Figures 6 and 7 of Appendix D-1 Wildfire Assessment. Establish and maintain for the future, a cooperative management agreements with entities that have jurisdiction over lands located to the north and south of the city limits.
VII-18	Survey the conditions in the wildfire approach pathways located within city limits as identified in Figure 8 of Appendix D-1 Wildfire Assessment in collaboration with the Los Angeles County Fire Department to assess vegetation management actions that could reduce wildfire movement.
VII-19	Actively engage with the County of Los Angeles, Santa Monica Mountains Conservancy, and Resource Conservation District of the Santa Monica Mountains as part of wildfire planning and implementation initiatives for unincorporated county areas that impact the City of Calabasas, including in particular those related to the Los Angeles County Fire Department Strategic Plan and the Los Angeles County Countywide Community Wildfire Protection Plan.
VII-20	Prepare a Community Wildfire Protection Plan for the City Calabasas that aligns with Los Angeles County's Countywide Community Wildfire Protection Plan by the next revision of the City of Calabasas Safety Element.
VII–21	Develop and maintain a GIS-based land inventory to identify fuel reduction status and points of contact to inform load reduction activities.
VII-22	Incorporate wildfire risk reduction measures, including healthy hillside management, load clearing, and brush management into plans, operations, and maintenance procedures for public access roads, parks, trails, open space, critical roads, and critical infrastructure.
VII–23	Conduct a City-wide survey of vegetation conditions in drainage corridors, hillsides, and similarly well-vegetated areas that could provide opportunities for wildfire to travel into built areas and specify recommended actions to reduce wildfire risks in these locations. VII-24 Minimize risks to existing development by identifying existing non-conforming development that does not meet contemporary fire safe standards, in terms of road standards and vegetative hazard, and require all new development to meet or exceed California Code of Regulations, division 1.5, chapter 7, subchapter 2, articles 1-5 requirements (State Responsibility Area Fire Safe Regulations).
VII–25	Encourage existing businesses and residents to adopt drought tolerant and fire resistant landscaping practices.
VII-26	Support Los Angeles County's Defensible Space Inspection Program that enforces defensible space standards of existing development in Calabasas by posting informational resources on the City's website and distributing via social media platforms.
VII-27	Develop and disseminate education and outreach materials to homeowners, residents, businesses, and landlords regarding retrofits and hardening that align with recommendations from CAL FIRE's Wildfire Home Retrofit Guide. Identify resources that can provide financial support for home retrofit and home hardening projects.

Policy	Description
VII-28	Develop and regularly update building and landscaping requirements and protocols that integrate CAL FIRE and Los Angeles County Fire Department regulations and procedures for retrofits and future development. Require ongoing maintenance and upkeep to be codified as part of building covenants or homeowner covenants, conditions and restrictions. Update the Calabasas Municipal Code with incentives for home retrofits.
VII-30	Update landscaping requirements and guidelines regarding landscape design, species preferences, installation, and maintenance to reduce vulnerability to ember ignition, and wildfire impacts.
VII-31	Minimize wildfire risk by increasing resistance of structures to heat, flames, and embers. Review current building code standards and other applicable statutes, regulations, requirements, and guidelines regarding construction, and specifically the use and maintenance of non-flammable materials (both residential and commercial) and consider adopting amendments to implement these higher standards.
VII-32	To reduce vulnerability of structures to ember ignition and wildfire impacts, review current building code standards and other appliable statutes, regulations, requirements, and guidelines regarding construction, and specifically the use and maintenance of non-flammable materials (both residential and commercial).
VII–33	Update the City's development standards to be in conformance with title 14, California Code of Regulations, division 1.5, chapter 7, subchapter 2, articles 1-5 (commencing with section 1270) (State Responsibility Area Fire Safe Regulations) and title 14, California Code of Regulations, division 1.5, chapter 7, subchapter 3, article 3 (commencing with section 1299.01) (Fire Hazard Reduction Around Buildings and Structures Regulations).
VII–34	Discourage development where wildfire risk mitigation measures would significantly impact biological resources. Where development must be accommodated, implement fuel modification techniques that would not adversely affect significant biological resources, to the greatest extent feasible. Site structures to maximize low-flammability landscape features to buffer against wildfire spread encourage sensitive siting of structures.
VII-35	In lieu of more highly combustible and non-native tree species, encourage existing residents and new developments to plant native oaks in strategic locations and near existing oak woodlands to protect developments from wildfires, as well as to lessen fire risk associated with developments.
VII-36	Coordinate with local organizations, such as Emergency Preparedness in Calabasas: A Fire Safe Council (EPIC), to pursue and allocate grant funding to support wildfire risk reduction activities.
VII–37	Coordinate with Los Angeles County Fire Department to evaluate their the City's capacity to adequately suppress wildfire, taking into account water supply availability and fire protection, including fire stations, fire engines and personnel, required for existing and newly developed areas, as part of the next Las Virgenes-Malibu Council of Governments Multi-Jurisdictional Hazard Mitigation Plan update.
VII-38	Coordinate with the Las Virgenes Municipal Water District to ensure the long term maintenance and integrity of water supply and water pressure for existing and future developed areas for firefighting purposes. Support the Las Virgenes Triunfo Joint Powers Authority's proposed Pure Water Project in order to provide residents with a locally produced water source that can be relied on through disasters and hazard events.
VII–39	Permit new development only within areas that have adequate water resources available, to include water pressure, onsite water storage, or fire flows.
VII-40	Limit new development along steep slopes and amidst rugged terrain to limit rapid fire spread and increase accessibility for fire-fighting.

Policy	Description
VII-41	Whenever feasible, locate new essential public facilities, including health care facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities, in areas of the City that are already developed rather than on properties adjacent to undeveloped lands.

In addition, the City of Calabasas Land Use and Development Code (2010) includes requirements intended to mitigate the threat of wildfire.

- Within the HM, RR, or RC zones, structures intended for human occupancy are to be located along a paved, all weather, accessible (to emergency personnel) road for the purpose of avoiding the need for firefighters to move equipment onto properties without adequate turnaround space. If a structure cannot feasibly be sited in this manner, the structure shall contain sprinklers as required by the city.
- Prior to approval of a building permit for any new structure intended for human occupancy within areas subject to wildland fires, applicants should meet with the County Consolidated Fire Districts to determine the most fire-safe location for the structure. New structures intended for human occupancy within areas subject to wildland fires are generally to be located on the lowest portion of the site. In addition, adequate setbacks from the top of slopes which have natural vegetation shall

Hidden Hills

The City of Hidden Hills has an extensive fire prevention program. The City reviews each new development to ensure that structures are adequately separated and that fire retardant materials are used in construction. In addition, the Hidden Hills Municipal Code requires that property owners maintain right-of-way improvements and public works in a clean, hazard-free condition to ensure safety.

The following City of Hidden Hills building codes are implemented as preventative measures for loss of life and property because of a fire hazard event.

Section	Title
Section 1. Chapter 3 of Title 4	City of Hidden Hills Fire Code

In addition, the Safety Element of Hidden Hill's General Plan (1995) includes a focus on, "the reduction and/or prevention of injuries, loss of life, property damage, and economic and social disruption due to fires, floods, seismic activities, and other natural disasters."

The City of Hidden Hills Safety Element serves three key functions:

- Provide a framework by which safety considerations are introduced into the planning and development process;
- Identify and evaluate natural hazards; and
- Establish goals and policies which minimize potential adverse effects related to natural hazards

The City has also implemented an Emergency Evacuation Plan. The Emergency Evacuation Plan is an important aspect since there are limited means of ingress and egress to the community.

The City of Hidden Hills includes specific goals and policies related to natural hazards and wildfire:

Goal 2: Protect natural resources, life, and property from fire hazards in the City.

Policy	Description
2.1	In all areas, maintain around and adjacent to all structures a cleared firebreak for a distance not less than 100 feet.
2.2	Permit future residential development only within areas of minimal slope.
2.3	Require minimum road standards in all new subdivisions in order that fire equipment will have access to all properties and that there is a safe means for people to evacuate fire areas. This shall include private drives over 100 feet in length.
2.4	Fire hydrants must be within 600 road feet of a given building site.
2.5	Establish and enforce minimum standards of fire protection for new developments.
2.6	Conduct a study on the adequacy of the City's water system for fire protection.

Malibu

The City of Malibu Building Code includes wildfire mitigation standards for residential construction. Specifically, 17.40.040 Residential Development Standards requires:

> 1. Every residence shall have a roof constructed with roofing material in compliance with a rating as specified by Section 1603 (Fire Zone 4) of Title 26 (Los Angeles Building Code) of this code (see Chapter 15.04).
>
> 8c. Ridgetop development is particularly susceptible to wildfire hazard. In addition to the criteria to reduce visual impact, the planning director shall evaluate all ridgeline development on slopes of at least 3:1 to incorporate adequate setbacks to address potential fire hazard concerns.

In addition, the City of Malibu General Plan, Safety and Health Element identifies areas of high wildfire risk and includes goals and measures to mitigate the risk of wildfire.

5.3.1 S Goal 1: A Community that is Free from All Avoidable Risks to Safety, Health and Welfare from Natural and Man-Made Hazards

S Objective 1.1: Losses to Life and Property from Natural and Man-Made Hazards Greatly Reduced from Historic Levels.

Policy	Description
S Policy 1.1.1	The City shall protect people and property from environmental hazards.
S Policy 1.1.2	The City shall minimize the risk of loss from fire.

Measures to implement wildfire mitigation in the City of Malibu are defined as follows:

Measure	Description
S Implementation Measure 1	Develop a master plan of fire prevention and control identifying hazards, assessing acceptable levels of cost and risk and determining protection programs.
S Implementation Measure 2	Work with other agencies to ensure effective and efficient fire suppression, prevention and rescue services.
S Implementation Measure 3	Encourage owners of swimming pools to obtain gasoline powered pumps to use in firefighting.
S Implementation Measure 4	Establish programs and guidelines for fire-safe landscaping including buffers comprised of fire resistant vegetation between residential areas and open space areas and encourage use of fire-safe landscaping principles which emphasize plant species with low fuel volumes.
S Implementation Measure 5	Work with the Los Angeles County Fire Department to adopt a program for controlled burning of combustible vegetation, based on the recommendations of the responsible forestry and fire-protection official.
S Implementation Measure 6	Work with the Los Angeles County Fire Department to enforce code requirements for flammable brush clearance, and reduction of flammable vegetation, including both native plants and ornamental landscaping.

Measure	Description
S Implementation Measure 7	Work with appropriate agencies to assure sufficient stored water and provide non-monetary incentives for on-site or area-wide shared storage water suitable for firefighting equal to one gallon for each square foot of structural floor area for all new development.
S Implementation Measure 8	Work with the Los Angeles County Fire Department to establish standards for firefighting equipment access suitable for Malibu.
S Implementation Measure 9	Create a major streets and routes plan which includes streets available as wildfire escape routes.
S Implementation Measure 10	Require all new and remodel structures to have Class A fire-retardant roofing.
S Implementation Measure 11	Develop guidelines and standards for all new and remodel structures to utilize fire-resistant building materials and designs, and, if feasible, to be sited to minimize fire hazards.
S Implementation Measure 12	Provide South Coast Air Quality Management District regional wind patterns maps to homeowners, architects and contractors to help them plan development siting and design that minimizes fire hazards.
S Implementation Measure 13	Work with the Los Angeles County Fire Department to provide on-site fire safety inspections of individual homes, when requested by resident or owner, and advise homeowners on ways to minimize fire hazards while maintaining slope stability and appropriate vegetation.
S Implementation Measure 14	Encourage and support arson and neighborhood watch programs.
S Implementation Measure 15	Require that all camping be in designated fire-safe camping areas.
S Implementation Measure 16	Develop a permanent, ongoing homeowner watershed area management plan to reduce fire hazards while maintaining appropriate vegetation that will stabilize the watershed and control the flow of water from it. Application of such plan in Resource Protection Areas shall be subject to review and approval for compliance with resource protection requirements.
S Implementation Measure 17	Work with water service providers to identify neighborhoods with inadequate flow from fire hydrants, and to upgrade deteriorated and undersized water-distribution systems.

S OBJECTIVE 1.2: RISKS TO RESIDENTS AND BUSINESSES FROM DEVELOPMENT IN HAZARDOUS AREAS ARE MINIMIZED.

Measure	Description
S Implementation Measure 39	Develop and maintain a development geo-hazard database to incorporate findings from site specific and area hazard-related studies.
S Implementation Measure 40	Adopt and update as appropriate maps of extreme fire danger areas, 100- year flood plains, landslide and debris flow danger, active and potentially active faults, tsunami, and any other hazard areas; and inform residents of those areas of risks and possible mitigation measures.
S Implementation Measure 47	To protect slope stability, restrict grading or development related vegetation clearance where the slope exceeds 2:1, except as required for fire safety, driveways and utilities and where there is no reasonable alternative.
S Implementation Measure 51	Evaluate proposed development for its impact on, and from, geologic hazards, flood and mud flow hazard, and fire hazard.

The City of Malibu has strategically placed 47 fire-resistant Beacon Boxes around the city which display critical information for public safety personnel such as water resources, road networks, egress areas, safe refuge areas, and high burn risk areas.

The City of Malibu has adopted a Community Wildfire Protection Plan (CWPP) aimed at reducing wildfire risks in the community. In includes measures such as vegetation management, firebreak creation, and community education.

The City of Malibu's Fire Hazard Tree Removal program addresses the critical need to identify and remove hazardous trees that pose a significant risk during wildfires. This initiative focuses on proactive measures to safeguard lives and property.

The City of Malibu utilizes Everbridge for their disaster notification system which includes both landline and cell phone contacts.

The City's three Fire Safety Liaisons are actively working with neighborhoods to achieve Firewise recognition and working to get the City included on the State's Wildfire Risk Reduction Community List. In addition, the Liaisons are working on implementing the recommendations in the Subdivision Review Program. (https://bof.fire.ca.gov/projects-and-programs/subdivision-review-program/)

Westlake Village

The Building and Safety Division of the Los Angeles County Department of Public Works serves under contract as the City's Building and Safety Department. Building and Safety is responsible for enforcing zoning restrictions and other regulations designed to reduce the threat of fire.

The City of Westlake Village General Plan (1993) contains specific goals, objectives, and policies to address fire hazards within the city.

Goal	It shall be the goal of the City of Westlake Village to: Protect the community from fire hazards in order to reduce potential fire damage and the loss of life.
Policies & Objectives	It shall be the objective of the City of Westlake Village to: 3. Reduce fire hazards in the community's built environment by incorporating sound fire prevention designs, materials and systems into new structures. <u>Policies</u> It shall be the policy of the City of Westlake Village to: 3.1. Continue to require that all structures and facilities in the City adhere to City, State and National regulatory standards such as the Uniform Building and Fire Codes and other applicable fire safety standards (I-1). 3.2. Prohibit the use of wood shingle/shake roofs and require the use of fire retardant non-wood roofing materials (I-7). 3.3. Encourage the installation of smoke detectors in existing residences built prior to January 1, 1986 (I-2). <u>Objective</u> It shall be the objective of the City of Westlake Village to: 4. Reduce the risk of property damage and human injury by incorporating fire safety designs into the planning of new developments. <u>Policies</u> It shall be the policy of the City of Westlake Village to: 4.1. Require adequate emergency access (i.e., two viable points of ingress and egress) for emergency vehicles and evacuation in the event of a fire (I-3). 4.2. Promote the clustering of development in hillside areas (I-4). <u>Objective</u> It shall be the objective of the City of Westlake Village to: 5. Ensure that the risk of damage and injury from brush fires is significantly reduced.

	Policies It shall be the policy of the City of Westlake Village to: 5.1. Require that developments located in wildland interface areas incorporate and maintain a fuel modification program, (i.e., brush clearance and the planting of slow burning and fire retardant vegetation) to reduce the threat of wildfires (I-5). 5.2. Ensure that high fuel brush vegetation in wildland areas is cleared/maintained as required to reduce the risk of brush fires (I-6). 5.3. Require all brush clearance/maintenance zones be located on the site they are intended to protect (I-8).

The City of Westlake Village Implementation Program includes:

I-1	Cooperate with the Los Angeles County Building and Safety Department as well as the Fire Department to ensure all applicable fire codes and standards are enforced.
I-2	Investigate the feasibility of providing a city rebate program for residents who purchase new smoke detectors for their homes where smoke detectors are absent.
I-3	Utilize the City's design review process to evaluate the fire safety aspects of proposed developments. Coordinate with the Los Angeles County Fire department to ensure adequate emergency access is being provided by all proposed developments.
I-4	Implement the Hillside Management Ordinance.
I-5	Coordinate with the Los Angeles County Fire Department to ensure that an adequate fuel modification program is actively being implemented and enforced.
I-6	In event of noncompliance, encourage the Los Angeles County Fire Department to enforce the required maintenance of high fuel areas, through notification and citation of violators.
I-7	Review and revise, as needed, current building codes pertaining to fire retardant roof materials and construction techniques.
I-8	Modify the hillside ordinance to require all brush clearance and maintenance zones be located on the site they are intended to protect.

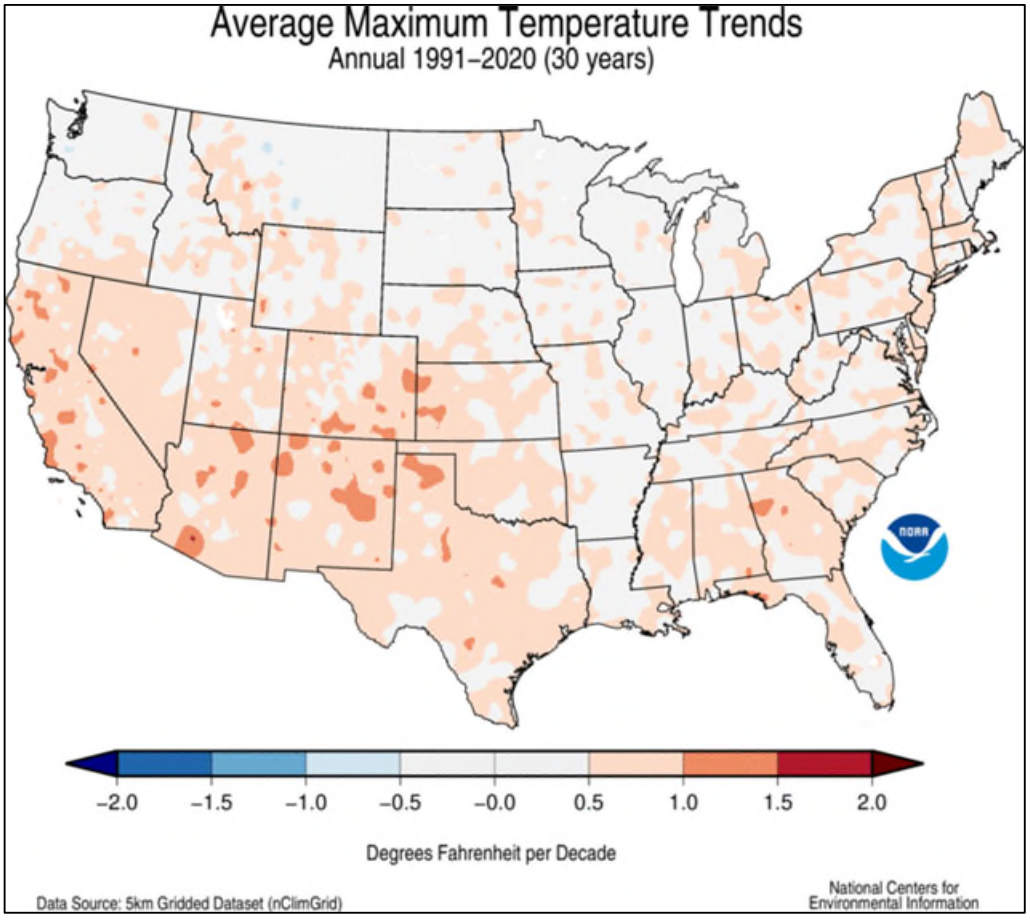
SECTION 8. CLIMATE CHANGE

THE NATURE OF THE CLIMATE CHANGE THREAT

According to "California's Fourth Climate Change Assessment" developed by the State of California, continued climate change will have a severe impact on California. Increased temperatures, drought, wildfires, and sea level rise are several of the main concerns related to climate change in the Southwest.

Temperature Rise

By the year 2100, the average annual maximum daily temperature is expected to increase 2° to 9.7° Fahrenheit.[9] This rise in temperature can result in power outages (from increased demands combined with limited supplies), drought, wildfires, sea level rise as well as agriculture and livestock losses. The National Centers for Environmental Information (NCEI) under the National Oceanic and Atmospheric Administration (NOAA) tracks temperature trends. The map below depicts the Maximum Annual Temperature trends for the U.S.



Map 54: Average Annual Maximum Temperature Trends – June 1991 – 2020 (30 years)

Source: NCEI NOAA (https://www.ncei.noaa.gov/access/monitoring/us-trends/tmax/jun)

[9] NOAA (https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature-projections)

Water and Drought

Despite the heavy snowpack created in 2022, by 2050, the water supply from the California snowpack is projected to decline by two-thirds. This will lead to water shortages of up to 16 percent in certain regions causing losses in agriculture as well as community water consumption restrictions.

Wildfire

By 2100, the frequency of severe wildfires is expected to increase, with a projected 77 percent rise in the average area burned statewide. In the areas that have the highest fire risk, wildfire insurance is estimated to see costs rise by 18 percent by 2055[10] (see **Wildfire** section for additional area specific information).

Sea Level Rise

The "California's Fourth Climate Change Assessment" predicts that 31 to 67 percent of Southern California beaches may completely erode by 2100 without large-scale human interventions. This will lead to $17.9 billion in losses to residential and commercial buildings statewide by 2050 from a projected 20 inches (50 cm) of sea level rise. Further, if a 100-year coastal flood were to occur, this cost would nearly double. For the City of Malibu, current projections estimate that the coastline risk of seal level rise ranges from Low to Moderate – though the loss of beach sand and higher waves can still have a significant impact on the area. The map below provides an example of areas subject to high tide flooding in Malibu. Note that multiple housing structures will be at risk along the entire Malibu coastline.

Map 55: City of Malibu High Tide Flood Zones
Source: NOAA Office for Coastal Management

In addition, a rise in sea level could impact Pacific Coast Highway, the major transportation route through the City of Malibu. As a result of the overall threat of sea level rise in the State of California, Caltrans is currently conducting climate vulnerability assessments to address these and other impacts to ultimately develop climate adaptation strategies for each of its 12 districts across the state. Additionally, the City of Malibu is conducting a Coastal Vulnerability Assessment to further understand the sea level rise risk and areas for potential mitigation (see Malibu Mitigation Activities section).

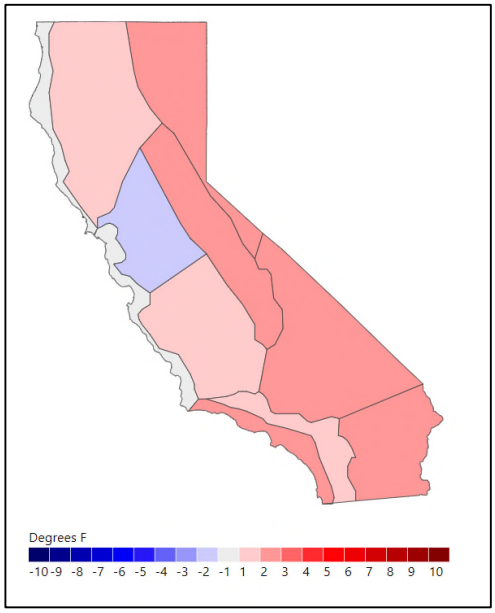
[10] California's Fourth Climate Change Assessment

CLIMATE CHANGE AND DROUGHT HISTORY

Temperature

Overall, temperatures in the South Coast Region of California have fluctuated year-to-year but have shown a consistent increase since 2013. The table on the right provides a summary of the annual average temperature from 2000 to 2022.

Source: The National Drought Mitigation Center, University of Nebraska-Lincoln



Map 56: CNAP Mean Temperature Departures from 1981-2010 Average

Furthermore, the average temperature in the South Coast Region rose 1 degree from 2000 to 2022 and in the summer of 2023, most of the country experienced some of the highest temperatures on record.

Year	Mean Temperature Degrees F	Historical Average	Departure
2022	70.7	69.1	1.5
2021	73.9	69.1	4.8
2020	69.4	69.1	0.3
2019	70.2	69.1	1.1
2018	70.2	69.1	1.1
2017	71.7	69.1	2.6
2016	72.6	69.1	3.5
2015	73.5	69.1	4.3
2014	70.8	69.1	1.6
2013	71.2	69.1	2.1
2012	68.5	69.1	-0.7
2011	65.8	69.1	-3.3
2010	68.1	69.1	-1
2009	66.5	69.1	-2.6
2008	70.1	69.1	0.9
2007	69.7	69.1	0.6
2006	72.4	69.1	3.2
2005	65.1	69.1	-4
2004	69.8	69.1	0.6
2003	70.5	69.1	1.4
2002	70.4	69.1	1.2
2001	70.6	69.1	1.4
2000	71.4	69.1	2.3

Table 139: Mean Temperature Observations and Departures for the South Coast

Source: Western Regional Climate Center

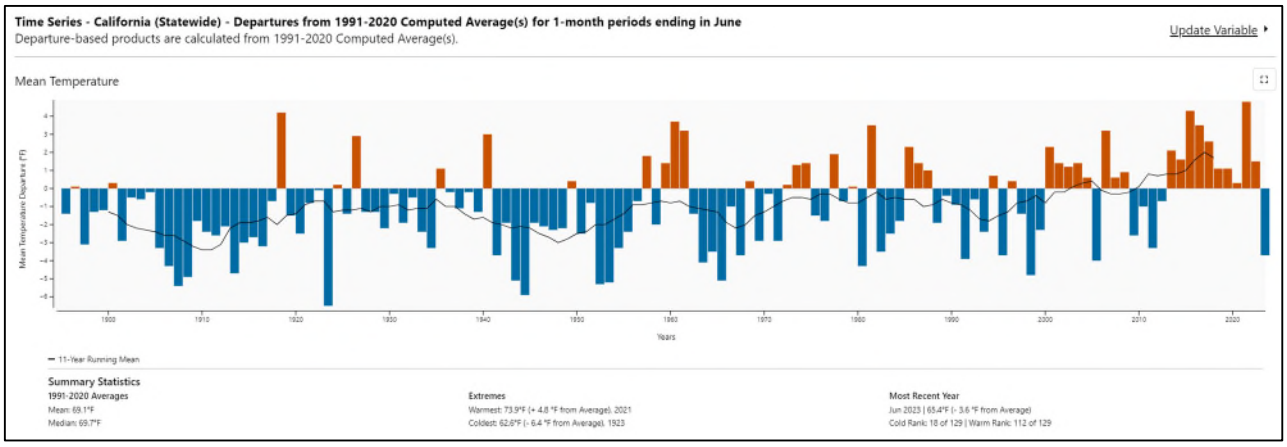
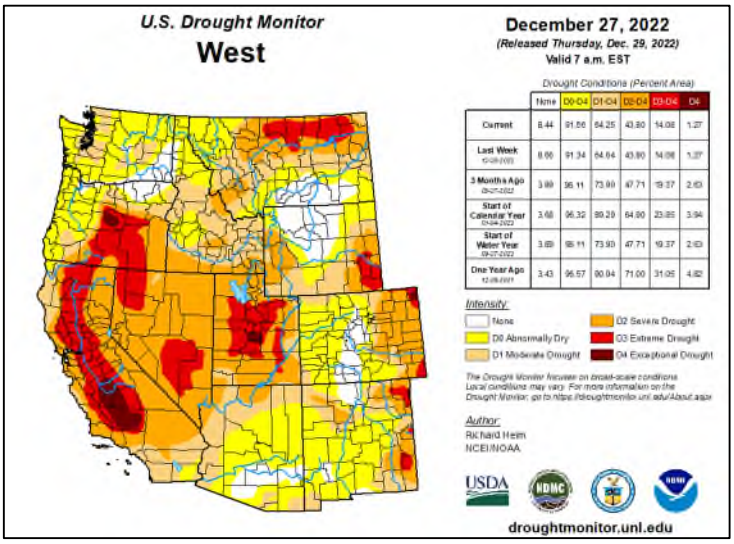


Figure 93: Time Series - Departures from 1991 – 2020 Computed Average(s) for 1-month periods ending in June

Source: Western Regional Climate Center

Drought

California is chronically under drought conditions. Although the end of 2022 to early 2023 was a major rainfall period, in general, drought conditions are expected to continue. Previously from 2021 to 2022, significant areas of California were in Severe to Exceptional Drought conditions. Similarly, from 2014 through 2016 a large part of the state was under Exceptional Drought status (Source: National Drought Mitigation Center, University of Nebraska-Lincoln).



Map 57: U.S. Drought Monitor - Western States Status (Dec 2022)

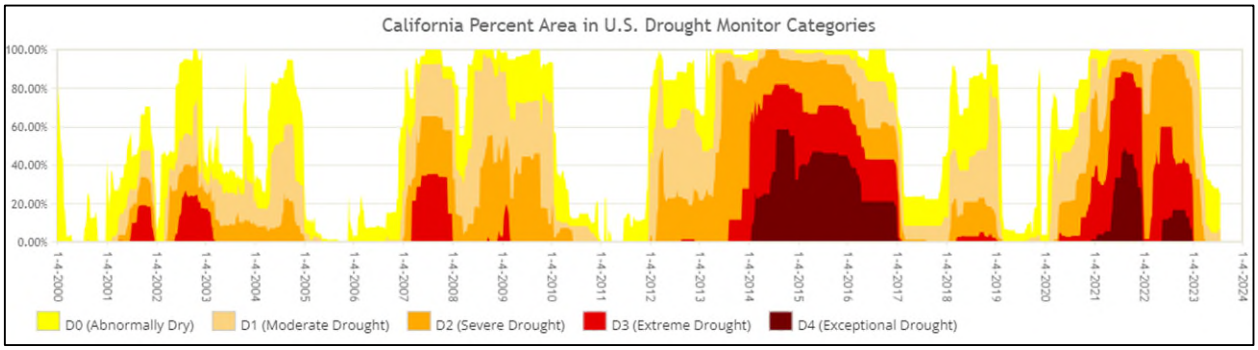


Figure 94: California Percent Area in U.S. Drought Monitor Categories

The table below provides a summary of the rainfall variations from 1980 to 2022 in Los Angeles County, California.

Year	Precipitation (inches)	Percent of Average		Year	Precipitation (inches)	Percent of Average
2022	7.19	45.50		2000	12.19	77.12
2021	7.02	44.41		1999	6.93	43.85
2020	12.11	76.60		1998	27.80	175.91
2019	22.97	145.38		1997	12.02	76.08
2018	10.24	64.78		1996	18.23	115.35
2017	12.57	79.55		1995	25.51	161.43
2016	11.78	74.52		1994	10.01	63.36
2015	7.55	47.80		1993	27.12	171.62
2014	9.56	60.47		1992	25.61	162.05
2013	4.75	30.07		1991	16.62	105.18
2012	9.23	58.39		1990	7.14	45.21
2011	12.02	76.06		1989	5.25	33.19
2010	25.18	159.32		1988	12.44	78.69
2009	9.99	63.21		1987	12.57	79.52
2008	14.59	92.32		1986	16.18	102.36
2007	6.37	40.29		1985	8.34	52.80
2006	13.23	83.69		1984	10.11	64.00
2005	27.40	173.39		1983	34.60	218.91
2004	18.43	116.64		1982	19.32	122.28
2003	14.62	92.50		1981	11.70	74.01
2002	7.49	47.37		1980	24.83	157.10
2001	17.12	108.34				

Table 140: Precipitation Observation and Percents of Average for the South Coast

Source: Western Regional Climate Center

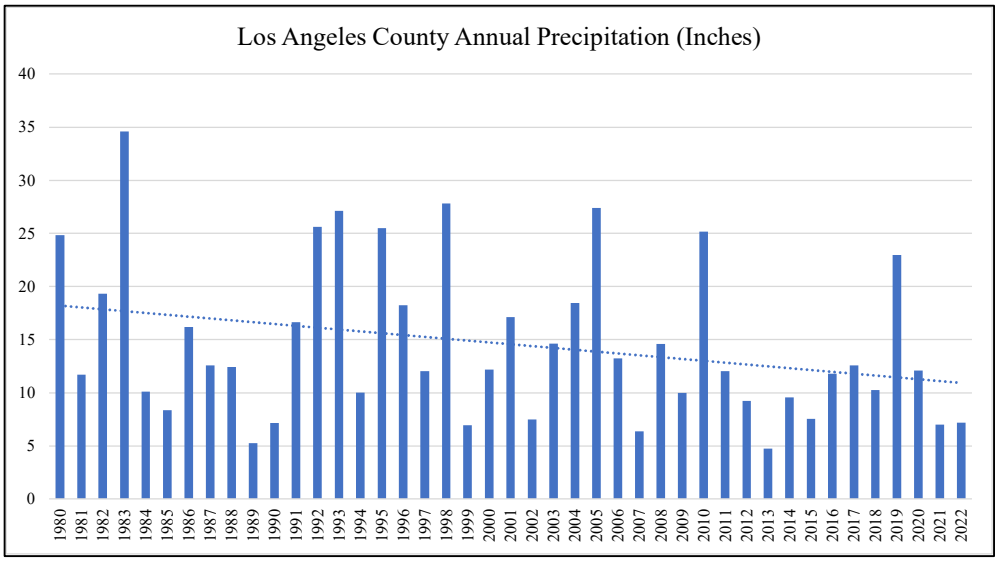


Figure 95: Annual Precipitation in Los Angeles County

Although the rainfall history shows significant variations between dry and extremely wet years, the overall rainfall trend has been moving downward over time which indicates a higher likelihood of drought in the future.

Extreme Weather Fluctuations (Heat and Cold)

Average temperatures in Los Angeles County have shown annual fluctuations between heat and cold with several extreme years showing larger variations than normal. For example, in 2014 the average temperature was over 3 degrees higher than the average and in 1998 the temperature was nearly 2 degrees lower than average. These temperature fluctuations can have a significant impact on the community due to changes in weather patterns, damage to plant life, loss of agriculture, and impact on wildlife. The following table illustrates the departure from normal readings from 1980 to 2022. Furthermore, the overall trend since 1980 has been a gradual temperature rise therefore periods of future high temperatures can be anticipated.

Year	Los Angeles County Temperature (Degrees F)	Departure from Normal		Year	Los Angeles County Temperature (Degrees F)	Departure from Normal
2022	62.80	1.18		2000	61.82	0.20
2021	62.79	1.18		1999	61.00	-0.62
2020	62.38	0.76		1998	59.86	-1.76
2019	61.11	-0.51		1997	62.85	1.24
2018	63.49	1.88		1996	62.99	1.38
2017	63.88	2.27		1995	62.15	0.54
2016	63.63	2.01		1994	61.33	-0.28
2015	64.02	2.41		1993	61.34	-0.27
2014	64.70	3.08		1992	62.15	0.54
2013	62.51	0.89		1991	60.89	-0.73
2012	62.81	1.20		1990	61.68	0.07
2011	60.58	-1.03		1989	61.63	0.02
2010	60.63	-0.99		1988	61.40	-0.22
2009	62.07	0.46		1987	60.86	-0.76
2008	62.49	0.87		1986	61.84	0.22
2007	62.20	0.59		1985	61.02	-0.59
2006	61.89	0.28		1984	62.27	0.66
2005	61.30	-0.32		1983	61.03	-0.58
2004	61.75	0.13		1982	60.00	-1.62
2003	62.49	0.87		1981	62.68	1.06
2002	61.43	-0.18		1980	61.54	-0.07
2001	61.38	-0.23				

Table 141: Los Angeles County Average Temperature 1980 - 2022

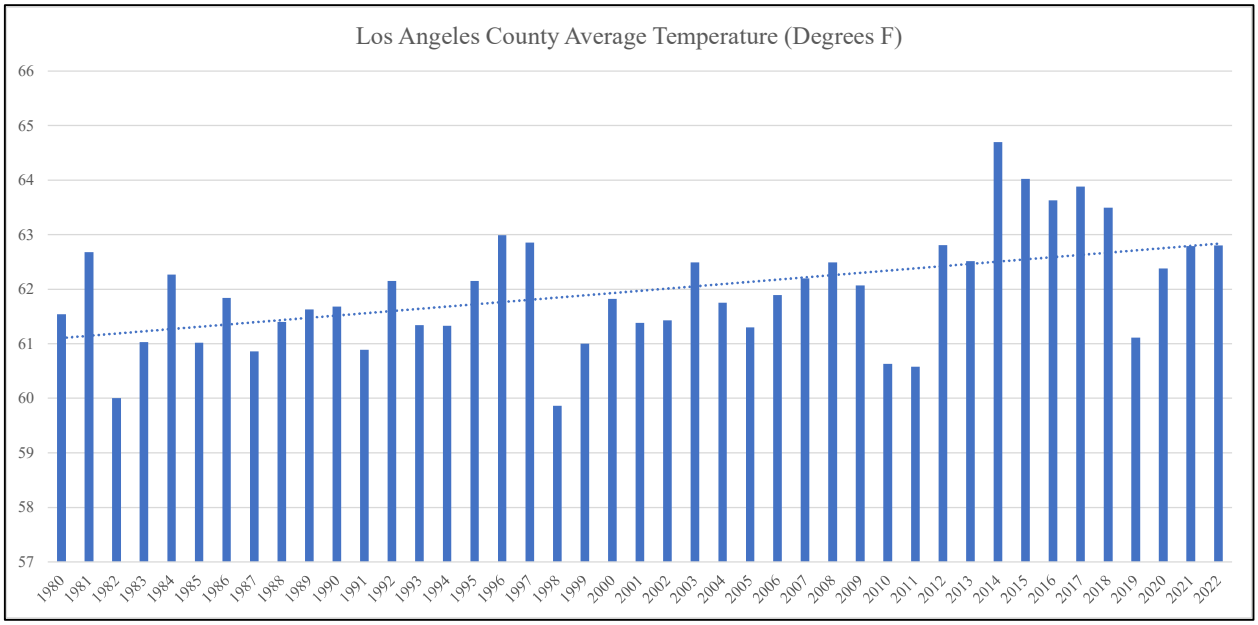


Figure 96: Average Annual Temperature for Los Angeles County

Sea Level Rise (SLR)

According to the California Office of Environmental Health Hazard Assessment (OEHHA) May 2018 report, "Indicators of Climate Change in California",[11] sea levels along the California coast have generally risen over the past century (except along the far north coast where uplift of the land surface has occurred due to the movement of the Earth's plates).

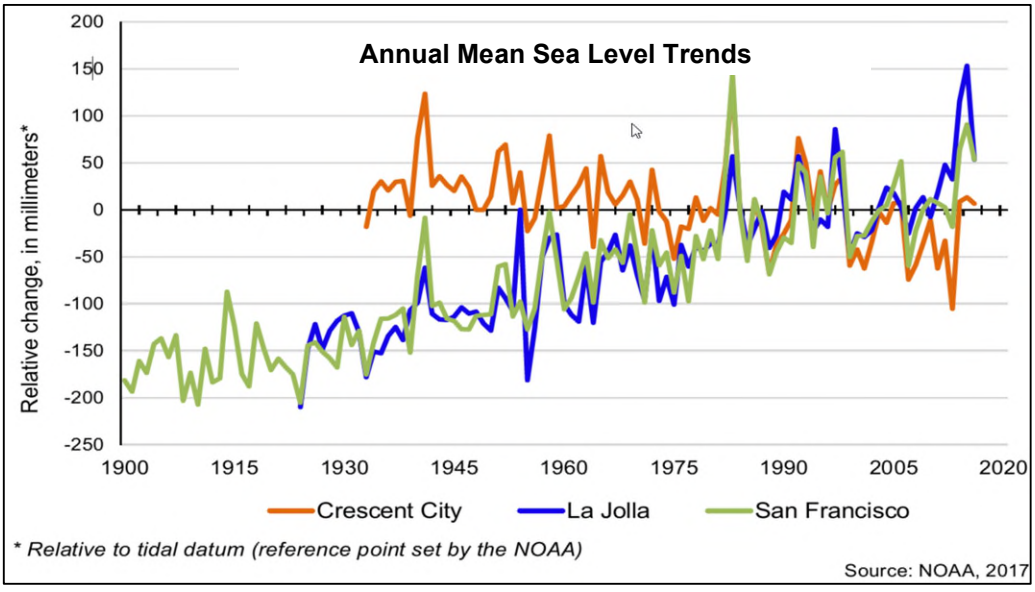


Figure 97: Annual Mean Sea Level Trends

[11] Milanes, et.al., Indicators of Climate Change in California, 2018

Measurements at La Jolla and San Francisco have climbed since 1990 from a standard elevation established by the National Oceanic and Atmospheric Administration (NOAA) as a reference point. Specifically, the mean sea level has increased by 180 millimeters (mm) or 7 inches since 1900 in San Francisco and approximately 150 mm or 6 inches since 1924 in La Jolla. Further, the 16 tide stations operated by NOAA in California shows an overall increase of 0.96 mm/year in the Los Angeles area coast from 1923 to 2016 (see table below) which equates to a total of 99.84 mm or approximately 4 inches.

Sea Level Trends (as reported by NOAA)

Location	Period of record	Trend, mm/year (inches/year)
Alameda*	1939-2016	+0.72 (+0.03)
Arena Cove	1978-2016	+0.53 (+0.02)
Crescent City	1933-2016	-0.80 (-0.03)
La Jolla	1924-2016	+2.17 (+0.09)
Los Angeles	1923-2016	+0.96 (+0.04)
Monterey	1973-2016	+1.39 (+0.05)
Newport**	1955-1993	+2.22 (+0.09)
North Spit	1977-2016	+4.68 (+0.18)
Point Reyes	1975-2016	+1.98 (+0.08)
Port Chicago*	1976-2016	+1.58 (+0.06)
Port San Luis	1945-2016	+0.84 (+0.03)
Redwood*	1974-2016	+1.99 (+0.08)
San Diego	1906-2016	+2.15 (+0.08)
San Francisco	1897-2016	+1.94 (+0.08)
Santa Barbara	1973-2016	+1.01 (+0.04)
Santa Monica	1933-2016	+1.51 (+0.06)

* Gauge not along the outer coast
** Currently inactive
Source: NOAA, 2017

Map 58: Sea Level Trends

Additionally, according to the "Indicators of Climate Change in California"[12] report, since the mid-19th century, global mean sea levels have been rising at a higher rate than during the previous two millennia.

- The rate of increase between 1993 and 2010 was at 3.2 mm/year (approx. 0.1 inch/year)
- The rate of increase between 1901 and 2010 was 1.7 mm/year (approx. 0.07 inch/year)

The Threat of Sea Level Rise to California

In 2020, a report by the California Legislative Analyst's Office (LAO) studied the effects of sea level rise in the state. The report entitled "The Threat of Sea Level Rise to California" cited the following major areas impacted by sea level rise:

- Public Infrastructure
- Private Property
- Vulnerable Communities
- Natural Resources
- Drinking and Agricultural Water Supplies
- Toxic Contamination
- Economic Disruption

[12] Milanes, et.al., Indicators of Climate Change in California, 2018

The following sections are quoted from the study[13]:

Public Infrastructure

Damage to public infrastructure located along California's coast represents one of the greatest threats from SLR, as these assets are key components of state and local systems of public health, transportation, and commerce. Examples of publicly owned infrastructure located along the coast include water treatment plants, roads and highways, railways, piers and marinas, and public recreational trails. Depending upon the specific location of these facilities, they could be impacted by both flooding from waves or rising groundwater levels, as well as damage from cliff erosion. In addition, flooding from SLR threatens several important California ports and airports—including those in Long Beach, Los Angeles, San Diego, and Oakland—that are managed by public special districts.

For example, a March 2020 study of SLR vulnerability in the San Francisco Bay Area found that four feet of higher water levels (either from SLR alone or in combination with periodic storm surges) would expose key transportation and commerce infrastructure in the region to flooding. Locations identified as being at risk include: 59 miles of highways and bridges, 48 miles of freight rail lines, 20 miles of passenger rail lines, 11 acres of ferry terminals, 780 acres of seaports, and 4,670 acres of airports. Such flooding could render this important infrastructure unusable for extended periods of time—or, in some cases, permanently—and require costly repairs or modifications.

A different study conducted in 2018 estimated potential impacts from SLR on wastewater infrastructure along the coast. Researchers found that 15 wastewater treatment plants in California will be exposed to flooding with three feet of SLR, growing to 36 facilities with six feet of SLR. Facilities in the San Francisco Bay region are particularly vulnerable, accounting for 30 of those 36 statewide plants, with rising groundwater levels magnifying flood risk. The study also found that with just over three feet of SLR, 28 percent of the plants in the Bay Area region will experience flooding on at least one-quarter of their surface areas. Flooding of such facilities could cause them to become inoperable for extended periods of time and create a risk of sewage leaks, posing serious threats to public health.

The erosion of coastal cliffs in California is already beginning to cause transportation disruptions. For example, in winter 2019, a portion of railway tracks used to carry passengers between Los Angeles and San Diego had to be closed to repair damage from a bluff collapse near the City of Del Mar.

Private Property

In addition to publicly owned assets, private property is also threatened by the effects of SLR. Specifically, both houses and businesses located along the coast face the threat of increased flooding, and those in cliff-side locations face damage from eroding bluffs.

[13] Petek Gabriel, California Legislative Analyst's Office, What Threat Does Sea-Level Rise Pose to California?, 2020

A 2015 economic assessment by the Risky Business Project estimated that if current global greenhouse gas emission trends continue, between $8 billion and $10 billion of existing property in California is likely to be underwater by 2050, with an additional $6 billion to $10 billion at risk during high tide. Moreover, a recent study by researchers from the U.S. Geological Survey (USGS) estimated that by 2100, roughly six feet of SLR and recurring annual storms could impact over 480,000 California residents (based on 2010 census data) and $119 billion in property value (in 2010 dollars). When adding the potential impacts of a 100-year storm—a storm with a one-in-100 likelihood of occurring in a given year—these estimates increase to 600,000 people and over $150 billion of property value.

Vulnerable Communities

While many coastal communities contain affluent neighborhoods, many of those communities include more vulnerable populations who also face the risk of more frequent flooding and damage from erosion. Those who will be affected include renters (who are less able to prepare their residences for flood events), individuals not proficient in English (who may not be able to access critical information about potential SLR impacts), residents with no vehicle (who may find it more difficult to evacuate), and residents with lower incomes (who have fewer resources upon which to rely to prepare for, respond to, and recover from flood events).

A 2009 study found that flooding from four and a half feet of rising seas combined with a 100-year storm in California would affect 56,000 people who earn less than $30,000 annually, 45,000 renters, and 4,700 individuals who are linguistically isolated and less likely to understand flood warnings. Additionally, a recent report estimated that four feet of higher water levels would cause daily flooding for nearly 28,000 socially vulnerable residents in the San Francisco Bay Area region. (The researchers defined social vulnerability using a variety of indicators, including income, education level, English proficiency, age, disability status, housing status, citizenship status, and access to vehicles.)

Natural Resources

In addition to buildings and infrastructure, SLR also poses a threat to ecological resources across the state. Flooding has the potential to inundate coastal beaches, dunes, and wetlands. This threatens to impair or eliminate important habitats for fish, plants, marine mammals, and migratory birds. Higher sea levels will also cause salt water to encroach into—thereby degrading—coastal estuaries where fish and wildlife currently depend upon freshwater conditions. A 2018 report by the State Coastal Conservancy and The Nature Conservancy found that 55 percent of California's existing coastal habitats are highly vulnerable to five feet of SLR, including 60 percent of the state's iconic beaches, 58 percent of rocky intertidal habitat, 58 percent of marshes, and 55 percent of tidal flats. The researchers estimated that five feet of SLR would also drown 41,000 acres of public conservation lands and add stress to 39 species whose populations have already been classified as rare, threatened, or endangered.

Humans are also dependent on these coastal environments, both for the natural processes that they provide (such as filtering stormwater runoff to improve water quality and providing protection from flooding), as well as their recreational benefits. Millions of California residents visit the coast annually to fish, swim, surf, and enjoy nature, particularly along the one-third of

the coastline owned by the State Park system. The state's Safeguarding California Plan cites that for every foot of SLR, 50 feet to 100 feet of beach width could be lost. Moreover, a recent scientific study by USGS researchers predicted that under scenarios of three feet to six feet of SLR, up to two-thirds of Southern California beaches may become completely eroded by 2100.

Drinking and Agricultural Water Supplies

SLR has the potential to impact the fresh water resources upon which Californians depend for drinking, bathing, and growing crops in two primary ways.

First, SLR may cause salty sea water to contaminate certain fresh groundwater supplies. Some coastal regions of the state are heavily dependent on drawing fresh water from underground aquifers to support their population and to grow crops. In some areas rising sea levels are likely to push saltwater up into these groundwater basins, thereby degrading key fresh water resources. The degree of this risk is still unknown and being researched, and will vary across the state based on factors like local geology and hydrology. Additionally, SLR may exacerbate conditions for coastal fresh water aquifers that already are experiencing some degree of saltwater intrusion due primarily to their current pumping practices—including in the Pajaro and Salinas Valleys, the Oxnard Plain, and certain areas in Los Angeles and Orange Counties.

Second, SLR could impair one of the state's key water conveyance systems. The State Water Project brings fresh water supplies to 27 million people and to irrigate 750,000 acres of farmland. The system is highly dependent on the integrity of the levees in the Sacramento-San Joaquin Delta to successfully move this water from the northern to the central and southern parts of the state. Higher sea levels pushing into the Delta from the ocean through the San Francisco Bay, however, will place more pressure on those levees. Should the levees in the southern part of the Delta be damaged and breached by these higher water levels, it would cause salt water to flood further into the estuary. This could contaminate the fresh river water supplies that currently pass through the Delta into the State Water Project's pumps and canals. Additionally, even if levees remain undamaged, SLR will on the natural bring salty tides further into the Delta estuary. This will require the state to direct greater flows of fresh river water to "push back" on those tides in order keep saltwater away from the conveyance pumps located at the southern end of the Delta. Research suggests that such conditions would therefore likely decrease the amount of freshwater supplies available for exporting via the State Water Project.

Toxic Contamination

Flooding and rising groundwater levels caused by SLR could also threaten public health by exposing coastal residents to toxic contamination. Specifically, in areas where underground sea water pushes the water table up towards—or above—the ground surface, water could also damage and intrude into underground sewer pipes and systems. This could lead to more prevalent incidents—particularly during high tides and storms—of raw sewage seeping into fresh groundwater aquifers or backing up into streets and homes. Additionally, water infiltrating upward may flow through hazardous contaminants currently buried in the soil and carry them toward the surface, thereby distributing pollutants into fresh groundwater supplies and surface soils, as well into stormwater runoff that flows through local streets and fields. Contaminated lands located along the coast and bay at risk of both surface and groundwater flooding include

active and closed landfills, as well as "brownfields" which are undergoing or require cleanup—such as federal Superfund sites, military cleanup sites, and California Department of Toxic Substances Control sites. Flooding from SLR could also lead to toxic contamination from facilities that generate and store hazardous materials, such as laboratories, manufacturing facilities, and gas stations. Floodwaters could penetrate both surface-level and underground tanks and force out toxic liquids, or liberate waste from pits or piles.

Available research suggests the threat of SLR causing harmful contamination is significant. For example, research suggests that more than 330 facilities across California that contain hazardous materials and are being regulated by the U.S. Environmental Protection Agency are at risk of flooding with 1.4 meters (about five feet) of SLR combined with a 100-year storm. Additionally, a study undertaken in Contra Costa County found that 28 brownfield sites within the county are at risk of flooding with two feet of SLR combined with a 100-year flood, growing to 38 sites with six feet of SLR. (The study did not consider the potential compounding impacts of groundwater flooding.) These sites contain 68 different contaminants of concern, including various metals, corrosive materials, petroleum products, volatile organics, and pesticides. The study found that "these contaminants can potentially affect soil, sediments, sediment vapor, groundwater, or surface water."

Economic Disruption

The potential impacts of SLR could have negative impacts on the economy and tax base—both locally and statewide—if significant damage occurs to certain key coastal infrastructure and other assets. For example, according to California's Fourth Climate Change Assessment, the state's ports were the destination for $350 billion in goods imported to the U.S. in 2016—by far the largest of any state. This economic activity would be disrupted by flooding of the docks, surrounding roadways, or adjacent railways through which goods are distributed. The productivity of the state's workforce—and associated economic output—would also be affected by SLR. For example, a recent study[14] found that over 104,000 existing jobs in the San Francisco Bay Area—including from some of the highly successful technology companies located along the Bay's shore—would need to relocate or be lost under a scenario of four feet of flooding in the region.

Moreover, the potential erosion of beaches associated with SLR would impact not only Californians' access to and enjoyment of key public resources, but also beach-dependent local economies. For example, research on the potential economic impacts of SLR specific to the San Diego region found that the tourism and recreation industries face the greatest vulnerabilities. Overall, the study[15] found that about three feet of SLR combined with a 100-year storm would pose a threat to 830 business establishments in San Diego County, which could in turn affect 15,000 jobs, $2 billion in property sales, and $2 billion in regional gross domestic product. A scenario of six feet of SLR combined with a 100-year storm increases the scope of this vulnerability to over 2,600 business establishments, which would affect 49,000 jobs, $8 billion in sales, and $6.1 billion of the county's gross domestic product.

[14] Adapting to Rising Tides, Summary of Regional Sea Level Rise Vulnerability and Adaptation Study, March 2020
[15] Middlebury Institute of International Studies at Monterey, Regional Economic Vulnerability to Sea Level Rise in San Diego County, March 2018

Additionally, if property values fall considerably from the increased risk and frequency of coastal flooding, over time this will affect the annual revenues upon which local governments depend. To the degree local property tax revenues drop, this also could affect the state budget in some years because the California Constitution could require that losses in certain local property tax revenues used to support local schools be backfilled by the state's General Fund.

Sea-Level Rise Threat to the City of Malibu

According to the City of Malibu General Plan, *"Elevations within the City range from sea level to approximately 1,700 feet above sea level. Most of the developed areas along the coast lie below 100 feet with the exception of the Point Dume and Malibu Park areas which reach an elevation of 500 feet. The hillsides and coastal mesas such as Big Rock and Las Flores have elevations ranging from 300 to 400 feet above sea level."* As a consequence, the threat of sea level rise is a concern. According to a 2016 report on the risk of sea-level rise prepared for the County of Los Angeles[16], the City of Malibu is at risk of sea-level rise due to the close proximity of assets and infrastructure to the shoreline and the anticipated reduction of beach width (sand front) along the coast due to wave runup and inundation. Further, continued sea-level rise will leave the City of Malibu more vulnerable to future storm events. Finally, if the situation continues, the erosion and loss of beaches can have a significant economic impact to the City. However, the City of Malibu is conducting a Coastal Vulnerability Assessment to further understand the sea level rise risk and areas for potential mitigation (see Malibu Mitigation Activities section).

High Tide Flooding

As a result of the report cited above as well as other similar studies, the City of Malibu may expect an increase in erosion, coastal flooding, and damage to infrastructure as sea level rise continues. The maps below provide an estimate of areas of Malibu that are susceptible to coastal flooding due to high tides.

Map 59: Malibu Coastal Flood Areas from a High Tide Flooding – Puerco Beach to Malibu Beach

[16] Noble Consultants-G.E.C., Inc., Final Report Los Angeles County Public Beach Facilities Sea-Level Rise Vulnerability Assessment, 2016.

Map 60: Coastal Flood Areas from High Tide Flooding - Malibu Beach and Malibu Lagoon

Source: NOAA

ESTIMATED IMPACT OF CLIMATE CHANGE AND DROUGHT

The consequences to local populations and employment of climate change and/or drought is difficult to measure. However, it is anticipated that severe heat will cause power outages, cause health problems, reduce economic output, and lead to decreased worker productivity. The table below provides the estimated impact of a disaster using an overall 10% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 10% Loss Occurs
Population*	20,362	23,410	2,182	10,915	8,081	6,495
65 Years and Older*	3,164	3,873	326	3,149	2,103	1,262
Total City Employment	11,100	11,800	4.5	6,483	3,700	3,309
Economy** (in thousands)	$621,000	$1,011,348	N/A	$578,443	$576,306	$278,710

Table 142: Estimated Population and Economic Loss of Climate Change and Drought

*U.S. Census – American Community Survey 2021
**2017 U.S. Economic Census (in thousands)

The table below provides the estimated impact of sea level rise for the City of Malibu using an overall 1% loss baseline.

Category	Malibu	Impact if a 1% Loss Occurs
Total Owner-Occupied Units	3,395	34
Average Home Value	$2,000,000	More than $88.8M

Table 143: Estimated Owner-Occupied Home Losses Due to Sea Level Rise

Based on a 10% loss projection, nearly 6,500 people could be impacted (either directly or indirectly) including over 1,200 people aged 65 years and older (high risk group) with potentially more than 3,300 jobs lost, either temporarily or permanently resulting in a negative economic impact of more than $278M.

Further, sea level rise can have a profound human and economic impact to the City of Malibu. If 1% of owner-occupied units were impacted, the loss would amount to 34 homes valued at more than $88 million (see individual city Community Profile sections for population, housing, and economic data).

Risk of Future Climate Change

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 7.25 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Climate Change	9	6	3	9.5	7.25

CLIMATE CHANGE VULNERABILITIES

In terms of vulnerabilities, the main concerns involve the impact of:

- Excessive Heat leading to:
  - Power outages
  - Heat-related health issues
- Drought and Limited water supplies causing:
  - Reduced water availability to the local community and residents
  - Livestock and domesticated animal losses (including pets, horses, etc.)
  - Damage to local natural habitats
- Sea Level Rise (City of Malibu)
- Wildfire (see **Wildfire** section)

See "The Threat of Sea Level Rise to California" section for additional vulnerabilities.

Climate Change Probabilities

According to the Environmental Protection Agency (EPA), continued emissions of greenhouse gases will lead to further climate changes. Future changes are expected to include a warmer atmosphere, a warmer and more acidic ocean, higher sea levels, and larger changes in precipitation patterns. The extent of future climate change depends on what we do now to reduce greenhouse gas emissions. The more emitted, the larger future changes will be.

Temperature Rise

California can expect an increase in temperature in the future. A recent presentation by the California Public Utilities Commission, Policy & Planning Division [17] stated that extreme heat days in some cities in California are likely triple by 2030. The graph below depicts the number of Extreme Heat days by year from 1950 through 2005 with predictions to 2099.

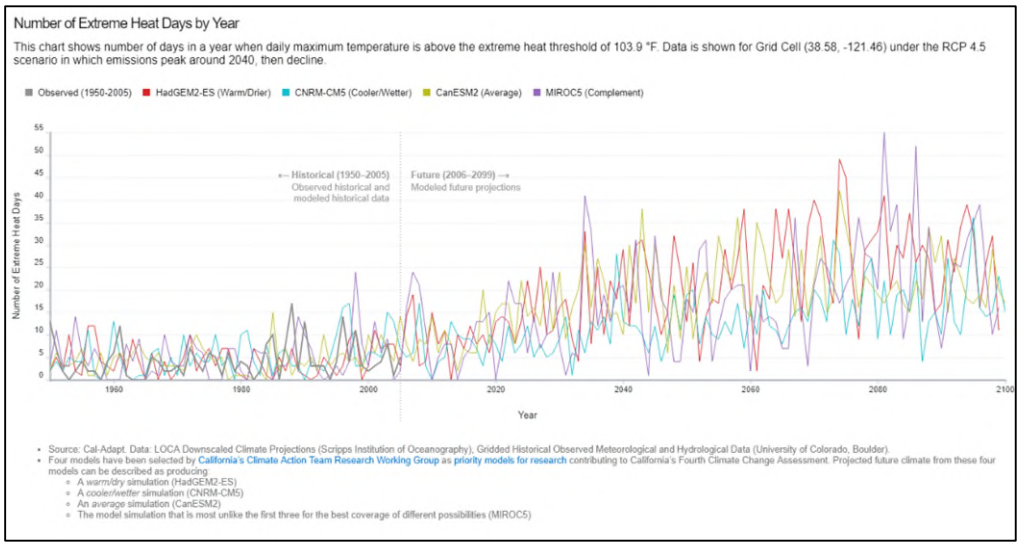
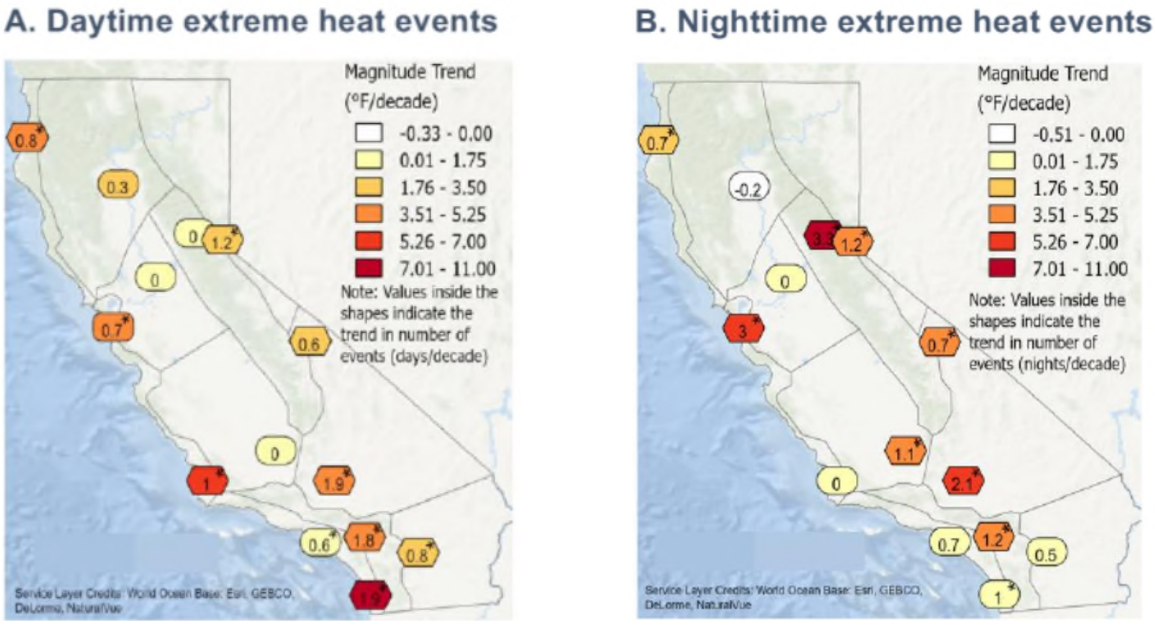


Figure 98: Number of Extreme Heat Days by Year

Source: Cal-adapt.org

[17] Douglas, Kristin, California in 2050: Some Sizzling Predictions, California Public Utilities Commission, Policy & Planning Division, 2017

The Indicators of Climate Change in California, Fourth Edition (2022) report[18] summarized trends in extreme heat conditions for the state. The report indicated that the number of daytime and nighttime heat waves increased from 1950 to 2021. For the cities within the LVMCOG the overall trend per decade shows a 0.6 F daytime temperature increase and a 0.7 F nighttime temperature increase.



Map 61: Magnitude and Frequency of Extreme Heat Events (trend per decade 1950 - 2021)

Source: Cal-Adapt, 2018, Dunn 2019, and RCC-ACIS, 2021

An extreme heat event occurs between April and October when the temperature is at or above a location-specific historical temperature threshold, set at the 95th percentile of daily maximum for daytime extreme events. The rate of change (per decade) in frequency, the total number of extreme heat events each year, is the value in each shape (hexagon or oval); an asterisk indicates a statistically significant trend ($p < 0.05$). The rate of change (per decade) in magnitude, the annual sum of daily exceedances above the historical temperature threshold, in degrees Fahrenheit (°F), is presented using the fill colors (see legend); a hexagon denotes a trend that is statistically significant ($p < 0.05$), while an oval is not significant. The outlines on the map show the boundaries of the eleven climate regions, as defined by the Western Regional Climate Center.

Per the report, "Since 1950, nighttime extreme heat events have increased in magnitude and frequency more than daytime heat events. The maps show decadal trends in the magnitude and frequency of daytime and nighttime extreme heat events during the warm months between April and October at selected locations."

[18] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA), Indicators of Climate Change in California, Fourth Edition, 2022

Drought

According to the Indicators of Climate Change in California, Fourth Edition (2022) report[19], "California experiences high year-to-year variability in precipitation: some years are very wet, while others are very dry. Since the early 1980s, precipitation over the state has become more variable. The same is true across the state's climate regions (see appendix; also He and Guatam, 2016). The past decade included the third wettest year on record (2017) and the second driest (2021). In 2017 California emerged from a severe and prolonged drought. From October 2018 to September 2019, California transitioned from a very dry fall into a very wet winter. The water year 2021 was the second driest on record, following 1924."

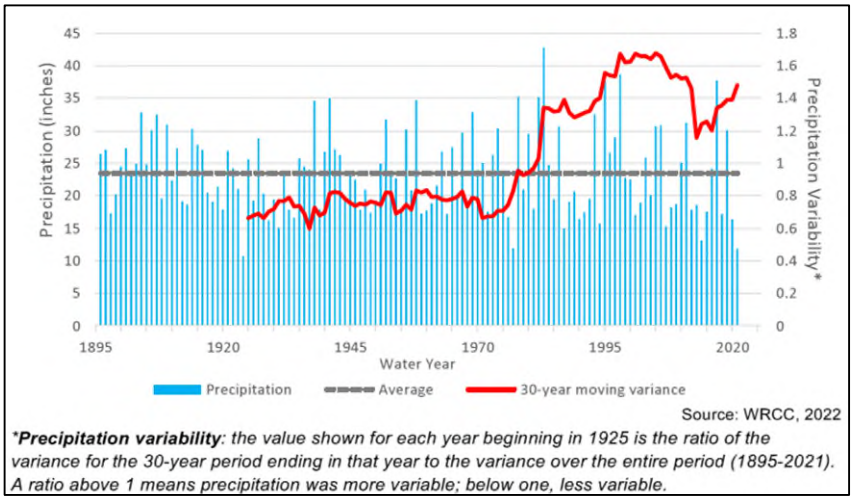


Figure 99: Statewide Annual Precipitation (1895-2021) - California

"Precipitation totals are tracked by "water year," from the beginning of the rainy season in October through the following September, the end of the dry season. This is more useful than a calendar year in California due to its typically dry summer and wet winter ("Mediterranean") climate. On average, 75 percent of the state's annual precipitation occurs from November through March, with 50 percent occurring from December through February."

Long-term, the LVMCOG region can expect lower than historical precipitation in the future. The chart below provides a predictive model of accumulated rainfall for the area from 2046 to 2074.

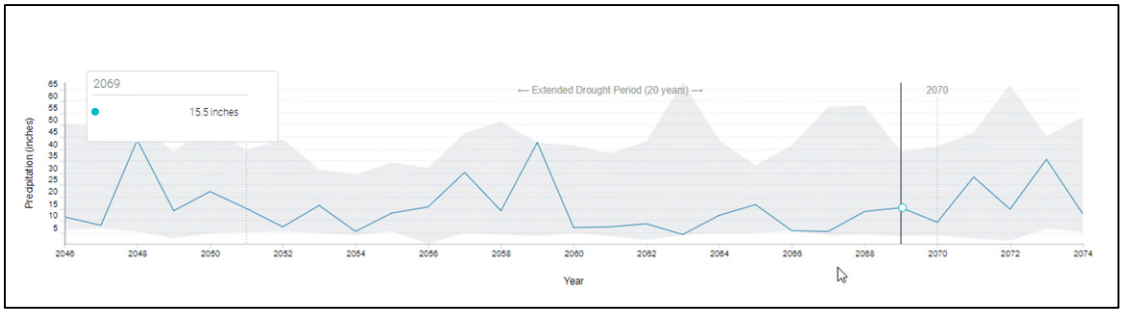


Figure 100: Extended Drought Scenario (2051 - 2070)
Source: Cal-adapt.org

[19] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA), Indicators of Climate Change in California, Fourth Edition, 2022

Sea Level Rise

In terms of Sea Level rise, Cal-Adapt reports that, "Global models indicate that California will see substantial sea level rise during this century, with the exact magnitude depending on such factors as, global emissions, rate at which oceans absorb heat, melting rates and movement of land-based ice sheets, and local coastal land subsidence or uplift." As indicated in the Sea Level Rise Threat section above, Malibu Lagoon and the entire Malibu coast are susceptible to flooding.

For the City of Malibu, on September 11, 2017 the USGS provided a presentation to the Malibu City Council[20] that provided an exposure analysis for the city. The analysis indicated the following impacts based on various Sea Level Rise (SLR) scenarios:

Condition (by 2100)	Projected Impact
With 3 ft SLR	• 13.6 miles of roadway / bikeway will be impacted
With 3 ft SLR + 100 yr storm	• 25.7 miles of roadway / bikeway impacted • 1695 buildings impacted (mainly residential)
With 5.5 ft SLR + 100 yr storm	• 29.6 miles of roadway / bikeway impacted • 1916 buildings impacted (mainly residential)

Table 144: Sea Level Rise Impacts for the City of Malibu (by 2100)

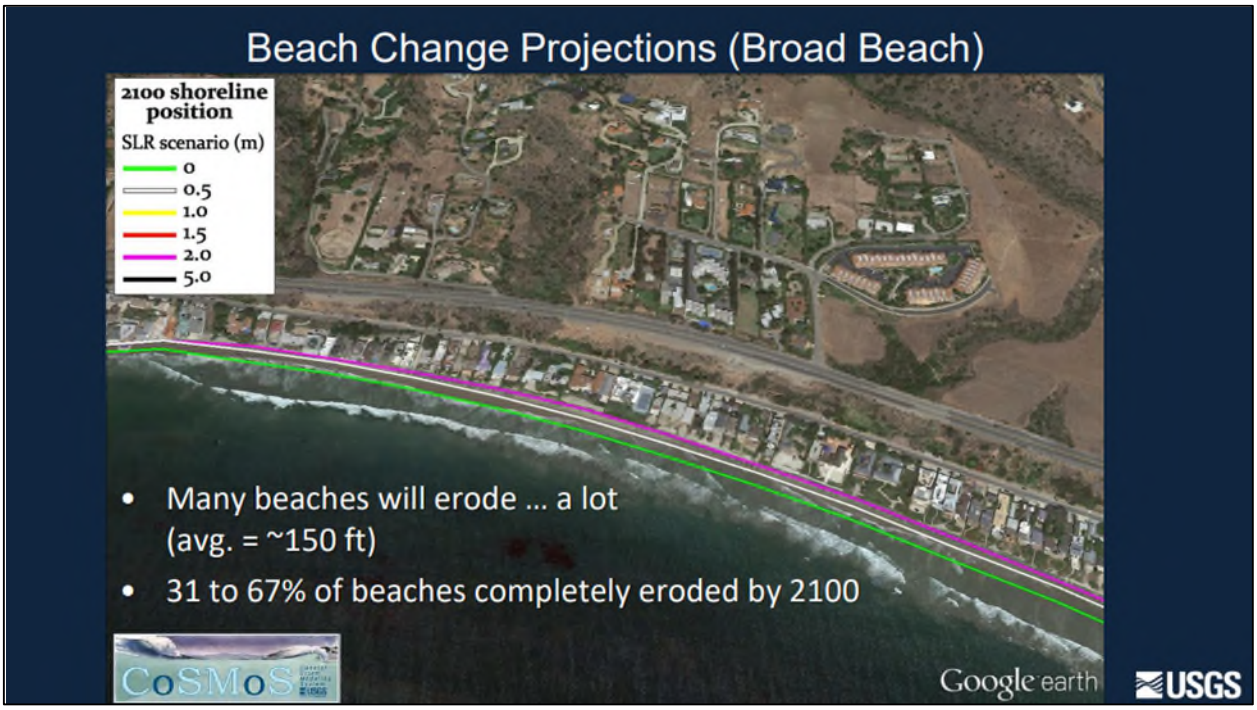


Figure 101: Beach Change Projections

[20] Hart, Juliette, Malibu City Council Presentation, Sea Level Rise: From Global to Local, 2017

CLIMATE CHANGE MITIGATION STRATEGIES

LVMCOG Mitigation Activities

Agoura Hills

The City of Agoura Hills has implemented several strategies to mitigate the impact of climate change and encourage environmental sustainability. For example, in 2020 the City conducted a public survey and workshop then developed a Climate Action Adaptation Plan to obtain input from community members and address the growing impact of climate change.

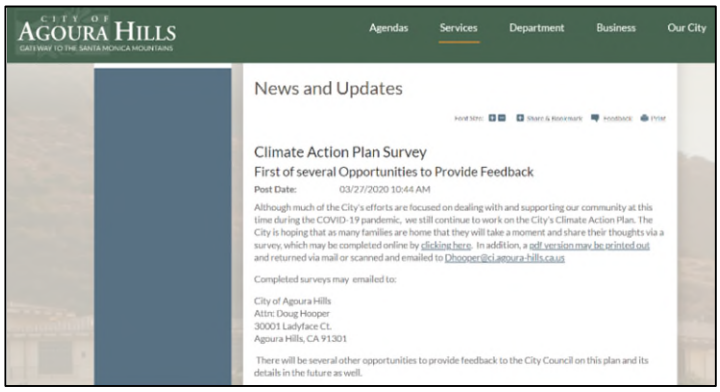


Figure 102: City of Agoura Hills CAAP Program

In addition, on May 13, 2015, the Agoura Hills City Council approved Resolution No. 15-1782 consenting to include properties within the incorporated area of Agoura Hills in the Los Angeles County Energy Program to finance renewable energy sources and energy and water efficiency improvements. The program provides property owners two County approved administrators for the Property Assessed Clean Energy (PACE) Financing Programs to assist with these improvements. In 2020, Los Angeles County ended the PACE Program however approved projects were to continue until completion.

The City of Agoura Hills Solid Waste Management Department works to reduce waste and encourage recycling. Key efforts include:

- Residential Recycling
- Commercial Recycling
- Electronic Waste Collection
- Organic Recycling
- Construction and Demolition Debris Recycling
- Household Hazardous Waste and E-Waste Disposal
- Illegal Dumping Reporting
- SHARPS Disposal

Figure 103: City of Agoura Hills Solid Waste Management Web Page

Further, the Agoura Hills General Plan Update (2010) includes a discussion on the issue of Climate Change and the need for the City to adopt and promote sustainability efforts including the Green Building Program.

> The General Plan excerpt:
>
> A key theme of the City of Agoura Hills' General Plan is sustainability. The General Plan, inherently through its goals and policies, takes steps to address the challenging issue of climate change by reducing Green House Gas (GHG) emissions, improving energy efficiency, reducing the urban heat island effect, recycling, and managing water use. The General Plan will reduce GHG emissions primarily through land use patterns that support public transit, increased opportunities for pedestrians, bicycle, and transit-use, and through requirements for "green building" practices and alternative energy systems. Policies also address adaptation to climate change, such as increasing flood protection.
>
> The sources, impacts of, and solutions to climate changes are complex. Climate change and GHG emissions reduction are addressed throughout policies and programs of the General Plan rather than in a single section. **Appendix A, General Plan Policies Addressing Climate Change**, includes a table that summarizes, by topic area, Agoura Hills General Plan policies that address climate change.

Appendix A General Plan Policies Addressing Global Climate Change includes the multiple policies and programs to meet the following objectives:

Mitigation Objective A: Reduction in Greenhouse Gas Emissions

- Strategy A-1: Reduce vehicle trips generated, gasoline consumption, and greenhouse gas emissions
- Strategy A-2: Reduce non-renewable electrical and natural gas/energy consumption and generation (energy efficiency
- Strategy A-3: Increase generation and use of renewable energy sources
- Strategy A-4: Reduce water consumption
- Strategy A-5: Reduce solid waste and maximize reuse of solid waste
- Strategy A-6: Promote carbon dioxide consuming landscaping
- Strategy A-7: Maximize preservation of open spaces and natural areas

Adaptation Objective B: Adapting Current Strategies so that Climate Change is Integral to Planning Activities and Decisions

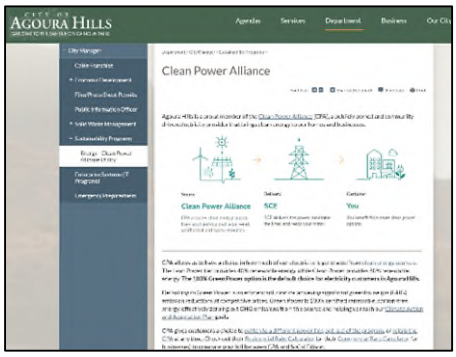
- Strategy B-1: Reduce risks from wildfire, flooding, and other hazards resulting from climate change
- Strategy B-2: Conserve and improve water supply due to shortages from climate change
- Strategy B-3: Provide education and leadership in response to climate change actions

Specific Climate Change Natural Resources programs and policies included in the General Plan, Strategy B-3 are listed under NR-10 Greenhouse Gas Reduction. Reduce emissions from all activities within the City boundaries to help mitigate the impact of climate change.

- NR-10.1 Climate Change. Comply with all state requirements regarding climate change and greenhouse gas reduction and review the progress toward meeting the emission reductions targets. (Imp NR-25)
- NR-10.2 Regional Coordination. Ensure that that any plans prepared by the City, including the General Plan, are aligned with, and support any regional plans to help achieve reductions in greenhouse gas emissions. (Imp NR-26)
- NR-10.3 Outreach and Education. Partner with local agencies and organizations to coordinate outreach and education regarding the effects of greenhouse gas emissions and climate change. (Imp NR-27)

The City's Green Building Program, according to the City's website, *"is committed to providing a more livable, equitable, and economically vibrant community through the reduction of greenhouse gas (GHG) emissions and enhancing the community's resilience towards vulnerabilities and risks posed by climate change".* This program includes other initiatives including installation of Electric Vehicle Charging Stations and Solar Panel Installation Program.

Agoura Hills is a member of the Clean Power Alliance (CPA), which enables the city to control the amount of electricity generated from clean energy sources.



The City of Agoura hill is taking on additional initiatives to address climate change, including:

- Solar Project for the Agoura Hills Recreation & Event Center in the 2024 Calendar Year
- Participation in the SCE Charge Ready Program in 2022-2023 which allowed the City to install 4 new EV Charging Stations (with 7 ports) available to the public 24/7
- Public Works Department replacing all 120 fluorescent City Street Sign bulbs to LED bulbs
- Plans to implement a new Polystyrene policy pertaining to the use of Styrofoam products, which was identified as a City Council Goal for the 2023 – 2024 Fiscal Year
- Multiple Environmental Responsibility Subcommittee Meetings in October 2023

Calabasas

The City of Calabasas has implemented an active Green City Program. According to the City's website, "*To ensure a viable future, the City of Calabasas is taking a leadership role and addressing the impacts placed on the environment by urbanization and a growing populace. These impacts include air and water pollution, climate change, and habitat loss. The City of Calabasas takes pride in its environmental stewardship and seeks to further its stewardship role by adopting a set of green building standards to help create high performance new and remodeled buildings that utilize efficient site and building design, sustainable construction practices, use of rapidly renewable, recovered or recycled building materials, and use of operational practices which have less of an impact on the environment than conventional methods*".

Figure 104: City of Calabasas Green City Web Page

City of Calabasas is working with Los Angeles County to provide energy efficient retrofits to its residents. Los Angeles County invested approximately $11 million in federal grant funds to build a PACE program to serve the county's 88 cities and nearly 10 million residents. The program is designed to encourage private property owners to invest in energy efficiency retrofits and is key part of a broader home retrofit program for LA County.

Renewable Funding was selected to develop and administer the PACE program and worked in partnership with BKi, Build It Green, Energy Coalition and South Bay Environmental Service Centers. LA County's initiative was developed at the request of the Board of Supervisors. The LA County PACE program was authorized under California's AB 811, which enables municipalities to provide private property owners with the ability to finance energy efficiency and renewable energy improvements through a voluntary property tax assessment that is paid back over 20 years. Note: in 2020, the Los Angeles County PACE program ended and no new contracts were approved, however existing contracts were managed to completion.

Other previous and current "Green" projects implemented by the City include:

Project	Description
City of Calabasas Civic Center	In July 2008, the City of Calabasas completed construction of a high performance, resource-friendly Civic Center consisting of a City Hall and Public Library. Both buildings were designed to meet a "Gold" standard from the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System for new construction. Sustainable design features include the use of energy and water efficient HVAC and plumbing systems, recycled and locally manufactured materials, use of a "cool" energy star rated roof, drought tolerant landscaping, low flow irrigation system, use of recycled water for landscape, use of natural daylight, increased views, systems to monitor and provide healthy indoor air quality and much more. Both the City Hall and Public Library were awarded a LEED Gold Certification by the United States Green Building Council (USGBC) on January 20, 2010.
Non-Residential Green Building Ordinance	On January 7, 2004, the City Council voted unanimously to approve an ordinance requiring all new non-residential development to achieve the equivalent of a "Certified" or "Silver" rating using the Leadership in Energy and Environmental Design (LEED) v.2.0 rating system. The Green Development Ordinance implements development standards that require new or significantly remodeled, buildings to be high performance environmentally friendly buildings.
Alternative Fuel Vehicle Fleet	The City's vehicle fleet consists of automobiles, trucks and vans for City employees and includes public transit shuttles and old fashioned trolley cars to serve the general public. Recognizing that standard gasoline using automobiles consume considerable energy and contribute significantly to air pollution, the City continues to build a vehicle fleet consisting of alternative fuel vehicles to improve fuel efficiency. Recently, the City added nine hybrid vehicles to the City's fleet for use by inspectors, saving gallons of gas from being consumed each year.

Project	Description
Mixed Use Development Ordinance	The Land Use Element of the General Plan states that a primary goal of the Land Use Element is to: • "…provide a distribution of land uses that maintains, yet also enhances the environmental, social, physical, and economic well-being of Calabasas". (General Plan, 2008, II-1) • Additionally, the Community Design Element of the General Plan establishes that, in order for new development to conform to the character of its natural setting: • "…new development should be accomplished through infill and revitalization of existing developed areas in order to conserve undeveloped areas" (General Plan, 2008, IX-8), • Mixed Use development constructed on infill parcels, or on existing developed areas as part of a revitalization plan, will enable Calabasas to maintain and enhance its existing natural environment, as well as boosting the social, physical and economic well-being of the City. Mixed Use does so through efficient and sustainable land use design, which involves combining different land use categories (such as residential and commercial uses) into one development. This eliminates automobile trips between the different land uses, and promotes walkability and a pedestrian-oriented environment. Through more compact, higher-density design, mixed use development helps conserve land as open space, and thus supports the City's key vision of protecting the natural environment of Calabasas which has attracted so many of the City's residents to the area. • Consequently, the City has adopted a Commercial Mixed Use zoning district, along with the General Plan identifying three different densities of mixed use land use districts, as follows: o Mixed Use 0.60 – where the maximum Floor Area Ratio (FAR) is 60% o Mixed Use 0.95 – where the maximum Floor Area Ratio (FAR) is 95% o Mixed Use 1.0 – where the maximum Floor Area Ratio (FAR) is 100%
Recycling Program	With the passage of AB 939 (California Integrated Waste Management Act) in 1989, Calabasas has set up a number of recycling programs to ensure that it meets the State's goal of a 50% diversion rate. These programs include curbside recycling, construction waste recycling, electronic waste recycling, and household hazardous waste round-ups. In addition, City staff provides outreach and technical assistance to the public, businesses and schools, and has initiated innovative programs to maximize waste prevention and recycling, and partner with organizations with compatible goals. More recently, the Calabasas City Council adopted a resolution on January 16, 2007 setting a new diversion goal of 75% by 2012, making Calabasas only the second California city (after San Francisco) and the first city in Southern California to set such an ambitious goal for recycling.
Polystyrene Ban	In 2007, the Calabasas City Council adopted Ordinance 2007-233 banning retail food establishments, nonprofit food providers and City facilities from using food packaging materials made of expanded polystyrene, known popularly by the trademark name Styrofoam. The ordinance required food service establishments in Calabasas to start using environmentally acceptable packaging by March 31, 2008, and to report on-going compliance with the ordinance on the first business day of each calendar year.

Project	Description
Watershed Management	The City's Environmental Services Division oversees a variety of activities that help reduce or eliminate pollutants from storm water and urban runoff, and enhance the water quality of our local watersheds. These activities include stream restorations, water quality monitoring, capital improvements, public education and outreach, and regulatory activities. Las Virgenes Creek Restoration Between 2003 and 2008, the City actively engaged in the Las Virgenes Creek Restoration Project, a project that restored 440 linear feet of a concrete channelized streambed to a natural condition. The Las Virgenes Creek is a part of the Malibu Creek Watershed which provides habitat for numerous animal species including Southern Steelhead Trout, the Southwestern Pond Turtle, Arroyo Toad, Pacific Tree Frog, American Goldfinches, Song Sparrows, Coyotes, and Mountain Lions. The City of Calabasas has sought funding from numerous State and Federal agencies for the restoration effort. In 2003, the City Council approved a conceptual design with final construction completed in Spring of 2008. The project has successfully achieved the following goals: • Enhanced Wildlife Habitat • Public Outreach and Education • Footpath and Trail Connection • Enhanced Water Quality • Increased aesthetics Other Water Quality programs include: • Water Quality Monitoring • Water Quality Mitigation • Urban Runoff Mitigation • Watershed Regulation
City Events	City Events include: • Household Hazardous Waste Collection Program • Wildlife Restoration Days • Earth Day Festival • Arbor Day

The City's website is used to provide the community with information on efforts that promote environmental sustainability and initiatives that support the City's activities to fight climate change. The City's Green City Program includes:

- Green Construction – Guidelines on sustainable design and construction options for homeowners
- Green Streets – Storm water management program information
- Green Rebates and Incentives – Links for homeowner incentive programs
- Helpful Links – Other links to green information websites

Hidden Hills

The City of Hidden Hills implemented a "Green Streets" program that helps to combat the effects of climate change. The City incorporates "Best Management Practices" (BMP) to improve water quality, facilitate groundwater replenishment, create parks and wildlife habitats, and provide pedestrian and bicycle accessibility.

Green streets are defined as right-of-way areas that incorporate infiltration and/or biofiltration BMPs to collect, retain, or detain stormwater runoff as well as a design element that creates attractive streetscapes. Green street BMPs may include, but are not limited to, street trees, permeable pavement, bioretention areas, and vegetated swales. As part of the program the City's policy is as follows:

- The City shall review new development redevelopment streets and roadway projects and CIPs conducted within the right-of-way that create or replace 10,000 square feet or more of impervious surface for opportunities to incorporate green street BMPs. This excludes routine maintenance or repair and linear utility projects.
- The City shall consider opportunities to replenish groundwater, create attractive streetscapes, connect neighborhoods, create parks and wildlife habitats, and provide pedestrian and bicycle accessibility through new development and redevelopment streets and roadway projects and Capital Improvement Projects (CIPs).
- The City's review of CIPs shall result in a prioritized list of CIPs best suited for green street BMPs. Green street BMPs shall be implemented in high priority CIPs.
- The City shall review and update the prioritized list annually.
- The City shall evaluate effectiveness of green street BMPs.

The City of Hidden Hills promotes solar installations in accordance with California Assembly Bill 2188 which amended the California Solar Rights Act, to require that every city create an expedited, streamlined permitting process for small residential rooftop solar systems. The purpose of the law is to further State policy of promoting and encouraging the installation and use of solar energy systems by limiting obstacles to their use and minimizing the permitting costs of such systems. The City of Hidden Hills created a web page and forms to help the applicants with the permitting process for Small Residential Rooftop Solar Systems.

Figure 105: City of Hidden Hills Solar Energy Web Page

Malibu

The City of Malibu promotes public awareness of the impact of climate change through "Earth Month". For example, the City hosts an Earth Month Speaker Series which has included various topics such as the impact on the earth and climate change anxiety.

The City of Malibu has implemented several initiatives to reduce its carbon emissions and promote environmental sustainability. In addition, the City website provides the community with links and information on California Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006 which requires a reduction of greenhouse gas (GHG) emissions. Examples of information links that the public is encouraged to investigate include:

CPA CLEAN POWER ALLIANCE	The Clean Power Alliance enables residents and business to obtain the percentage of clean energy delivered: 36%, 50%, or 100%.
WESTSIDE Energy Partnership	The Westside Energy Partnership is a collaboration between the City of Malibu, Southern California Edison, and SoCal Gas. The West Side Partnership encourages citizens to reduce energy use as a means to lowering utility bills and helping the environment. Examples include: HERO Program - Finance projects for renewable energy, energy and water efficiency improvements, and electric vehicle charging infrastructure. Summer Discount Plan – Earn up to $180 in credits on your energy bill with the Southern California Edison Summer Discount Plan. There is no cost to enroll or participate in the program. Time-of-Use Rates (TOU) - Southern California Edison's TOU plans can assist with energy costs. Take advantage of lower rates during off-peak and super off-peak periods. Medical Baseline Allowance – Southern California Edison and SoCalGas offer financial assistance for powered medical equipment. Energy Star – Tool to find rebates and special offers available by zip code. Energy Upgrade California - Learn the connection between saving water and saving energy. Southern California Edison - Information about rebates, incentives, and savings tips. Southern California Gas - Find out what home improvements are eligible for rebates.

The City of Malibu has an Environmental Sustainability Department to manage its initiatives to improve the environment. These programs also support the City's efforts to counter-act climate change. The City of Malibu, Environmental Sustainability Department maintains a Facebook site to promote environmental sustainability and provide the public with information on programs that the City has implemented as well as ideas for improving the environment.

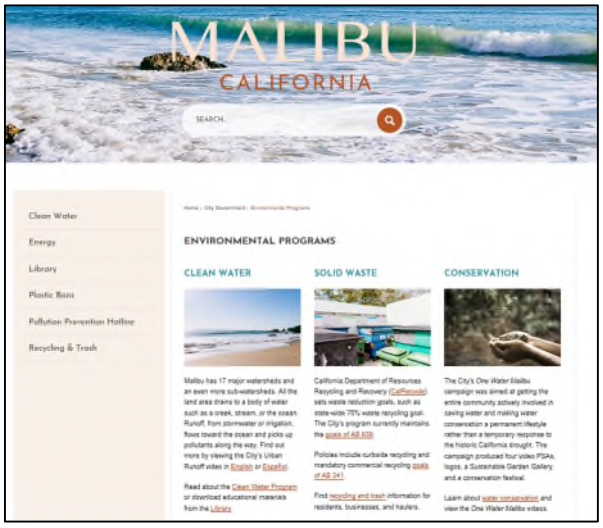


Figure 106: City of Malibu Environmental Programs Web Page

The City of Malibu Planning Division oversees the City's land use which includes coastal development. As part of this responsibility, requirements that address the impact of climate change and sea level rise are included in the City's Local Coastal Program (LCP). Examples include:

- All new development on the beach or oceanfront bluff must be setback as far as possible and elevated above the base Flood Elevation.
- All new development that would require shoreline armoring or hardening should be prohibited.
- All applicants for new development on beachfront or bluff-top property must include an impact report and analysis that addresses the effect of the development in relation to a number of things including future projections of sea level rise.

Figure 107: City of Malibu Environmental Sustainability Facebook Page

In 2019, the City of Malibu initiated a Coastal Vulnerability Assessment to obtain additional data on sea level rise. However due to the COVID-19 pandemic a delay occurred and the program was re-started in the spring of 2023 with a series of public workshops. Additionally, the City has partnered with The Bay Foundation and Los Angeles County Department of Beaches and Harbors, and the California State Coastal Conservancy on the Malibu Living Shoreline Project (start of implementation in the winter of 2020-2021). The aim of the project is to restore three acres of sandy beach and dune habitat at Zuma and Point Dume County Beaches, providing a cost-effective and low-impact solution to increase the resiliency of the beach shorelines.

In October and November of 2023, the City of Malibu held multiple Environmental Sustainability Subcommittee Special Meetings to discuss and address environmental and climate change efforts within the city.

Further, the City of Malibu regulates development activities along the coast in conjunction with the regulatory authority of the State of California. Other mitigation strategies in the future that may be undertaken by the State or County of Los Angeles may include beach sand replacement, sand dune maintenance, and shorefront protection strategies. These strategies were summarized in the 2016 report in the table, "Suggested Adaptive Management Strategy for Los Angeles County Public Beach Assets"[5] as follows:

Region	Malibu									Santa Monica Bay							Palos Verdes		
Potential strategy for existing or future asset on beach	**Nicholas Canyon County Beach**	**El Sol County Beach**	**Zuma County Beach**	**Point Dume County Beach**	**Latigo Shores County Beach**	**Dan Blocker County Beach**	**Malibu Surfrider County Beach**	**Las Tunas County Beach**	**Topanga County Beach**	**Will Rogers State Beach**	**Venice Beach**	**Dockweiler State Beach**	**Manhattan Beach**	**Hermosa Beach**	**Redondo Beach**	**Torrance Beach**	**Royal Palms County Beach**	**White Point County Beach**	**Point Fermin Beach**
Temporary winter berm protection			1							2	1	1	2	1	2	2			
Dune building and maintenance	2											2							
Maintain existing sand retention devices										2	2	2			2				
Beach nourishment			3	3					3	3	3	3	3	3	3	3			
Natural dunes and retreat	3	3			3	3	3	3									3	3	3

Adaptive management strategy key

1 = Short term period when sea-level rise is less than than 1 foot
2 = Transitional period when sea-level rise is between 1 and 2 feet
3 = Long term period when sea-level rise exceeeds 2 feet

Table 145: Suggested Adaptive Management Strategy for Los Angeles County Public Beach Assets

Additionally, in 2022, the City of Malibu held outreach events regarding climate change efforts, including the following events:

Westlake Village

The City of Westlake Village has implemented several programs to address the impact of climate change. The City's Sustainability website provides residents with an easy to access portal to these programs which prioritize environmental stewardship as a means to counteract the impact of climate change. The City's website provides the community with information on the program and actions that the public can take to contribute to the effort.

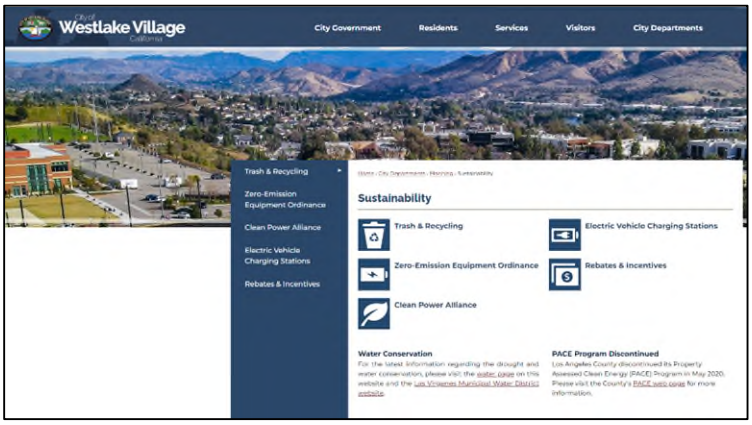


Figure 108: City of Westlake Village Sustainability Web Page

The website includes information on conservation, rebates, and other environmental tips as well as environmental programs that the City participates in.

In September, October, and November 2023, the City of Westlake Village held an Environmental City Council Committee Meeting to discuss and address environmental and climate change efforts within the City.

As part of its Green efforts, the City provides information on:

- Trash & Recycling
- Zero-Emission Equipment Ordinance
- Clean Power Alliance
- Electric Vehicle Charging Stations
- Rebates & Incentives

Additionally, in June 2020, the City began emphasizing the need and benefits of renewable energy through its membership in the Clean Power Alliance. As part of this program, the City of Westlake Village chose "Lean Power" as the default option for the community. Lean Power provides 36% renewable content at the lowest possible cost and offers customers an overall 1-2% discount on their electric bill, as compared to what they would pay if they remained on SCE rates for energy supply. Residents were offered three rate options with various levels of environmental benefits and costs:

Lean Power (Westlake Village's Choice)	Clean Power	100% Green Power
Provides 36% renewable content at the lowest possible cost - with the added benefit of local management and control. Our community has selected Lean Power as our default option.	Provides 50% renewable content and the opportunity to support building a cleaner future, all at cost competitive rates.	Provides 100% renewable content and gives you the opportunity to be an environmental champion - leading the way to a greener future.

On Earth Day 2019, the City of Westlake Village unveiled twenty-two electric vehicle charging stations (EVSE) that are available at publicly accessible locations around the City, some of which are open to the public 24 hours a day to further the City's commitment to investing in clean air and sustainable practices. All of the City's stations are 'Level 2' with a maximum output current of 6.6kW. As one of the largest per-capita installations of any city around, six stations are located at the Westlake Village Civic Center and sixteen at the Westlake Village Community Park. These projects were completed in partnership and funding provided by the City of Westlake Village, the Mobile Source Air Pollution Reduction Review Committee of the South Coast Air Quality Management District, Southern California Edison's ChargeReady program, and ChargePoint Inc. Further, the City promotes rebates and incentives to residents for energy conservation and air quality efforts.

Figure 109: Westlake Village Green Rebate and Incentive Programs

In 2022, the City Council adopted an ordinance to prohibit the use of gasoline powered leaf blowers in Westlake Village starting January 1, 2023. This prohibition applies Citywide to all

Figure 109: Westlake Village Green Rebate and Incentive Programs

homeowners, gardeners, homeowners associations, and landscape maintenance companies. Eligible landscape maintenance professionals can now obtain zero-emission landscape equipment at reduced or no cost through the Clean Off-Road Equipment Voucher Incentive Program (CORE). A Business Outreach Day was held at the Westlake Village Civic Center on January 4, 2023. The American Green Zone Alliance and City staff shared information on how landscape maintenance companies could receive up to 70% off of new electric landscaping equipment. Equipment demonstrations and Spanish translation were provided. Additionally, virtual community workshops were held via Zoom on May 26, 2022, and June 28, 2022. An in-person workshop and equipment demonstration was held on September 7, 2022, at the Westlake Village Civic Center.

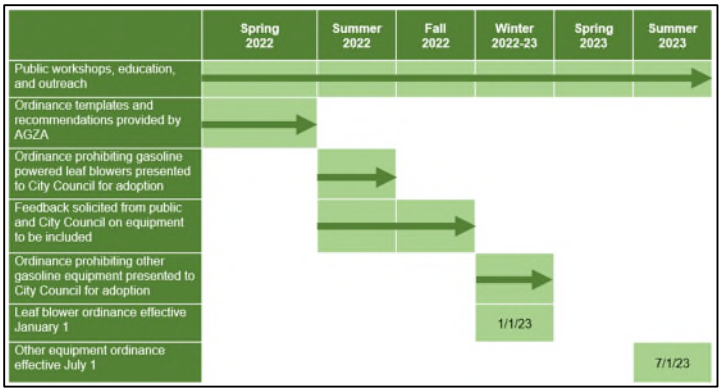


Figure 111: City of Westlake Village Zero Emission Ordinance Timeline

The City of Westlake Village has an active trash and recycling program which is promoted via the City website. These efforts are designed to reduce the impact waste and promote conservation efforts by residents.

Figure 112: City of Westlake Village Trash & Recycling Programs

Finally, the City of Westlake Village also participates in environmental outreach efforts throughout the Malibu Creek Watershed that include beach clean-ups, Earth Day events, annual watershed tour, printed materials, and television and radio broadcasts that support Eco-friendly messages. Other City programs include:

- Nearly all City vehicles are fuel efficient hybrids or EV vehicles (one gas powered truck).
- City streets are swept weekly to reduce unwanted materials entering our storm drains.
- The City conducts weekly water quality monitoring tests to better protect our streams and creeks. Westlake Village tests have shown bacteria levels well below the state mandated levels.
- The City employs a synchronized traffic signal network thereby limiting emissions by minimizing congestion on major thoroughfares.
- The City has updated several in-house procedures to ban the use of polystyrene foam products at City Hall.

The City of Westlake Village has equipped City Hall with an emergency generator. Additionally, the City contracts with a vendor to provide fuel. The City currently has a solar project that is intended to replace the diesel generator on site. Additionally, the City has multiple battery powered generators that could be used in case of emergency.

- The City operates Westlake Village Transit which helps to deliver hundreds of kids to school and reduce traffic congestion in and around our neighborhood schools.
- The City provides household hazardous waste and e-waste recycling curb-side pick-up.
- The City's annual street resurfacing project recycles and uses approximately 20,000 waste tires per year on average. That equates to about 2.2 tires per City resident.
- The City's traffic signals and safety lights use LED lights as a means of reducing energy costs.

Through an extensive recycling program, the City has diverted 62% of the City's waste from the landfill, exceeding the state's 50% waste diversion goal by 12%.

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SECTION 9. ENERGY DISRUPTION

THE NATURE OF THE ENERGY THREAT

Energy is a critical dependency throughout the LVMCOG Region. Sources of energy include electric power, natural gas, oil and fuel supplies. The focus of this section is on electric power disruptions.

The electric power system of North America is comprised of four major sections: the Quebec Interconnection, Eastern Interconnection, Western Interconnection and the ERCOT Interconnection. California is part of the Western Interconnection. Within each Interconnection there are interdependent power generators and transmission lines. As such, a failure in any part of an Interconnection can cause a widespread disruption to all or a major section of the electrical grid.

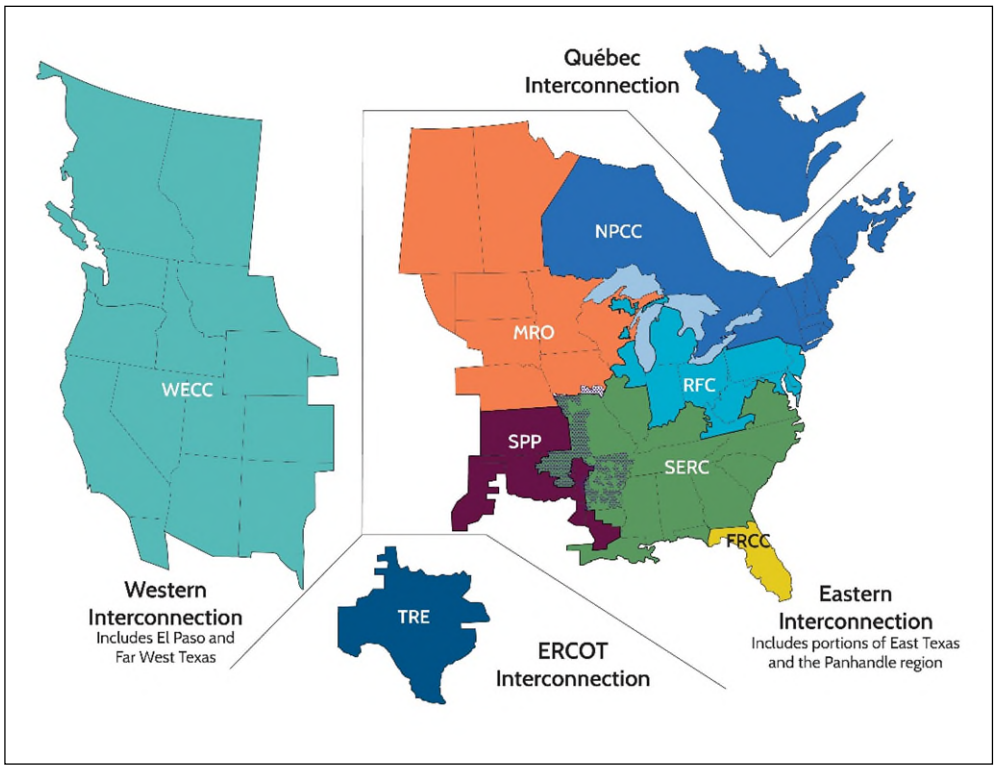

Figure 113: NERC Interconnections

Energy disruptions have a major impact on the public, businesses, and critical infrastructure. Such disruptions result from natural or human-generated disasters or be a result of other issues such as spikes in demand during peak energy use, unanticipated power plant shutdowns, transmission system congestion, and equipment or system failures.

HISTORICAL RECORD OF POWER OUTAGES

Energy disruptions have a major impact on the public, businesses, and critical infrastructure. Within Southern California and Los Angeles County (including the LVMCOG Region), there have been incidents of major power outages in the past. The table below lists examples of major and minor power failures in the area since 1996 to depict the variety of causes and impacts from natural events, technology failures, and man-made incidents.

Event Year	Event	Affected Areas	Cause
2023 October 1 to December 12	Public Safety Power Shutoff (PSPS) Events	Multiple counties in California were subjected to PSPS from by Southern California Edison (SCE)	Sustained strong dry winds resulted in multiple PSPS events to reduce the potential for wildfires due to downed power lines and blown debris.
2014	Pasadena Power Outage	Several thousand home and businesses in Pasadena experienced a prolonged blackout.	Man-made: Mylar balloon tangled in power lines.
2014	Los Angeles County Blackouts	More than 50,000 homes were without power in Los Angeles County.	Natural: Winter storms.
2013	Malibu Power Outage	More than 3,000 customers along Pacific Coast Highway lost power in a local outage.	Natural: Bird striking power lines.
2013	Los Angeles County Power Outage	Power outage impacting more than 69,000 homes in Los Angeles County including parts of Calabasas and Westlake Village.	Undetermined: Downed power lines.
2011	Southwest Blackout	California – San Diego, Orange, Riverside, and Imperial Counties. Also affected states in Northern Mexico, as well as counties in Arizona.	Man-made: human error.
2011	Southern California Windstorm	More than 340,000 homes were without power in Los Angeles County including the San Gabriel Valley, Westchester, Highland Park, South Los Angeles, and the San Fernando Valley.	Natural: Downed trees caused by high winds brought down power lines resulting in major power outages in the region.
2005	Los Angeles Blackout	The City of Los Angeles, West Los Angeles, San Fernando Valley, Hollywood	Man-made: human error
2004	Rolling Blackouts	Forced blackouts in local communities from Calabasas to Simi Valley.	Technology: Power company equipment failure.
2000 – 2001	California Electricity Crisis	The State of California	Man-made: energy shortages caused by market manipulation, regulation and deregulation, price caps, supply and demand.
1996	Western North American Blackouts	Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington and Wyoming, Alberta, British Columbia, and Baja California Norte in Mexico.	Man-made: trees too close to power lines caused systemic failures.

Table 146: Large Power Outages in Southern California

Average Power Outage Duration, Frequency, and Duration

Southern California Edison (SCE) provides distributes electricity for the LVMCOG region. The **SCE Annual Electric Reliability Report 2022** provides average power outage data for its service region.

Acronym	Description
MED	Major Event Day: A day in which the daily system SAIDI exceeds a threshold value. For purposes of calculating daily system SAIDI, any interruption that spans multiple calendar days is accrued to the day on which the interruption began. Statistically, days having a daily system SAIDI greater than a threshold value are days on which the energy delivery system experienced stresses beyond that normally expected (such as severe weather). Events are excluded based on the "2.5 beta method." Per IEEE Standard 1366, days are excluded from a given year's metric if their SAIDI exceeds 2.5 times the standard deviation of the natural logarithm of daily SAIDI over the previous five-year period.
SAIDI "What's the total time my power service will be unexpectedly interrupted this year?"	The System Average Interruption Duration Index is the amount of time on average a customer was without power in a year due to sustained interruptions (measured in minutes per customer). $\frac{\text{sum of all "sustained" customer interruption durations}}{\text{total number of customers served}}$
SAIFI "How many times will my power service be unexpectedly interrupted this year?"	The System Average Interruption Frequency Index is the number of times an average customer was without power in a year due to service interruptions lasting more than 5 minutes (measured in interruptions per customer). $\frac{\text{sum of total quantity of "sustained" customer interruption durations}}{\text{total number of customers served}}$
MAIFI "How many times will my power service be momentarily interrupted (≤5 minutes) this year?"	The Momentary Average Interruption Frequency Index is the number of times an average customer was without power in a year due to service interruptions lasting 5 minutes or less (measured in interruptions per customer). $\frac{\text{sum of total quantity of "momentary" customer interruptions}}{\text{total number of customers served}}$
CAIDI "How long will it take to restore my power after an unexpected interruption?"	The Customer Average Interruption Duration Index is the average time required to restore service for a sustained outage. $\frac{\text{SAIDI}}{\text{SAIFI}}$

The table below summarizes SCE's 2022 performance for unplanned outages including and excluding MEDs. The table also consists of a 10-year average performance for unplanned outages including and excluding MEDs for comparison.

	Total System Indices (All Interruptions Included)				Total System Indices (Major Event Days Excluded)			
YEAR	SAIDI	SAIFI	MAIFI	CAIDI	SAIDI	SAIFI	MAIFI	CAIDI
2022	131.13	1.08	1.42	121.45	101.03	0.96	1.23	104.83
10 Year Avg (2013-2022)	143.09	1.02	1.45	139.67	94.70	0.88	1.29	107.20

Table 147: SCE 10-Year Average Performance for Unplanned Outages

The 10 year average performance indicates that a customer may experience 1 sustained power outage lasting over 2.3 hours and nearly 1-1/2 momentary power outages per year.

During 2022, there were fewer PSPS events that required de-energization of one or more circuits than prior years and SAIDI and SAIFI impact was smaller than prior years. The table below contains the required SAIDI, SAIFI, MAIFI[2] and CAIDI indices for 2013-2022 including and excluding MEDs for the SCE system unplanned outages. All calculations are based on the IEEE 1366 method for MEDs. Reliability indices are for unplanned outages only.

	Total System Indices (All Interruptions Included)				Total System Indices (Major Event Days Excluded)			
YEAR	SAIDI	SAIFI	MAIFI	CAIDI	SAIDI	SAIFI	MAIFI	CAIDI
2022	131.13	1.08	1.42	121.45	101.03	0.96	1.23	104.83
2021	179.79	1.11	1.57	161.70	103.82	0.96	1.43	108.10
2020	201.32	1.06	1.38	190.47	91.40	0.87	1.25	105.51
2019	177.97	1.04	1.38	171.17	90.75	0.87	1.23	104.75
2018	136.82	0.87	1.43	156.61	71.25	0.72	1.27	99.58
2017	139.73	1.19	1.84	117.19	91.72	0.87	1.42	105.40
2016	134.48	1.10	1.55	122.26	109.98	0.99	1.40	110.69
2015	114.83	0.92	1.42	125.40	100.15	0.86	1.29	116.56
2014	112.25	0.97	1.36	116.28	92.40	0.86	1.23	107.12
2013	102.61	0.91	1.20	112.76	94.49	0.88	1.18	107.85

Table 148: Unplanned Outage System Indices (2013-2022)

POWER OUTAGE HAZARD IDENTIFICATION

Electrical power is supplied to the Las Virgenes-Malibu Region by Southern California Edison (SCE). Power outages can occur whenever there is a severe disruption to power generation facilities or the electric distribution network (for instance during a severe storm, earthquake, or wildfire).

In addition, during certain extreme weather conditions, SCE and other electric system distribution utilities implement proactive de-energization known as Public Safety Power Shutoff (PSPS). A PSPS is an operational protocol that is implemented in order to minimize the threat of wildfires and keep communities safe from potentially dangerous situations.

In addition, human error is a potential risk. For example, on September 8, 2011 an Arizona Public Service (APS) employee is believed to have caused a major power outage that included Arizona and portions of Southern California including San Diego, Orange, and Imperial Counties. The outage impacted more than 5 million people. While the Las Virgenes-Malibu Region was not impacted, this event demonstrates the potential for widespread power disruptions.

Furthermore, there is an ongoing risk of cyber-attack to the nation's critical infrastructure. On August 14, 2003, the MSBLAST worm (Blaster) and SoBig worms were suspected of causing a massive blackout in the Northeastern Interconnect impacting 50 million customers from the mid-west to the east coast.

CAUSES AND CHARACTERISTICS OF ENERGY EVENTS

Energy threats can be categorized into five types of events:[21]

- Natural disasters caused by nature (e.g., floods, wind, earthquakes)
- Extreme weather conditions causing damage to electrical distribution systems or forcing implementation of PSPS
- Accidental events caused by technological failure (e.g., pipeline rupture, chemical spills, nuclear system failure)
- Systemic threats caused by the physical inability of the energy delivery system (generation and distribution) to meet demand
- Deliberate attacks caused by people – (e.g. terrorists, criminals, hackers, delinquents, employees)

Natural Disasters

Natural hazard events have the potential to cause disruptions in the energy supply. In the Lancaster area, the following types of events can cause outages or other energy events:

- Drought
- Earthquakes
- Flooding
- Severe storms
- Subsidence
- Wildfires
- Windstorms

Public Safety Power Shutoffs

During extreme weather conditions such as sustained strong dry winds can result in Public Safety Power Shutoffs (PSPS) to reduce the potential for wildfires due to downed power lines and blown debris. For example, in December 2017, arcing SCE power lines during high winds caused the Thomas Fire which resulted in 440 square miles burned. Per an investigation by the Ventura Fire Department, the arc, "deposited hot, burning or molten material onto the ground, in a receptive fuel bed, causing the fire".[22]

[21] The National Association of State Energy Officials (NASEO) *State Energy Assurance Guidelines*

[22] Weber, Christopher, "Report: Power lines sparked massive Southern California fire". AP NEWS. March 14, 2019

Accidental Events

Accidental events that cause energy disruptions can be due to technological failure, hazardous materials releases, pipeline rupture, nuclear system failure, accidental actions or inaction. Accidents can be a localized event such as a car crashing into a power pole or a local transformer incident or can be more widespread such as the Southwest Blackout of 2011 that was caused by an employee making repairs at an electrical substation. As the energy infrastructure ages, there is the possibility of equipment failure that can cause intermittent power or pipeline failures.

Systemic Threats

Systemic threats affect the entire energy distribution and production network, including production plants and distribution infrastructure. Systemic events occur when energy delivery systems are physically unable to meet demand. Examples of systemic threats include insufficient power generation capabilities during peak demand such as such as during a prolonged heat wave.

Deliberate Attacks

Deliberate attacks are intentional, malicious acts caused by people that are aimed at personnel, equipment, infrastructure, or computer systems (cyber-attacks). Many power plants and other infrastructure are remotely controlled by supervisory control and data acquisition (SCADA) systems. SCADA systems are vulnerable to attack by hackers who can access the system and perform acts of sabotage against a target, and an attack against SCADA can shut down an energy provider's operations. A deliberate attack such as a Denial of Service attack can slow or shut down a provider's Web site and make it difficult for customers to access personal or billing information. In addition, physical attacks can target distribution points, transmission lines, and pipelines.

POWER OUTAGE HAZARD IDENTIFICATION

A large power outage in the LVMCOG Region that happens during the hottest part of summer or the coldest part of winter will likely result in injury and in extreme cases fatalities. An outage at any time will disrupt roads, highways, lifelines, public services, and the general health of local populations. The examples listed below provide brief descriptions of the types of impacts that can be anticipated.

Injuries

There is a potential for injuries both at home and on the roads during a power outage. During an outage, traffic signals will no longer function, creating the potential for automobile and pedestrian accidents. If the outage occurs at night, streetlights will not work, increasing the probability of accidents and corresponding injuries. Emergency responders will have difficulty navigating traffic if the outage causes traffic issues on city streets, and police will probably be used to manage traffic at high-volume intersections, reducing their ability to respond to accident sites. Finally, injuries and fatalities can result from inappropriate use of household generators during power outages.

Transportation Infrastructure

Residents in the LVMCOG area commute frequently by automobiles and public transportation. A power outage will affect the usability of roads, railways, highways, and freeways. Street signals and streetlights will not work causing traffic jams and increase the possibility of accidents.

Lifelines

Many lifelines are dependent on power, including water pumping stations, food distribution, telecommunications systems, some natural gas and fuel pipelines, and sewage systems. A power

outage will prevent these systems from running normally as they are reliant on electricity for operations. A disruption to lifelines will impede the ability to distribute important information to the public, as well as endanger public health and safety. Examples include:

- Water pumping stations, wells, and sewage treatment plants are dependent on electrical power. While the pumping stations have backup generators in case of power outages, an extended outage may affect the ability of these stations to provide or preserve the safety of water.
- Perishable foods are dependent on refrigeration and electrical power. Without electricity, these foods expire relatively quickly, leading to the potential of foodborne illness.
- The telecommunications infrastructure is comprised in part of hard-wired telephone and cable systems (including Internet Service Providers), microwave transmission stations, cellular telephone systems, and radio systems. Industries dependent on the telecommunications sector include oil and gas, electric power, transportation, emergency services, government services, water, and banking and finance. Most telecommunications providers have backup power plans and agreements to procure the fuel needed to run during a power outage, although an extended outage may impede the ability of telecommunications providers to continue to deliver service to the dependent industries.
- Some gas and fuel pipelines may be dependent on electricity at pumping and filtering stations. Utility offices and command centers may be reliant on natural gas or other fuels to maintain continuity of operations.

Services

Public facilities are electricity dependent and will be disrupted during a power outage. An extended outage will affect the ability of some organizations to continue to provide public services as well as affect the ability of residents to function normally. Examples include:

- Most hospitals have backup generators to get through short power outages and plans to get through longer outages and battery systems to keep critical equipment functioning. Nevertheless, generators have been known to fail during power outages. In the case of generator failures, hospitals may have to move patients to other facilities and postpone scheduled non-emergency services.
- Emergency call centers are dependent on electricity to run and to dispatch emergency services. During a power outage they may be able to sustain operations for a period of time utilizing power generators, however if the situation persists over several days, generators will run out of fuel and the rate of equipment failure will likely increase.
- A power outage may cause pump failures that result in a loss of water pressure in some areas, hampering firefighting efforts.
- ATMs and banks rely on electricity to provide money and services. Credit card and Point of Sale systems rely on electricity to process transactions. Without access to banks and ATMs, cash may be in short supply during a power outage, and many stores will only be able to accept cash transactions. Some stores will not be able function as cash registers, inventory systems, and electronic entry doors are dependent on electricity.
- Gas stations rely on electricity to power gas pumps and payment processing devices; therefore, many gas stations will be inoperable during a power outage.

- Government services that rely on banking, transportation, or communications, such as electronic checks, may be delayed during an outage.

Personal Safety

There will be risks to personal safety during a prolonged power outage. A prolonged outage will compromise medications that require refrigeration (such as insulin and diabetes medications) and prevent home medical equipment from operating. Further, closed pharmacies mean a lack of access to prescription refills. Stress caused by power outages may exacerbate existing medical conditions such as respiratory disease, asthma and cardiovascular conditions. Power outages may stress people trapped in elevators, subways, mines, or other enclosed or isolated spaces.[23] Home accidents such as food and carbon monoxide poisoning increase, and heat related illness such as hyperthermia or hypothermia is a concern depending on the location and date of the outage and weather conditions.[24] Additionally, a loss of Internet access will have a widespread impact including ISP supported communications, navigation systems, and access to public information.

Economy

The direct economic impacts due to power outages include lost business output and productivity, property damage, business and government overtime costs, increased waste, and commodities losses caused by a lack of refrigeration. Indirect impacts include diversion of capital investments into blackout protection systems.[25]

Furthermore, manufacturing companies may suffer heavy losses from a power outage, caused by production line disruptions, equipment failure, and increased accidents. Companies outside of the manufacturing sector will likely suffer minimal physical loss in a power outage, but can suffer significant customer and revenue loss. Small businesses are especially vulnerable as they generally have fewer resources and are less likely to have prepared or planned for such an event. For example, the estimated permanent economic losses from the thirteen-hour Southwest Blackout in September 2011 resulted in losses between $97 million to $118 million dollars.[26]

[23] G. Brooke Anderson and Michelle L. Bell, Lights out: "Impact of the August 2003 power outage on mortality in New York, NY", *Epidemiology*. 2012 March; 23(2): 189–193.
[24] Broder J, Mehrotra A, Tintinalli J., "Injuries from the 2002 North Carolina ice storm, and strategies for prevention", *Injury*. 2005 Jan 36(1):21-6.

[25] Electricity Consumers Research Council, "The Economic Impacts of the August 2003 Blackout"
[26] National University System Institute for Policy Research, "Economic impact of September 9th Power Outage"

Estimated Impact of an Event

If an energy disruption were to occur, the consequences to local populations could be significant. The table below provides the estimated impact of a disaster using a 10% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 10% Loss Occurs
Population	20,362	23,410	2,182	10,915	8,081	6,495
Total Owner-Occupied Units	5,861	6,010	603	3,395	2,492	1,836
Total City Employment	11,100	11,800	4.5	6,483	3,700	6,618
Economy* (in thousands)	$621,000	$1,011,348	N/A	$578,443	$576,306	$557,419

Table 149: Estimated Population and Economic Loss of a Power Disruption

Source U.S. Census Bureau 2021 American Community Survey 5-Year Estimate
***2017 U.S. Economic Census (in thousands)**

Based on a 10% loss projection, nearly 6,500 people would be impacted, and more than 6,600 jobs could be disrupted causing over $557M in economic losses. Also, more than 1,800 homes could experience an energy loss (see Community Profile section for population, housing, and economic data).

Risk of Future Energy Disruption

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 8.20 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Energy Disruption	5.67	15	3.33	6.5	8.20

POWER OUTAGE VULNERABILITIES

The major concern regarding the impact on communities from power outage events is the failure of critical infrastructure and the danger to public health. Critical infrastructure failures may require days or weeks to repair. In addition, the impact to business and industry can result in immediate and long term economic loss.

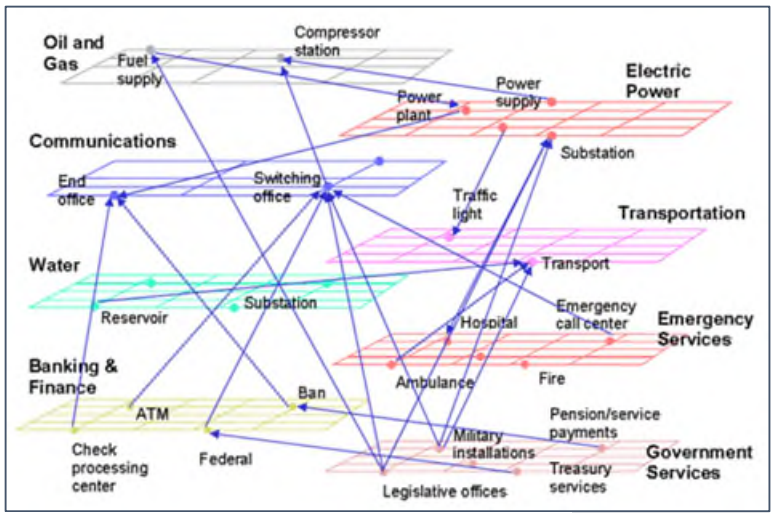

Figure 114: Infrastructure Interdependencies

Source: FCC Public Safety and Homeland Security Bureau

Critical Infrastructure

Critical infrastructure can fail during a power outage, especially if the event lasts longer than a few days. Outages will affect water and sewer systems, pipelines, transportation networks, emergency facilities, telecommunications systems, hospitals, and other essential sites. Power outages that last a few hours may only be an inconvenience as most critical infrastructure component have generators or backup power capabilities, but prolonged outages will affect the usability of generators and depend heavily on access to fuel sources. Finally, the failure of services such as the sewage system may pose a hazard to the health of the local community.

Many infrastructure components are dependent on each other. For example, pipelines depend on electricity, and while fuel can be used to run generators, once existing fuel supplies are depleted, it is difficult to procure new supplies without electricity. If gasoline is unavailable, transportation systems become unreliable. As a result, these "infrastructure interdependencies" can create larger issues the longer a power outage lasts.

Business and Industry

Power outages impact businesses by causing shutdowns during the course of the event. Damage to physical property, interruptions in the supply chain, damage to refrigerated or heated goods that rely on electricity to maintain a certain temperature, and losses to goods on production lines that must be shut down at the time of the event are expected during a power outage. Further, some computer-based businesses will not be able to function without access to power, cooling systems, and the Internet.

Public Health and Safety

A Yale University study of the August 2003 blackout that affected the Northeast and Midwest regions of the United States and parts of Canada showed an increase in accidents and illness that lead to an increased number of deaths during the event.[27] A study by the New York City Department of Health and Mental Hygiene for the same event showed an increase in foodborne related illness as a direct result of the outage.[28] Injuries due to slips and falls and heat related illness or hyperthermia are commonly reported during power outages. Hospitals may fill as people will not be able to utilize home-based medical equipment or procure prescription medications.

ENERGY DISRUPTION MITIGATION STRATEGIES

Southern California Edison (SCE) provides power to all cities within the LVMCOG Region and is responsible for managing the power supply. Consequently, the LVMCOG cities have no jurisdiction over SCE or its operations.

To mitigate the threat of power outages, SCE has an emergency preparedness program in place to address pre- and post-disaster planning needs. Additionally, they have included in their plans the need to communicate with the public during an outage. SCE also continually assesses the vulnerability of their system to hazards and takes steps to mitigate the risk. This includes contingency plans for shutting down parts of the electric distribution network in high risk wildfire conditions such as during periods of extreme wind.

SCE conducts regular briefings to each of the LVMCOG cities to provide updates on their mitigation efforts. For example, SCE has provided the LVMCOG multiple presentations on Wildfire Mitigation, Safety, and Grid Resiliency. During these presentations, SCE outlines the major threats to the electric system and the ongoing risk of wildfire, steps being taken to harden the system against these threats, mitigation and monitoring efforts, and the steps taken if a public safety power shutoff is implemented. For example, during high wildfire risk periods, SCE may de-energize the system to prevent wildfires ignited by the electric power transmission system (see Wildfire section for related details). In such cases, SCE has stated that it will provide notifications starting 48 hours prior to a potential power shutoff to:

- First responders
- Local governments
- Water & Communication Service Providers
- Critical Care and Medical Providers
- Customers

The cities within the LVMCOG are investigating the implications of such actions and the potential impacts to their communities. In addition, LVMCOG cities have implemented building codes, zoning ordinances, and growth and development plans to help mitigate future energy disruptions:

- Building codes can be used to ensure that minimum required construction standards are met to safeguard public health and safety and can also increase a community's ability to handle electrical outages by requiring that facilities are adequately prepared for power

[27] Lights out: Impact of the August 2003 power outage on mortality in New York, NY
[28] New York City Department of Health and Mental Hygiene, "Diarrheal illness detected through syndromic surveillance after a massive power outage: New York City, August 2003"

disruptions. For example, commercial and industrial buildings may be required to have emergency power systems to operate fire control systems and alarms and sites with elevators may be required to have backup power.

- Zoning ordinances can specify the type of land use that is acceptable in various locations in a community, and thus affect the electric power requirements of an area as areas zoned "residential" will have a different electricity profile than areas zoned "commercial" or "industrial".
- Growth and Development plans are developed by each city. Southern California Edison (SCE) develops future long-term demand projections as a starting point for planning the expansion of electric power generation, transmission, and distribution facilities.

Finally, several cities within the LVMCOG have installed and maintain emergency power generation for designated critical sites.

Agoura Hills

The City of Agoura Hills has installed and maintains an emergency generator at City Hall. In addition, a second critical site has been equipped with generator capabilities.

Calabasas

The City of Calabasas maintains an emergency generator at City Hall and is in the process of investigating options and funding for upgrading the system to ensure adequate power supplies during emergencies. These options include additional fixed generators and portable generators.

Hidden Hills

The City of Hidden Hills has equipped City Hall and the Community Center with emergency generators. Further, the City is in the process of purchasing a portable generator for additional resiliency. Additionally, the Las Virgenes Municipal Water District (LVMWD) is in the process of constructing a permanent generator in the Hidden Hills pump station to replace the need for portable generators which will help ensure ongoing water supplies in the event of a power outage. Also, Spectrum provides Internet access within the City of Hidden Hills and has upgraded their battery backup system to enable 72 hours of operation at each node in Hidden Hills which will allow for extended Internet access if a power failure occurs. Finally, the City of Hidden Hills upgraded its radio communications tower and facility to allow for solar power, backup battery power, and portable generator power via a quick connect system.

Malibu

The City of Malibu maintains an emergency generator at City Hall and has distributed small personal generators to residents as part of a Senior Preparedness Program (CDBG Grant funded). Further, the City has taken additional steps to provide communications in the event of a power disruption including:

- Satellite communications between City Hall and CERT members
- A plan to distribute incident information at strategically located Information Stations

within the City

- Setup of Information Stations to provide community members with access to limited satellite Internet access

Westlake Village

The City of Westlake Village has equipped City Hall with an emergency generator. Additionally, the City contracts with a vendor to provide fuel. The City currently has a solar project that is intended to replace the diesel generator on site. Additionally, the City has multiple battery powered generators that could be used in case of emergency.

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SECTION 10. LANDSLIDE, DEBRIS FLOWS, AND MUDFLOWS

THE NATURE OF THE LANDSLIDE, DEBRIS FLOW, AND MUDFLOW THREAT

Landslides are defined as, the movement of a mass of rock, debris, or earth (mud) flow down a slope. Landslides are a type of "mass wasting" which denotes any down slope movement of soil and rock under the direct influence of gravity (FEMA). Landslides can be initiated by rainfall, earthquakes, changes in groundwater, disturbance and change of a slope by man-made construction activities, or any combination of these factors. Underwater landslides can also occur causing tidal waves and damage to coastal areas. Debris flows are fast-moving landslides that are particularly dangerous to life and property because they move quickly, destroy objects in their paths, and often strike without warning. Debris flows generally occur during periods of intense rainfall or rapid snowmelt and usually start on hillsides or mountains. Debris flows can travel at speeds up to and exceeding 35 mph and can carry large items such as boulders, trees, and cars (USGS). A mudflow is defined as, "A river of liquid and flowing mud on the surface of normally dry land areas, as when earth is carried by a current of water. Other earth movements, such as landslide, slope failure, or a saturated soil mass moving by liquidity down a slope, are not mudflows" (FEMA).

The size of a landslide or debris flow normally depends on the geology and the initial cause of the event. Landslides and debris flows vary greatly in their volume of rock and soil, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide or debris flow are slope of the hillside, moisture content, and the nature of the underlying materials and the type of failure depends on their composition and characteristics.

Landslides can be described as either: (1) rapidly moving (generally known as debris flows), and (2) slow moving. Rapidly moving landslides or debris flows present the greatest risk to human life. People living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Slow moving landslides can cause significant property damage but are less likely to result in serious human injuries (USGS).

Nationally, landslides (including mudslide and debris flows) cause 25 to 50 deaths each year. The best estimate of direct and indirect costs of landslide damage in the United States range between $2 billion and $4 billion annually (U.S. Geological Survey)[29]. As a seismically active region, California has had a significant number of locations impacted by landslides. Further, landslides and debris flows/mudslides are a particular risk in areas denuded by wildfire when significant rains occur. In addition to the potential loss of life, landslides can result in private property damage, impact transportation corridors, break fuel and energy conduits, and disrupt communication facilities.

Within the Las Virgenes-Malibu Region there are areas that are susceptible to landslides and debris flows due to slope instability, fire activity, rainfall and the geologic make-up of the area. Although all of the cities within the LVMCOG prohibit development in areas that may be prone to landslides, there are existing properties that may be susceptible to landslide activity.

[29]American Geosciences Institute, https://www.americangeosciences.org/critical-issues/faq/how-much-do-landslides-cost-terms-monetary-losses

Debris Flow

A debris or mud flow is a river of rock, earth and other materials, including vegetation that is saturated with water. This high percentage of water gives the debris flow a very rapid rate of movement down a slope. Debris flows can have speeds on the order of 20 mile per hour and can often move much faster (California Department of Conservation). This high rate of speed makes debris flows extremely dangerous to people and property in its path. In the event of a major landslide, debris flow can destroy roadway pavement and fill the storm drain catch basins. Any significant surface movement along streets will isolate residents and disrupt utilities in those areas. Although no significant debris flow resulting from landslide activity has been recorded in the Las Virgenes-Malibu Region, it remains a possibility.

HISTORICAL RECORD OF LANDSLIDE, DEBRIS FLOW, AND MUDFLOW EVENTS

History of Landslides, Debris Flows, and Mudflows in Southern California

The National Weather Service has documented the following significant flood triggered landslide, debris flows, and mud slide events in Southern California since 2014 (additional flood events are documented in the **Flood and Severe Winter Storm** section).

Date(s)	Weather	Adverse Impacts
9.12.2022	Moisture from remnants of Tropical Cyclone Kay brought precipitable water measured at 2.35" inches, a record level for September and the second wettest all-time in the sounding record back to 1956. Rainfall ranged from 2 to 6" from the Anza Borrego Desert to Mt. Laguna on 9.9. Thunderstorms erupted in the mountains and desert and Inland Empire from 9.10 to 9.12. Including one storm producing a rain rate of 2.44" in one hour at Raywood Flats on 9.12.	On 9.12, flash floods and debris flows flowed into Forest Falls and Oak Glen, where 30 homes and businesses were damaged. Search and rescue operations found all missing persons but one, a woman who was killed in Forest Falls. 14 evacuees spent at least one night at a Red Cross shelter. Several roads and highways in this area were blocked by debris and closed. Other massive debris flows, including large trees and boulders, flowed down Banning and Mias Canyons above Banning. Flash floods were also reported in Barona and Temescal Valley.
8.13.2022	Thunderstorms hit the San Bernardino Mountains. 2.28" at Yucaipa Ridge.	The rain came in a short time and triggered debris flows and flash floods into Forest Falls.
7.31.2022	Numerous heavy thunderstorms struck the El Dorado burn scar (above Yucaipa). Rainfall intensities exceeded 1" in 1 hour and a couple approached 2" per hour. Some weakening thunderstorms managed to drift across southern Orange County to the coast.	Significant flash floods and debris flows that closed parts of highway 38 near Angelus Oaks for days. Storms in the high desert led to several flash floods.
12.23-24.2021	A series of storms paraded through the region, each bringing heavy rain during late December. Two-day totals for this storm reached 6" in the mountains, but Lytle Creek alone achieved just over 8". The northern Inland Empire got 2-5", while most other lower elevation stations received 0.75-3". Even parts of the lower deserts got more than one inch.	Several mountain roadways were washed out, including Highways 18 and 243. Flooding was observed in the Mojave River in Hesperia, along Indian Canyon Road near Palm Springs, in San Bernardino, in Cherry Valley just below the Apple Fire burn scar, and in nearby Oak Glen. Debris flows inundated parts of Silverado Canyon within the Bond Fire burn scar.
12.14.2021	A significant winter storm brought heavy rain to lower elevations. 5 to 6" of rain fell on the southwest slopes of the San Gabriel and San Bernardino Mountains, with Lytle Creek singularly achieving 7.06".	Several debris flows occurred, in the Bond Fire burn scar in eastern Orange County and below the Apple Fire burn scar near Beaumont. Localized flooding was common across the region. Rocks and debris closed some mountain highways.

Date(s)	Weather	Adverse Impacts
10.25.2021	A significant storm for October tapped into a weakening atmospheric river to bring over 2" of rain to parts of the San Bernardino Mountains. 1-2" were common in the mountains, while 0.25- 1" was common at lower elevations, including the high desert.	The rain combined with vulnerable burn scars to produce rock slid mud and debris flows that closed es, off several highways in the mountains. These closures were near Big Bear Dam, Oak Glen and Forest Falls.
7.30.2021	A surge of monsoon moisture produced numerous heavy thunderstorms across the mountains. Rain rates of 1.0 to 1.5 inches per hour were observed in the heavier storms.	Several flash floods and debris flows occurred, particularly on the El Dorado Fire burn scar along Highway 38 near Angelus Oaks.
7.26.2021	Widespread showers and thunderstorms hit the entire region, even to the coast. Many locations in mountains and deserts received over one inch of rainfall, with Lake Cuyamaca topping the list at 2.32", Indio 1.60" and Apple Valley 1.34". West of the mountains, amounts ranged from 0.01" to 0.83" inch at Rincon Springs. Distribution was not uniform in any respect.	A flash flood spread sand and rocks across Dillon Road and Ramon Road near Thousand Palms. Several Indio streets were flooded with water.
3.11.2021	A powerful storm contained a heavy burst of rain in eastern Orange County that struck the Bond Fire burn scar in Silverado Canyon. 0.20 inch of rain fell in 15 minutes.	A debris flow went over roads and into homes, damaging six homes and eight vehicles in Silverado. The flow also closed a stretch of Silverado Canyon Road.
1.28-29.2021	A powerful winter storm and atmospheric river brought heavy rain. 4 to10 inches fell across San Luis Obispo and Santa Barbara Counties, 2 to 6 inches fell in Ventura County and 1 to 4 inches fell in Los Angeles County. 1.5 inches of rain fell across Santiago Canyon in eastern Orange County.	Many areas flooded, including Santiago Canyon where mud and debris flows covered roads and damaged homes. A vehicle got stuck in floodwaters in Perris, prompting a water rescue. 8 people were trapped in a flooding storm drain between Otay Mesa and San Ysidro. 7 were helped to safety, but one perished.
4.8-10.2020	A warm front moved through the region on 4/8 and brought waves of showers from south to north. Following the warm front, an upper low moved into the California Bight and stalled on 4/9, bringing 3 to 5 inches of rain to Orange County and San Diego County through 4/10. Many locations recorded their highest daily rainfall record: San Diego (1.98"), Chula Vista (1.56"), and Vista (3.18"). Oceanside Harbor recorded their wettest 24-hours on record with 3.06". Six-day storm totals were 3 to 7 inches along the coast and valleys, 4 to 8 inches with locally 10 in the mountains, and 1 to 2 inches in the deserts. Rainfall in San Diego County was 3-4" inches in a 24 hour period. All-time daily rainfall records were broken on 4/10 in Oceanside and Vista, each recording over 3". Monthly rainfall records were broken for April at those locations, each receiving over 6" in just six days.	Numerous flash floods and floods resulted. Flood waters combined with mud, boulders and debris in Bonsall, Oceanside, Carlsbad, Encinitas, Vista, Pacific Beach, Del Mar, Valley Center, Rancho Penasquitos and several spots in Mission Valley. Highway 78, a major freeway corridor between Oceanside and Escondido, was closed in both directions from flooding on adjacent Buena Vista Creek. Numerous swift-water rescues were made all across San Diego County. The San Diego River at Fashion Valley reached a peak of 12.5 feet.
3.12.2020	An atmospheric river brought heavy rain and thunderstorms, especially to the deserts where 1 to 2 inches fell. 550 lightning strikes occurred.	Flash flooding was observed near Canebrake, Borrego Springs, Lakeview, Riverside, Corona, parts of the Coachella Valley, Apple Valley. A mudslide occurred near Pinyon Pines. A road was eroded near Mentone. Water rescues happened in Glen Avon and Corona.

Date(s)	Weather	Adverse Impacts
2.14.2019	A major atmospheric river pummeled Southern California with heavy rain. Many mountain locales recorded 8 to 10 inches of rain, with Palomar Mountain recording over 10 inches. Palm Springs recorded 3.69 inches, the third wettest day on record.	Flash flooding resulted with damage to roads. High snow levels resulted in flooding in the San Bernardino Mountains. Flash flooding and debris flows occurred at and below the Holy Fire burn scar near Lake Elsinore. Highways ripped out by water and debris on both sides of Mt. San Jacinto were closed for weeks for major repairs.
2.2.2019	A strong downpour across the burn scar of the 2017 Whittier Fire triggered a debris flow in Duval Canyon (Giorgi 2019).	The event clogged and damaged a culvert beneath Highway 154, shutting down the highway for a month between Highway 246 in Santa Ynez to Highway 192 in Santa Barbara for clearing, severing a key north-south arterial linking north county and south county.
1.19.2018	On Tuesday, January 9, 2018, following the 2017 Thomas Fire, which burned 281,893 acres in Ventura and Santa Barbara Counties, a reported 0.54 inches of rain fell within 5 minutes in the burn scars from the Thomas Fire in the foothills of Montecito. Over two days a total of four inches of rain fell in the area.	The heavy rains caused massive debris flows and flooding that damaged or destroyed 408 homes, killed 23 residents, and led to the closure of Highway 101 and the UPRR for more than 3 weeks, cutting off the county from communities to the south. California Geological Survey scientists estimated the Montecito debris flow as having speeds of 10-15 mph, being up to 25-30 feet deep, and capable of carrying boulders as large as a tow truck. (California Geological Survey 2019b).
1.5-7.2016	A strong, low latitude jet stream brought a series of storms through Southern California with periods of moderate to heavy rain. Three-day rainfall totals were around 2-7" for the coast, valley and foothill areas, and 1- 3" for the deserts. After several years of drought, this was the only precipitation event of significance during an otherwise disappointing strong El Niño season.	Flooding resulted nearly everywhere, with southwestern San Diego County being hardest hit. Floods buried cars in Ocean Beach and Mission Valley. High water rescues occurred on 1.6 around San Diego. Small mudslides, including boulders on highways were reported near Ramona, Redlands, Crestline, Orange, Rancho San Diego and De Luz. Three debris flows in Silverado Canyon below a burn scar.
9.15.2015	A Pacific trough tapped into remnant moisture from tropical cyclone Linda. 1-2" of rain was common across the entire region.	Major traffic jam during the morning commute in LA and Orange County, along with a debris flow in Silverado Canyon, and widespread urban flooding.
7.18-19.2015	Moisture from Hurricane Dolores, along with monsoon moisture resulted in showers and thunderstorms over most Southern California. Rainfall ranged from 0.5-4", including a record 1.71" at San Diego on 7.18 (unprecedented rainfall: single-day and July monthly total). The San Diego River at Fashion Valley had 2 crests above monitor stage, 7.7 feet on the 18th and 8.8 feet on 7.19. On 7.19 over 6" of rain fell over several hours just west of Desert Center.	A debris flow hit the burn scar of Silverado Canyon. Flash floods hit Moreno Valley, Perris, and La Mesa on 7.19. A wet microburst struck Tierrasanta on 7.18, causing wind damage. A haboob caused wind damage in the Anza Borrego Park and in Palm Desert. The rain caused the first rain-out of a Los Angeles Angels baseball game since 1995, and a rare 2-hour rain delay at the San Diego Padres baseball game. Over 2000 lightning strikes were reported on 7.18, some starting small brush fires. Near Desert Center on 7.19 eastbound lanes of Interstate 10 collapsed where they crossed a heavily flowing wash. A vehicle drove into the hole in the collapsed bridge, trapping the driver and requiring rescue. I-10 was closed in both directions causing huge traffic backups.

Date(s)	Weather	Adverse Impacts
7.6.2015	Monsoon thunderstorms hit the mountains and upper desert. A few spots received up to around one-third of an inch, including a portion of the Lake Fire burn area south of Big Bear Lake.	Several debris flows resulted, including one consisting mostly of ash and mud over portions of Highway 38, up to a foot deep in some areas.
12.3-4.2014	A Pacific storm brought moderate to heavy rain. Two-day rainfall totals of 1-2" were recorded west of the mountains, while the southern slopes of the San Bernardino County mountains saw up to 5" of rain (isolated amount of 14.5" at Yucaipa Ridge).	Flooding resulted, with mud, debris and water closing several roadways and stranding vehicles. Mud with debris 10 feet high piled up on Soboba Rd. north of San Jacinto. A swift water rescue was needed.
9.7-8.2014	Weakening Hurricane Norbert brought moisture to produce thunderstorms mainly in Riverside and San Diego Counties. Rainfall amounts of 1 to 2 inches fell over the city of Riverside, San Bernardino and Hemet, while the mountains in that county saw up to 0.60" near Sky Valley. Early morning thunderstorms on 9.8 drenched parts of the Coachella Valley which received 0.33" up to just over 3 inches near the lower foothill in Thousand Palms and La Quinta.	Widespread flash flooding, most notably in the Coachella Valley on 9.8. Mud and water closed roads and stranded vehicles in La Quinta, Palm Desert, and Thousand Palms. Homes in La Quinta were surrounded by water. Moving water was 3 feet deep on roads and 4 to 5 feet of standing water submerged vehicles. Mud was several feet deep on Varner Road.
8.12.2014	A heavy thunderstorm struck east of Julian.	A debris flow blocked Hwy. 78 east of Julian on the Banner Grade that was one to two feet deep. The Banner Fire burn scar contributed to this flow.
2.28-3.1.2014	A very wet storm was the only significant storm of the 2013-14 wet season. Rainfall ranged from 1 inch at the coast to up to 8 inches in the mountains. Up to 1 inch fell in the desert. Yucaipa Ridge measured over 11 inches.	Urban and flash flooding with mud/debris flows, causing numerous road closures and swift water rescues in and around Anaheim, San Diego-Fashion Valley, Escondido, Fallbrook and Lake Elsinore. Mud slides closed Hwy. 74 (Ortega Highway) stemming from the Falls Fire burn scar. Many road closures in the Coachella Valley where rivers saw rises of 2 to 5 feet, in some instances within 12 hours. On 3.1, flooding resulted in Oceanside, Temecula, Sea World San Diego, as well as minor street flooding in Mission Viejo.

Table 150: A History of Significant Weather Events in Southern California - Organized by Weather Type (Feb 2023) – From 2014 to 2022

Significant Southern California Landslides, Debris Flows, and Mudflows

2023 Rolling Hills Estates Landslide

In July 2023, a landslide destroyed 12 homes in Rolling Hills Estates on the Palos Verdes Peninsula (south of the Malibu coast) with other residents forced to evacuate. Each of the 12 destroyed homes was valued at over $1 million each resulting in a total loss of more than $15.5 million.

2022 Southern California Mudflows

In 2022, heavy rains in the Southern California area resulted in numerous cases of landslides and mudflows. For example, in Oak Glen near Yucaipa flashfloods resulted in mudflows that destroyed several homes and businesses.

2018 Southern California Mudflows

In January 2018, a series of mudflows occurred in the Los Angeles, Orange, Riverside, and Santa Barbara Counties. These mudflows occurred in areas that had previously experienced major wildfires. Subsequent rains resulted in multiple mudflow events. Specifically, the Montecito Mudslide caused 23 reported deaths, multiple injuries, and at least $177 million in property damage.[30]

Figure 115: Montecito Mudflow 2018

Source: Matt Udkow, Santa Barbara County Fire Department

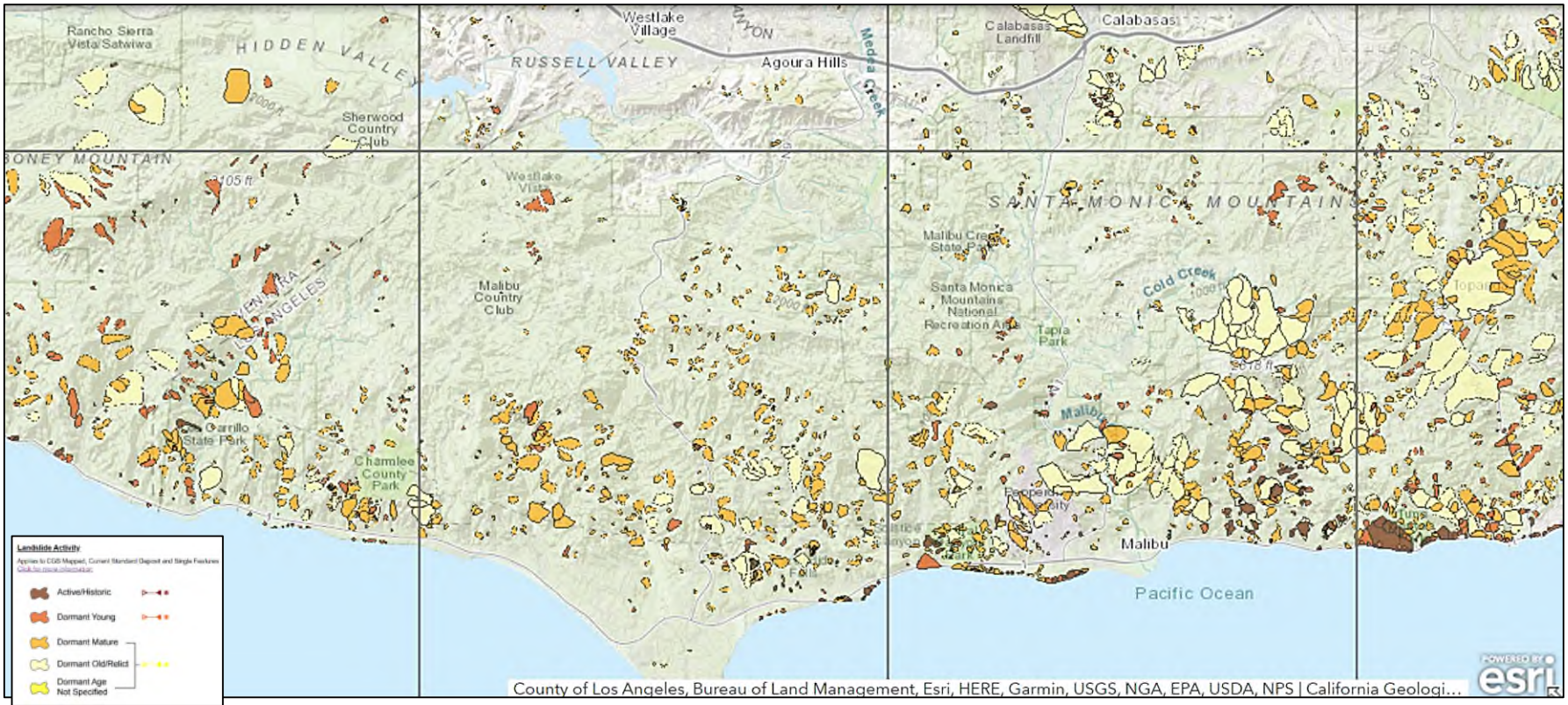
1994 Northridge Earthquake Landslide Related Impact

As a result of the magnitude 6.7 Northridge, California, earthquake, more than 11,000 landslides occurred over an area of 10,000 km^2. Most were in the Santa Susana Mountains and in mountains north of the Santa Clara River Valley. The earth movement destroyed dozens of homes, blocked roads, and damaged oil-field infrastructure. It also caused deaths from Coccidioidomycosis (Valley Fever), the spore of which was released from the soil and blown toward the coastal populated areas. The spore was released from the soil by the landslide activity.

[30] Robert D. Niehaus, Inc., Preliminary Impact Assessment: Montecito Mudslides, 2018

Landslides, Debris Flows, and Mudflows in the Las Virgenes-Malibu Region

The cities within the Las Virgenes-Malibu Region are subject to landslide events due to heavy rains or seismic events. The map below depicts the historic dormant and active landslide (debris flow and/or mudflows) areas within each city. Note: No historic or active landslide zones are within the boundaries of Hidden Hills.



Map 62: Dormant and Active Landslide Areas in the LVMCOG Region

Source: California Department of Conservation (https://maps.conservation.ca.gov/cgs/lsi/app/)

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Agoura Hills Landslides, Debris Flows, and Mudflows

Examples of landslide events in the City of Agoura Hills since 1990 include the Via Amistosa, Morrison Ranch, Liberty Canyon Slope Failure, Laura La Plante, Laro, and Chateau Park landslides. In 1999, Agoura Hills experienced the Kanan Slope Repair as a result of the El Nino storms of 1998. However, as of 2023 all remediation slope repairs have been completed. The City will continue future repair efforts as a result of future storms.

Calabasas Landslides, Debris Flows, and Mudflows

In January 2023 a mudslide blocked the northbound lanes at the intersection of Mulholland Highway and Stunt Road near the southwest border of the City of Calabasas. In June 2022, a large rock blocked Mulholland Highway near Las Virgenes Road in Calabasas (no injuries reported).[31] This event disrupted traffic in the area until the roadway could be cleared.

Malibu Landslides, Debris Flows, and Mudflows

Due to the topography of the area, landslides in Malibu can severely disrupt transportation at a regional level. For example, Pacific Coast Highway is a heavily used transportation route and road closures due to landslides are a major concern. Recent incidents in the City of Malibu have included the Highway 23, Little Dume Beach, and Piuma Road landslides (see 2021-2023 summary below). Previous events include the: Calle del Barco, Kanan, Pacific Coast Highway, Las Flores, Love, and Malibu Road landslides.

2021 - 2023 Malibu Landslides / Mudslides

In December 2021, a mud and rockslide forced the closure of Highway 23 (no injuries reported). Also, in November 2021, a rockslide near Little Dume beach occurred requiring closure of the area until the potential for further rock falls could be determined. In October 2022, a landslide north of Pacific Coast Highway resulted in the closure of Highway 23 between Westlake Village and Malibu. Road clearing and repair efforts required the road to be shut down for 3 weeks. In March 2023, a rockslide caused by heavy rains occurred south of Piuma Road causing several large boulders to fall onto Malibu Canyon Road. The rockslide required the closure of the road for 24 hours while clean-up crews cleared the road (no injuries reported).

Other landslide events periodically occur in the City of Malibu and the City has taken steps to monitor and mitigate the issue. For example, The Malibu Road Landslide Assessment District was authorized in 1998 (Resolution 98-036) to provide funding to maintain and monitor dewatering facilities that are intended to stabilize the landslide area.[32]

[31] https://cadoc.maps.arcgis.com/apps/webappviewer/index.html?id=bc48ad40e3504134a1fc8f3909659041
[32] Fugro, Annual Report Malibu Road Landslide Assessment District, June 2017

CAUSES AND CHARACTERISTICS OF LANDSLIDES, DEBRIS FLOWS, AND MUDFLOWS

Landslide, Debris Flows, and Mudflows Events and Impacts

Landslides including debris flows and mudflows are a common hazard in California. Weathering and the decomposition of geologic materials produces conditions conducive to landslides and human activity further exacerbates landslide potential. Many landslides are difficult to mitigate, particularly in areas of large historic movement with weak underlying geologic materials.

Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. These rock falls are fast moving with materials free falling or bouncing down slopes. The volume of material involved is generally small, but large boulders or blocks of rock can cause significant damage.

As communities continue to modify the terrain and influence natural processes, it is important to be aware of the physical properties of the underlying soils as they (along with climate) create landslide hazards. This is especially important with the demands placed on buildable land (particularly in urban areas) that increases the tendency to build on geologically marginal areas such as hillside lots.

LANDSLIDE, DEBRIS FLOWS, AND MUDFLOWS HAZARD IDENTIFICATION

Landslides, debris flows, and mudflows are often triggered by periods of heavy rainfall. Earthquakes, subterranean water flows, pipeline ruptures, and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events. Further, wildfires can denude large areas of hillsides increasing their susceptibility to landslides, debris flows, and mudflows.

Natural Processes

Natural processes can cause landslides, debris flow, or mudflows or re-activate historical sites with previous events. Seismic tremors can trigger landslides on slopes with a history of landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on moderate slopes above steep streams and riverbanks.

Land Development, Grading, and Excavation

Although landslides including debris flows and mudflows are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness. Grading and excavation can decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content.

Drivers for hillside development include intensification of existing development on residential lots and expansion into undeveloped areas. Intensification consists of additional construction and modification of existing construction or the complete demolition and redevelopment of a residential lot.

Intensification expands developed pad areas into previously "natural" hill slope areas and often involves a corresponding increase in the size and volume of the onsite sewage disposal systems. Other human activities effecting landslides include: excavation, drainage modifications, groundwater alterations, and changes in vegetation and soil conditions.

Drainage and Groundwater Alterations

Water flowing through or above ground is often the trigger for landslides, debris flows, and mudflows. Any activity that increases the amount of water flowing into landslide-prone slopes can increase the hazard. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. Ineffective storm water management and excess runoff can also cause erosion and increase the risk of landslide hazards. Drainage can be affected naturally by the geology and topography of an area; development that results in an increase in impervious surfaces impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, ponding, and erosion on slopes all indicate potential slope problems.

Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides. Building Codes require drainage devices to dispose storm runoff away from hillside developments. Storm runoff is designed to be discharged into the storm drain system. Storm drain catch basins are normally maintained by Public Works Departments and are regularly cleaned to prevent any flooding or ponding.

Changes in Vegetation and Soil Conditions

Wildland fires in hills covered with chaparral are often a precursor to debris flows or mudflows in burned out canyons. The extreme heat of a wildfire can create a soil condition in which the earth becomes impervious to water by creating a waxy-like layer just below the ground surface. Since water cannot be absorbed into the soil, it rapidly accumulates on slopes, often gathering loose particles of soil in to a sheet of mud and debris.

If vegetation on very steep slopes has been removed either by wildfire or man-made development, there is an increased risk. Additionally, changing away from native ground cover plants may increase the risk of landslide, debris flow, or mudflow. For example, if certain vegetation requires heavy watering, soil conditions can change and trigger landslides.

Landslide, Debris Flow, and Mudflow Risk Factors

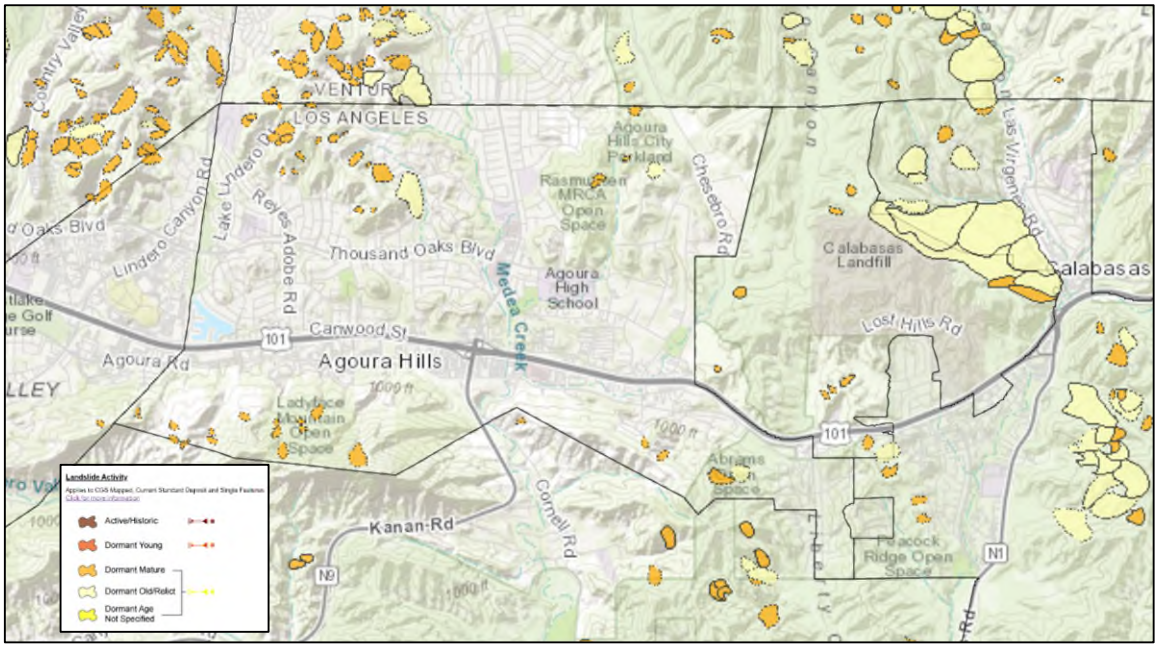
Locations at risk from landslides, debris flows, or mudflows include areas with one or more of the following conditions:

1. On or close to steep hills;
2. Steep road-cuts or excavations;
3. Existing landslides or places of known historic landslides, debris flows, or mudflows (such sites often have tilted power lines, trees tilted in various directions, cracks in the ground, and irregular-surfaced ground);
4. Steep areas where surface runoff is channeled, such as below culverts, V -shaped valleys, canyon bottoms, and steep stream channels; and
5. Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.
6. Canyon areas below hillside and mountains that have recently (within 1-6 years) been subjected to a wildland fire.

Potential Landslide, Debris Flow, and Mudflow Areas

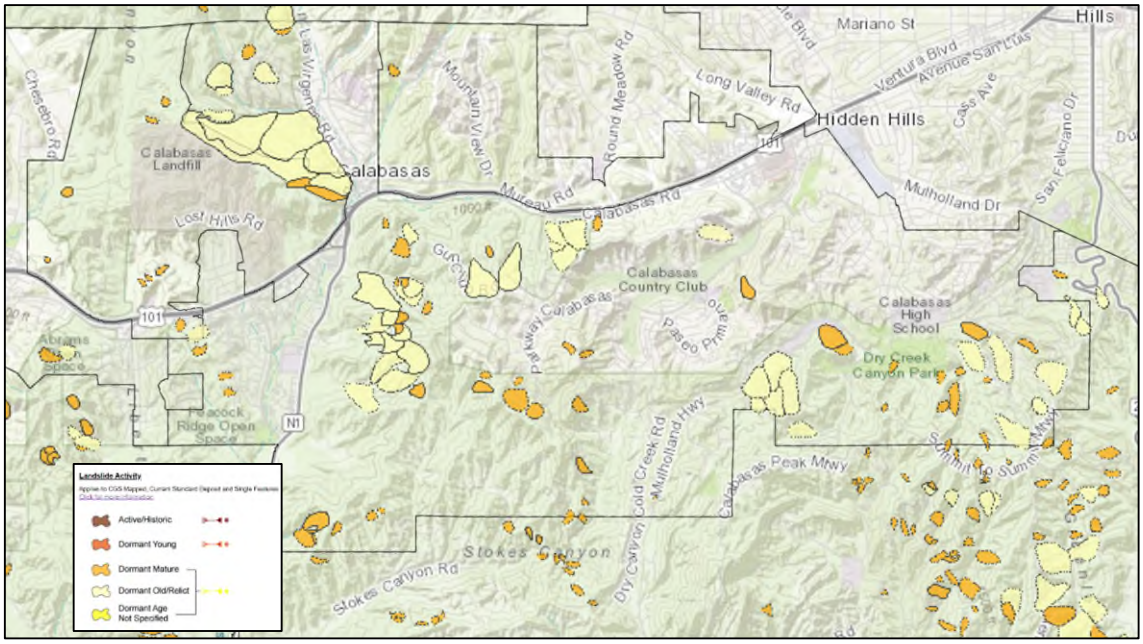
The following potential landslide, debris flow, and mudflow areas have been identified for each city within the LVMCOG (note: no landslide hazards were identified within the City of Hidden Hills). Source: County of Los Angeles, Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA | California Geological Survey

Agoura Hills



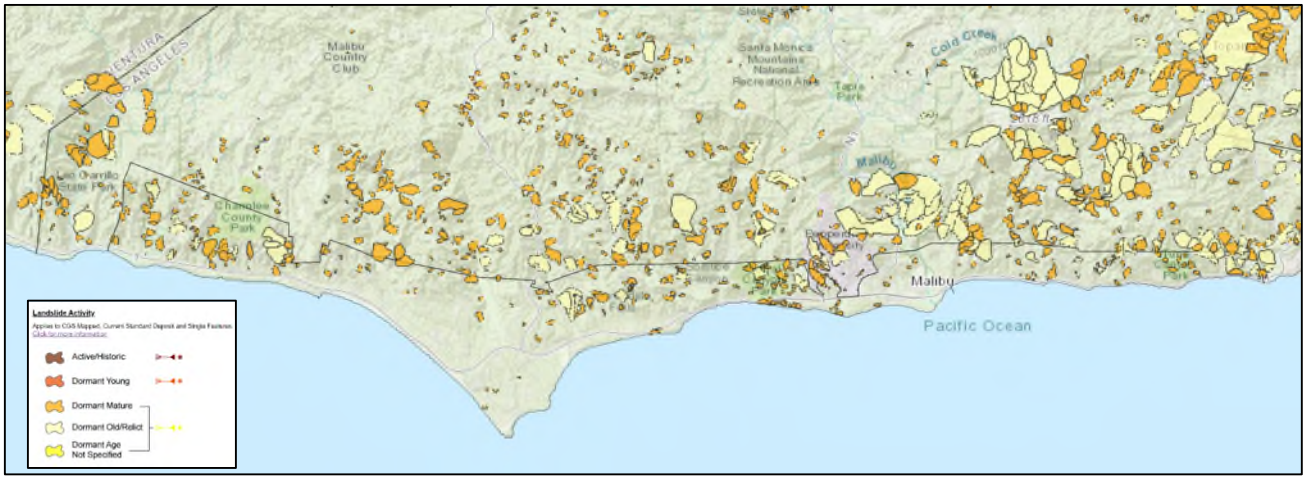
Map 63: Agoura Hills Landslide, Debris Flow, and Mudflow Areas

Calabasas



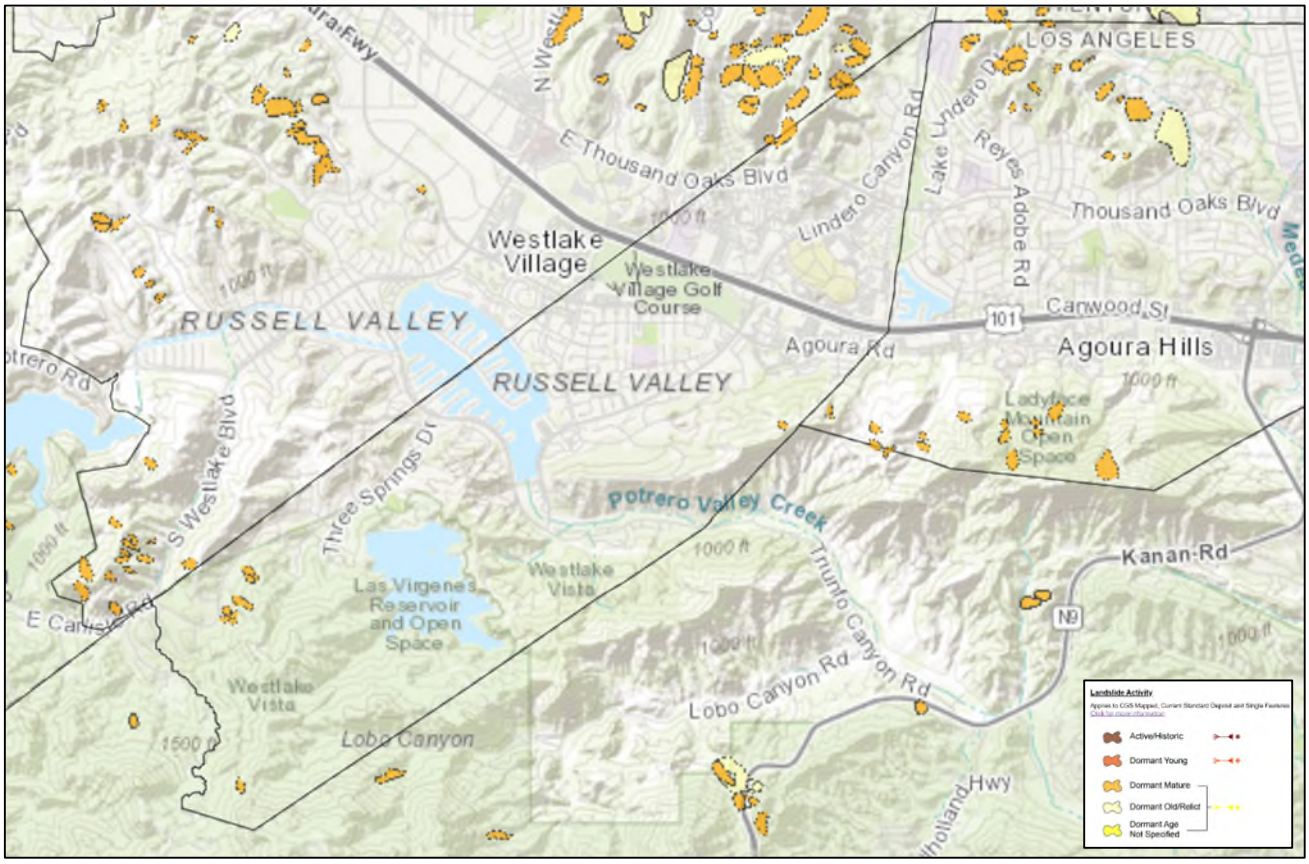
Map 64: Calabasas Landslide, Debris Flow, and Mudflow Areas

Malibu



Map 65: Malibu Landslide, Debris Flow, and Mudflow Areas

Westlake Village



Map 66: Westlake Village Landslide, Debris Flow, and Mudflow Areas

Estimated Impact of an Event

If landslides, debris flows, or mudflows were to occur, the consequences to local populations and housing could be significant. The table below provides the estimated impact of a disaster using a 0.1% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 0.1% Loss Occurs
Population	20,362	23,410	2,182	10,915	8,081	65
Total Owner-Occupied Units	5,861	6,010	603	3,395	2,492	18
Median Home Value	$857,700	$1,141,600	$2,000,000+	$2,000,000+	$1,029,100	More than $25,302,240 (based on an average home value of $1,405,680 x Total Owner Occupied Units Impacted)

Table 151: Estimated Population and Economic Loss of Multiple Landslides

Source U.S. Census Bureau 2021 American Community Survey 5-Year Estimate

Based on a 0.1% loss projection, approximately 65 people could be displaced or significantly impacted, and approximately 18 homes could be damaged or destroyed resulting in over $25 million in losses based on an average home value of $1,405,680 and damage to 18 owner occupied units (see Community Profile section for population, housing, and economic data).

Risk of Future Landslide, Debris Flow, Mudslide

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 6.40 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Landslide (including Debris Flow and Mudslide)	3	3.67	20	9.5	6.40

LANDSLIDE, DEBRIS FLOW, AND MUDFLOW VULNERABILITIES

Landslides, debris flows, and mudflows can affect a variety of functions including utility services, transportation systems, and critical lifelines. Communities may suffer immediate damages and loss of service. Disruption of infrastructure, roads, and critical facilities may also have a long-term effect on the economy. Utilities, including potable water, wastewater, telecommunications, natural gas, and electric power are all essential to service community needs. Natural gas pipes may also be at risk of breakage from landslides, debris flows, or mudflows.

Roads

Public Works Departments along with other departments within the cities in the Las Virgenes-Malibu Region are responsible for cleaning-up slides that inhibit the flow of traffic or are damaging roadways. Public agencies can usually only repair the roadway itself, as well as the areas adjacent to the slide. Individual property damage does not fall under their immediate attention.

Landslide, debris flow, and mudflow hazards can be alleviated by grading slides, by: installing load bearing walls on roadsides and installing new drainage systems on slopes to divert water from potential landslide, debris flow, or mudflow areas. This type of response activity is often the most cost-effective in the short-term but is only temporary.

Lifelines and Critical Facilities

Landslides, debris flows, and mudflows can have direct and indirect impacts on lifelines and critical facilities. Closed transportation arteries may result in an inability of hospitals and other emergency facilities to receive and transport patients as well as obtain emergency supplies. Loss of power and telephone service are also potential consequences of landslide events. Soil erosion in hillside areas can undermine the soil supporting high voltage transmission towers and communication networks. Finally, soil displacement can result in pipeline breaks, further exasperating the potential for landslides.

LANDSLIDE MITIGATION STRATEGIES

LVMCOG Mitigation Activities

Landslide mitigation activities include current mitigation programs and activities that are being implemented by local or regional organizations. Building and Zoning Codes provide examples of mitigation activities common to all LVMCOG cities.

Building/Zoning Codes

All cities within the Las Virgenes-Malibu Region follow the California Building Code. The CBC requires geotechnical investigation of the potential soil liquefaction and soil strength loss during earthquakes for development in the liquefaction zones. The geotechnical reports are to address potential consequences of any liquefaction and soil strength loss and discuss mitigating measures.

Agoura Hills

The City of Agoura Hills has implemented the following regulations in order to provide better preventive measures for loss of life and property due to landslide:

- Requirement for geotechnical and geologic report submittal and review prior to development entitlement.
- Requirement for graded slopes to be landscaped for stability.
- More restrictive foundation support requirements than the State adopted Building and Residential codes (CBC, CRC).

The following building codes provide examples of how Agoura Hills has enacted preventative measures against loss of life and property because of a landslide.

Agoura Hills Code Section	Title
8102 (ppp)	Engineered Grading Requirements
8103(qqq)	Seismic Design Provisions for Hillside Buildings
8102 (ss)	Retaining Walls
8202 (ddd) California Building Code Adoption & Local Grading Amendments	Maintenance of Protective Structures / Devices / Installations and Grading

In addition, 9652.5 – Policy: Hillside Management and Significant Ecological Areas specifies:

9652.5. - Policy.
Either a conditional use permit or an architectural review approval shall be obtained before the issuance of any building or grading permit, approval of minor land division or subdivision, importation of fill material for the purpose of altering natural terrain, or commencement of any construction or enlargement of any building or structure on any parcel that is in, or partly in, a hillside area or SEA. In addition to preserving the natural character of the hillsides and valleys within the City of Agoura Hills and ensuring the preservation of the scenic viewshed, hillside development regulations are designed to protect residents from geologic hazards, such as unstable soils and erosion, and the possible loss of life and destruction of property. The intention and policy of the city is to:

1. Encourage minimal grading which relates to the natural contours of the land as opposed to padding or stairstep grading;
2. Require the retention of trees and other vegetation which stabilize hillsides, retain moisture, prevent erosion, and enhance the natural scenic beauty, and, when necessary, require additional landscaping to promote the above;
3. Require immediate planting whenever appropriate to maintain cut and fill slopes;
4. Encourage a variety of building types and design to reduce grading and disturbance of the natural character of the area; and
5. Require the retention of natural landmarks and prominent natural features which enhance the character of a specific area.

Calabasas

The following building codes provide examples of how Calabasas has enacted preventative measures against loss of life and property due to landslide.

Calabasas Code Section	Title
Title 15 – Building and Construction	Chapter 10: Grading Permit Requirements and Procedures Chapter 11: Grading, Erosion and Sediment Control Standards 15.11.020 Excavations and Fills 15.11.050 Revegetation and Slope Surface Stabilization 15.11.070 Setbacks for Cut and Fill Slopes 15.11.080 Storm Drainage and Runoff 15.11.100 Erosion and Sediment 15.16 Flood Hazard Prevention

In addition, the City of Calabasas has enacted specific requirements for land use and development under Title 17 of the Calabasas Municipal Code. Regulations related to landslide mitigation include the following:

17.18.020 - Old Topanga (-OT) overlay zone.
A. Purpose and Applicability. The Old Topanga (-OT) overlay zone is applied to the Old Topanga area of the city. This is a mountainous area where existing parcels were created before modern zoning and subdivision regulations required appropriate relationships between parcel size, terrain, and building size. The intent of this zoning district is to:

1. Ensure that the scale of residential development is in reasonable proportion to the size of the building site and its environmental constraints, including slope and vegetation;
2. Provide standards for appropriate development in relation to the high fire hazards, flood hazards, access problems, and steep slopes of the areas to which this overlay zoning district may be applied; and
3. Ensure that development is consistent with the hillside and ridgeline regulations in Article III and the grading ordinance in Title 15.

17.18.025 - Calabasas Highlands (CH) Overlay Zone.
A. Purpose and Applicability. The Calabasas Highlands (-CH) overlay zone is applied to the Calabasas Highlands area of the city. These are mountainous areas where existing parcels were created before modern zoning and subdivision regulations required appropriate relationships between parcel size, terrain, and building size. The intent of this zoning district is to:

1. Ensure that the scale of residential development is in reasonable proportion to the size of the building site and its environmental constraints, including slope and vegetation;
2. Provide standards for appropriate development in relation to the high fire hazards, flood hazards, access problems, and steep slopes of the areas to which this overlay zoning district may be applied; and
3. Ensure that development is consistent with the hillside and ridgeline regulations of Article III in this title and the grading ordinance in Title 15.

Hidden Hills

Although the risk of landslide in Hidden Hills is low, the following building codes have been implemented as preventative measures to protect against the loss of life and property due to a landslide event.

Hidden Hills Code Section	Title
Title 5 – Land Use and Development	Chapter 5-9-3: General Provisions (8) Flood-Related Erosion-Prone Area Chapter 5-5B-4: Foundations on Expansive Soil Chapter 5-5B-6: Excavation and Grading J112.2: Geologic Hazard J113: Geology and Engineering Report Chapter 5-9-5: Provisions for Flood Hazard Reduction

As part of implementation of building codes to mitigate the risk of landslides, the City of Hidden Hills has an ongoing comprehensive hill slope management program.

Malibu

The City of Malibu Local Coastal Program Land Use Plan (LUP) adopted by the California Coastal Commission (9/13/2002) includes policies to minimize the hazards associated with shoreline and bluff development including slope stability and landslide potential in hillside areas. Specific policies related to landslide mitigation include:

C. Land Use Plan Policies

4.1 The City of Malibu and the Santa Monica Mountains coastal zone contains areas subject to hazards that present substantial risks to life and property. These areas require additional development controls to minimize risks, and include, but shall not be limited to, the following:

- Low Slope Stability & Landslide/Rockfall Potential: hillside areas that have the potential to slide, fail, or collapse.
- Fault Rupture: the Malibu Coast-Santa Monica Fault Zone.
- Seismic Ground Shaking: shaking induced by seismic waves traveling through an area as a result of an earthquake on a regional geologic fault.
- Flood prone areas most likely to flood during major storms.
- Liquefaction: areas where water-saturated materials (including soil, sediment, and certain types of volcanic deposits) can potentially lose strength and fail during strong ground shaking.
- Liquefaction/Flood prone areas where saturated sediments lie in flood plains.
- Tsunami: shoreline areas subject to inundation by a sea wave generated by local or distant earthquake, submarine landslide, subsidence, or volcanic eruption.
- Wave Action: shoreline areas subject to damage from wave activity during storms.
- Fire Hazard: areas subject to major wildfires classified in Fire Zone 4 or in the Very High Fire Hazard Severity Zone.

1. General Development

4.2 All new development shall be sized, designed and sited to minimize risks to life and property from geologic, flood, and fire hazard.

4.3 Information should be provided to the public concerning hazards and appropriate means of minimizing the harmful effects of natural disasters upon persons and property relative to siting, design and construction.

4.4 On ancient landslides, unstable slopes and other geologic hazard areas, new development shall only be permitted where an adequate factor of safety can be provided, consistent with the applicable provisions of Chapter 9 of the certified Local Implementation Plan.

4.5 Applications for new development, where applicable, shall include a geologic/soils/geotechnical study that identifies any geologic hazards affecting the proposed project site, any necessary mitigation measures, and contains a statement that the project site is suitable for the proposed development and that the development will be safe from geologic hazard. Such reports shall be signed by a licensed Certified Engineering Geologist (CEG) or Geotechnical Engineer (GE) and subject to review and approval by the City Geologist.

4.6 The remediation or stabilization of landslides that affect existing structures or that threaten public health or safety may be permitted. Alternative remediation or stabilization techniques shall be analyzed to determine the least environmentally damaging alternative. Maximum feasible mitigation shall be incorporated into the project in order to minimize adverse impacts to resources.

4.7 Hillside Management Program requirements shall be applicable to proposed development on steep slopes.

4.8 Grading and/or development-related vegetation clearance shall be prohibited where the slope exceeds 40 percent (2.5:1), except that driveways and/or utilities may be located on such slopes, where there is no less environmentally damaging feasible alternative means of providing access to a building site, provided that the building site is determined to be the preferred alternative and consistent with all other policies of the LCP.

4.9 Buildings within flood prone areas subject to inundation or erosion shall be prohibited unless no alternative building site exists on the property and proper mitigation measures are provided to minimize or eliminate risks to life and property from flood hazard.

4.10 New development shall provide adequate drainage and erosion control facilities that convey site drainage in a non-erosive manner in order to minimize hazards resulting from increased runoff, erosion and other hydrologic impacts to streams.

4.11 New development involving a structure dependent on a wastewater disposal system shall utilize secondary treatment, at a minimum, and evapotranspiration waste disposal systems or other innovative measures, where feasible.

4.12 Land divisions, including lot line adjustments, shall be prohibited unless all proposed parcels can be demonstrated to be safe from flooding, erosion, and geologic hazards and will provide a safe, legal, all-weather access road(s), which can be constructed consistent with all policies of the LCP.

4.13 Land Divisions including lot line adjustments shall be prohibited unless all proposed parcels and access roads are found to comply with all applicable fire safety regulations and all required approvals are obtained.

4.14 New development shall be prohibited on property or in areas where such development would present an extraordinary risk to life and property due to an existing or demonstrated potential public health and safety hazard.

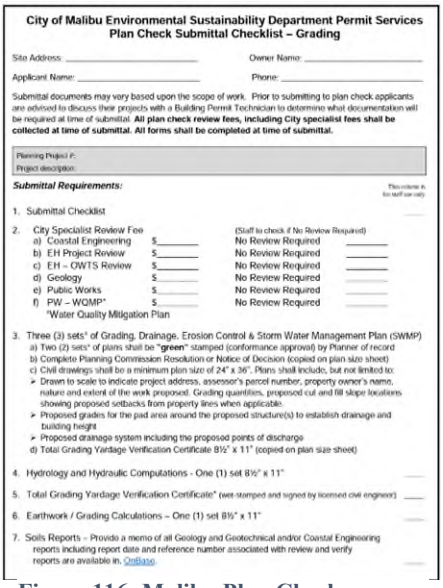
4.15 Existing, lawfully established structures, which do not conform to the provisions of the LCP, may be maintained and/or repaired provided that such repair and maintenance do not increase the extent of nonconformity of the structure. Except as provided below, additions and improvements to such structures may be permitted provided that such additions or improvements comply with the current standards and policies of the LCP and do not increase the extent of nonconformity of the structure. Substantial additions, demolition and reconstruction, that result in demolition and/or replacement of more than 50% of the exterior walls shall not be permitted unless such structures are brought into conformance with the policies and standards of the LCP.

In addition to the above referenced policies, the City of Malibu Zoning and Building Codes address development regarding grading, drainage, general building guidelines on slopes, as well as Geotechnical Engineering Standards. The following codes are implemented as preventative measures for loss of life and property, in addition to maintaining standards.

Malibu Code Section	Title
Title 17 Zoning, Chapter 17.40 Property Development and Design Standards	Slope and Set Back Requirements
Title 26 Building Code, Appendix J Grading	J101.2: Flood Hazard Areas J101.5: Protection of Utilities J101.7: Storm Water Control Measures J103.1: Permits Required J104.2.1: Grading Designation J104.2.3: Engineered Grading Requirements J109: Drainage and Terracing J110: Slope Planting and Erosion Control
Title 26 Building Code, Chapter 1 Administration	Section 111 Engineering Geology and Soils Engineering Reports

Generally, the ordinance requires slope stability analyses for proposed developments with slopes steeper than 4:1 (horizontal:vertical). More detailed surface and subsurface investigations are warranted for slopes of 4:1 or flatter if indicated by engineering and geologic hazards.[33] This may include soils, vegetation, geologic formations, and drainage patterns. Site evaluations may also occur where stability might be lessened by proposed grading/filling or land clearing. Requirements for grading and erosion control are included in the Plan Check Submittal Checklist. Additionally, the City of Malibu has an Information Bulletin regarding Erosion Control, distributed to residents during heavy storms.

[33] City of Malibu, Guidelines for the Preparation of Engineering Geology and geotechnical Engineering Reports and Procedures for Report Submittal, 2013



City of Malibu Environmental Sustainability Department Permit Services
Plan Check Submittal Checklist – Grading

Site Address: _____ Owner Name: _____

Applicant Name: _____ Phone: _____

Submittal documents may vary based upon the scope of work. Prior to submitting to plan check applicants are advised to discuss their projects with a Building Permit Technician to determine what documentation will be required at time of submittal. **All plan check review fees, including City specialist fees shall be collected at time of submittal. All forms shall be completed at time of submittal.**

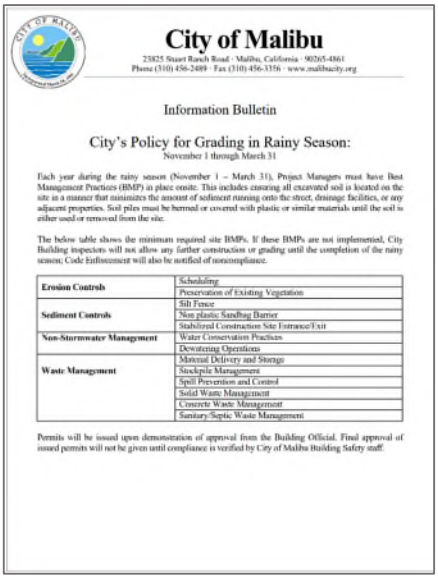
Planning Project #:
Project description:

Submittal Requirements:

1. Submittal Checklist
2. City Specialist Review Fee (Staff to check if No Review Required)
   a) Coastal Engineering $_____ No Review Required _____
   b) EH Project Review $_____ No Review Required _____
   c) EH – OWTS Review $_____ No Review Required _____
   d) Geology $_____ No Review Required _____
   e) Public Works $_____ No Review Required _____
   f) PW – WQMP* $_____ No Review Required _____
   *Water Quality Mitigation Plan
3. Three (3) sets[1] of Grading, Drainage, Erosion Control & Storm Water Management Plan (SWMP)
   a) Two (2) sets* of plans shall be "**green**" stamped (conformance approved) by Planner of record
   b) Complete Planning Commission Resolution or Notice of Decision (copied on plan size sheet)
   c) Civil drawings shall be a minimum plan size of 24" x 36". Plans shall include, but not limited to:
   - Drawn to scale to indicate project address, assessor's parcel number, property owner's name, nature and extent of the work proposed. Grading quantities, proposed cut and fill slope locations showing proposed setbacks from property lines when applicable.
   - Proposed grades for the pad area around the proposed structure(s) to establish drainage and building height
   - Proposed drainage system including the proposed points of discharge

   d) Total Grading Yardage Verification Certificate 8½" x 11" (copied on plan size sheet)
4. Hydrology and Hydraulic Computations - One (1) set 8½" x 11"
5. Total Grading Yardage Verification Certificate* (wet-stamped and signed by licensed civil engineer)
6. Earthwork / Grading Calculations – One (1) set 8½" x 11"
7. Soils Reports – Provide a memo of all Geology and Geotechnical and/or Coastal Engineering reports including report date and reference number associated with review and verify reports are available in, OnBase.

Figure 116: Malibu Plan Check Submittal Checklist - Grading



City of Malibu
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Phone (310) 456-2489 · Fax (310) 456-3356 · www.malibucity.org

Information Bulletin

City's Policy for Grading in Rainy Season:
November 1 through March 31

Each year during the rainy season (November 1 – March 31), Project Managers must have Best Management Practices (BMP) in place onsite. This includes ensuring all excavated soil is located on the site in a manner that minimizes the amount of sediment running onto the street, drainage facilities, or any adjacent properties. Soil piles must be burmed or covered with plastic or similar materials until the soil is either used or removed from the site.

The below table shows the minimum required site BMPs. If these BMPs are not implemented, City Building inspectors will not allow any further construction or grading until the completion of the rainy season; Code Enforcement will also be notified of noncompliance.

Erosion Controls	Scheduling
	Preservation of Existing Vegetation
Sediment Controls	Silt Fence
	Non plastic Sandbag Barrier
	Stabilized Construction Site Entrance/Exit
Non-Stormwater Management	Water Conservation Practices
	Dewatering Operations
Waste Management	Material Delivery and Storage
	Stockpile Management
	Spill Prevention and Control
	Solid Waste Management
	Concrete Waste Management
	Sanitary/Septic Waste Management

Permits will be issued upon demonstration of approval from the Building Official. Final approval of issued permits will not be given until compliance is verified by City of Malibu Building Safety staff.

Figure 117: Malibu Erosion Control Information Bulletin

Westlake Village

The City of Westlake Village has identified areas in the city that may have unstable slopes. Engineering/geology soils investigations are required prior to hillside development in unstable slope areas in order to mitigate the loss of property or life due to a landslide. Local building codes and regulations are managed by the Building and Safety Division of the Los Angeles County Department of Public Works, which serves under contract as the City's Building and Safety Department. The following building codes are implemented as preventative measures for loss of life and property due to a landslide event.

Westlake Village Code Section	Title
Building Code Chapter 8.5 Floodplain Management	8.5.015: Methods of Reducing Flood Losses
Article 9 Zoning Regulations	Chapter 9.17 Hillside Development

Specifically, Westlake Village Zoning Regulations require a Soils and Geologic Report when applying for a new construction project grading permit.

9.17.050 Site Planning Standards, E. Grading Standards
A detailed Soils and Geologic Report shall accompany each Grading Permit application. The report shall address such items as the recommended maximum slope angles for natural and manmade cuts and fill slopes, the effect of saturation or supersaturation of soils due to over-watering (irrigation), seismic safety, liquefaction, and soil or rock erosion. The foregoing items are minimum requirements for the report. The report shall address any other items necessary, in the professional opinion of the soils and/or geologic engineer, and as required by the City.

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SECTION 11. WINDSTORM

THE NATURE OF THE WINDSTORM THREAT

Severe windstorms pose a significant risk to life and property by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. High winds have the potential to cause damage to local homes and businesses from falling trees and debris. In addition, windstorms increase the risk of wildfire as the moisture content decreases in brush and vegetation on hillsides, especially in urban interface areas.

HISTORICAL RECORD OF WIND EVENTS

History of Severe Winds in Southern California

The National Weather Service has documented the following severe wind events in Southern California since 2014.

Date(s)	Weather	Adverse Impacts
12.31.2022 – 1.1.2023	Strong winds accompanied a winter storm with gusts over 60 mph on ridgetops and adjacent desert slopes. The highest measured gust was 79 mph at Toro Peak. Gusts near the coast reached 35 to 40 mph.	Several trees at the coast were toppled, causing damage.
11.25.2022	This Thanksgiving, an upper low diving south through the Southwest propelled offshore winds, with many gusts 60 to 77 mph in the foothills. Sill Hill was the extreme outlier, achieving 88 mph.	
11.15-16.2022	Offshore winds exceeded 80 mph for a few locations in the foothills of the San Bernardino, Santa Ana, and San Diego County Mountains. Many more spots exceeded 60 mph.	
11.8-9.2022	A deep trough of low pressure brought strong winds to the region. Winds gusted to over 70 mph in the mountains, downing trees and triggering minor power outages. An impressive gust of 101 mph was recorded at Burns Canyon (east side of San Bernardino Mountains).	Trees were downed in the mountains and power outages were incurred.
9.9.2022	Remnants of Tropical Cyclone Kay brought strong, easterly winds early in the morning. Observed wind gusts in the mountains and foothills ranged from 70 to 95 mph. One gust from Cuyamaca peak came in at 727 a.m. and registered 109 mph, which was verified to be the strongest measured wind gust ever observed in Southern California. Other gusts: Big Black Mountain 96 mph, Sill Hill 91 mph, Otay Mountain 81 mph, Mt. Laguna Observatory 80 mph. Thankfully, wind gusts in the populated areas were not nearly as strong.	
1.21-22.2023	Strong Santa Anas peaked in the foothills of the San Gabriel and San Bernardino Mountains and adjacent valleys ranged from 50 to 80+ mph.	Numerous trees and power poles in Upland, Ontario and Claremont were downed, crushing several vehicles, damaging homes and knocking out power.
12.14.2021	Winter storm winds on the lee slopes of the mountains reached over 80 mph, while coastal areas experienced gusts over 40 mph.	Trees and power lines were damaged.

Date(s)	Weather	Adverse Impacts
2.28.2021	A great month for offshore winds as more Santa Anas developed. Fremont Canyon had the top gust at 81 mph, with Fontana and Jurupa Valley each reporting 60-mph gusts.	
2.25.2021	After several offshore wind events during February, a particularly strong Santa Ana blew. Gusts of 80to 90 mph were measured in the foothills north of San Bernardino, with gusts of 75 mph at Fremont Canyon and 72 mph in Fontana and Jurupa Valley.	A few trees in Devore were knocked down and a big rig tipped over in the Fontana area. Wind spread a fire in Bloomington.
1.28-29.2021	A powerful winter storm produced strong southerly winds of up to 80 mph in the mountains of Los Angeles and Ventura Counties.	
1.19.2020	Very strong and gusty Santa Ana winds of up to 99 mph hit the coastal hills of Ventura and Los Angeles counties.	Numerous small trees and branches were downed.
10.26.2020	A strong offshore wind, a "cool" Santa Ana, produced many exceeding 70 mph and a top gust of 88 mph at Fremont Canyon.	The winds toppled big rig trucks and downed mature trees in the northern Inland Empire. The dry winds also contributed to spreading two fire starts, the Blue Ridge and Silverado fires in eastern Orange County.
6.8.2020	Strong and gusty northerly winds impacted the mountains of Santa Barbara, Ventura and Los Angeles counties. Wind gusts up to around 75 mph were reported in some areas.	
2.25-26.2020	Strong surface high pressure over the Great Basin brought intense east to northeast winds to Southern California. The strongest winds were in the foothills of San Diego County where a peak wind gust of 106 mph from a mountain wave was recorded at Sill Hill. This is believed to be the strongest wind gust ever measured in San Diego County. Many other mountain locations reported wind gusts of 65-75 mph.	Two tractor trailers were overturned on I-8 in San Diego County, and many trees fell due to high wind.
2.10-11.2020	A wind storm from the north produced peak wind gusts of 60-70 mph in the wind-prone passes and canyons.	Winds overturned tractor trailers and downed trees.
1.29-30.2020	Strong offshore winds struck the region, with gusts reaching 70 mph.	Many trees were downed on homes and cars, and one home caught fire when a tree fell on it.
12.26.2019	A severe squall struck the coast and valley areas during the morning. Some wind gusts exceeded 40 mph.	The winds damaged property and felled trees in Ventura and National City.
11.28.2019	A squall line of strong winds and thunderstorms came ashore in San Diego County with wind gusts 40 to 50 mph.	Roof and tree damage was incurred in Carlsbad.
10.30-31.2019	Cool Santa Ana winds impacted the region. Northeasterly wind gusts up to 68 mph were reported across the mountains and valleys of Ventura and Los Angeles counties.	The Maria Fire started near Santa Paula in the critically dry vegetation, and burned into early November, eventually burning 9,999 acres.

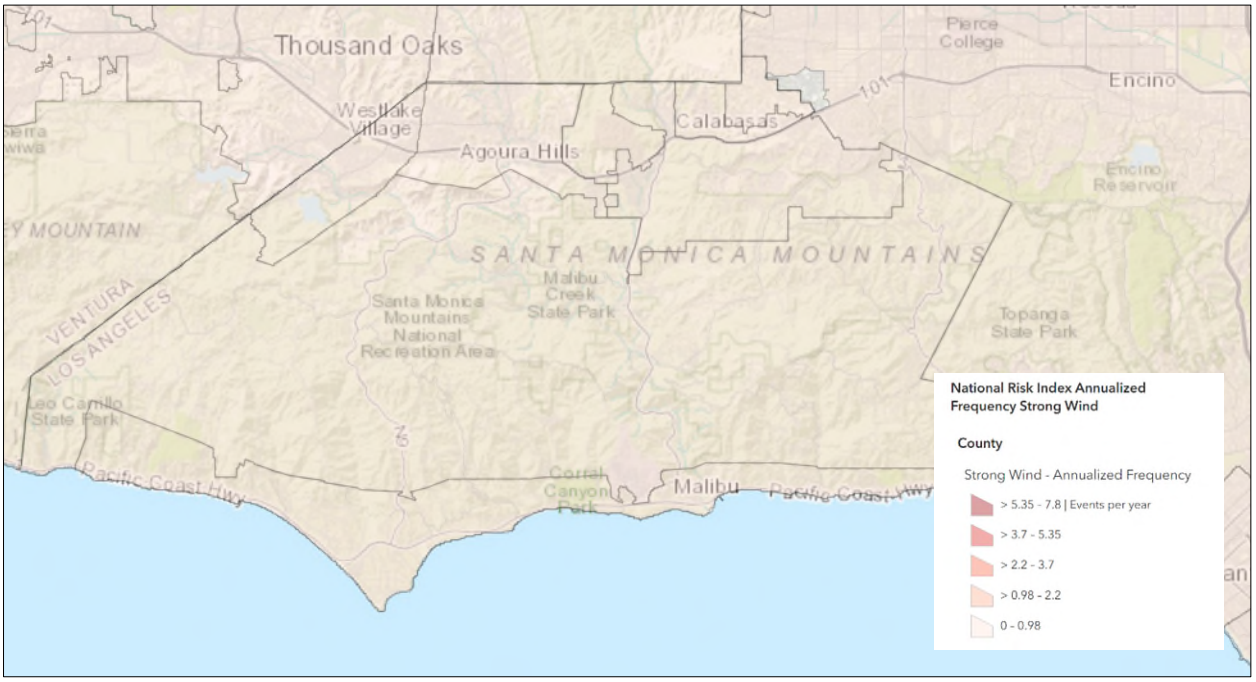
Date(s)	Weather	Adverse Impacts
10.10.2019	Several episodes of Santa Ana winds started on this day and continued through 10.24. Top wind gusts reached 60 to 80 mph. Relative humidity was near zero percent for several locations on several days during this period.	Numerous fires broke out across Southern California. The Saddleridge Fire would eventually burn over 8,700 acres in the foothills of the San Fernando Valley near Sylmar. Over 100 residences were either damaged or destroyed. There was one death due to cardiac arrest.
3.6.2019	A storm system brought strong winds to the mountains and deserts. A wind gust of 98 mph was clocked at Burns Canyon.	
1.21.2019	A period of Santa Ana winds immediately followed an inside slider, and brought strong winds to the region, especially the mountains. The peak observed wind gust was 84 mph at Burns Canyon.	Two people were killed when a large tree fell on their home in Point Loma.
10.15.2018	A deep low pressure axis extending across Southern California produced strong region-wide Santa Ana winds. The strongest gust reached 82 mph in Fremont Canyon, with widespread gusts above 40-50 mph reported in valley locations.	In Orange County, over 200 trees were downed and one person was killed when a tree fell onto their vehicle.
12.4.2017	Strong sundowner and Santa Ana winds persisted across Southern California for two weeks. Northerly wind gusts between 65 and 85 mph were reported at a few locations sometime during the two weeks.	On this day, the Thomas fire sparked to life just north of Santa Paula. Over the next few weeks it burned over southwest Ventura and southeast Santa Barbara Counties and became California's largest wildfire, burning 281,893 acres. It destroyed at least 1,063 structures and damaged 280 others. One firefighter and one civilian died.
3.30.2017	A trough of low pressure brought strong winds that produced mountain waves in the deserts. Numerous wind gusts in the 60-70 mph range were reported in Palm Springs and Borrego Springs.	Winds downed trees and power lines in Palm Springs, leaving more than 2,200 without power. Power line damage was also reported in Borrego Springs.
2.18.2017	A strong cold front swept into the coast, noteworthy for the strong prefrontal southerly winds. A gust of 67 mph was measured at Laguna Beach.	Significant tree damage was incurred near the coast and in the valleys.
1.9.2017	A strong mountain wave produced an impressive wind gust of 107 mph at Burns Canyon (east side of San Bernardino Mountains).	
8.16.2016	Gusty winds and low humidity swept through the Cajon Pass.	Winds fanned the Blue Cut Fire into a fury on this day. The fire spread rapidly forcing 84,000 mandatory evacuations and threatening 35,000 homes. Numerous roads were closed, including I-15 in both directions for two days. The fire destroyed 105 homes, and 313 smaller structures, and scorched 36,274 acres before it was extinguished.
3.28.2016	Mountain wave activity produced winds in excess of 50 mph that generated a dust storm with near zero visibility along Highway 247 in Lucerne Valley.	A multicar pileup ensued, involving more than a dozen vehicles and injuring 28 people.
1.31.2016	A powerful storm with a surface low that rapidly deepened in the Southern California Bight brought an exceptionally strong cold front with widespread damaging wind gusts of 40-70 mph from the coast to the mountains. A broken line of thunderstorms formed along the front and combined with post frontal winds.	Over 500 downed trees caused extensive damage. One woman was killed and two were injured when a pine tree eight feet in diameter crushed four cars in Pacific Beach.

Date(s)	Weather	Adverse Impacts
1.5-7.2016	A series of winter storms brought strong storm winds exceeding 60 mph across some coastal and valley areas.	Damage resulted mainly from thunderstorm wind gusts.
5 .12-5.15.2014	A strong late-season Santa Ana wind event raked the region. Winds gusted to 40 to 45 mph in parts of the coast and valleys, and 60 to 80 mph in the foothills.	The winds knocked down many trees and power lines, and blew off some roof tiles. 14 fires erupted in San Diego County, killing one, burning over 27,000 acres and causing more than $50 million in property damage. The Poinsettia fire in Carlsbad and the Cocos Fire in San Marcos damaged homes.
4.30-5.1.2014	This strongest and most widespread offshore wind event in years occurred very late in the season. Gusts reached as high as 100 mph at Sill Hill near Cuyamaca Peak. Numerous other stations measured speeds that exceeded 60 mph.	Numerous trees and power lines were downed in the San Diego County interior. A Garden Grove school incurred roof damage. The Etiwanda fire near Rancho Cucamonga broke out.
2.28-3.1.2014	A strong storm hit Southern California with westerly winds. A report of a 102 mph wind gust came from the Bear Mountain ski resort weather equipment on 2.28. Thunderstorm wind gusts.	Numerous large trees and power poles toppled, as well as damage at John Wayne Airport. Thunderstorms on the 2.28 downed several trees and damaged power lines and other structures.

Table 152: A History of Significant Weather Events in Southern California - Organized by Weather Type (Feb 2023) – From 2014 to 2023

Windstorm Risk in the Las Virgenes-Malibu Region

Overall the risk of strong wind in the Las Virgenes-Malibu region is low with an annualized frequency less than one per the National Risk Index. Regardless, strong winds cannot be completely disregarded especially since annual Santa Ana winds result in local damage as well as an increase in the risk of severe wildfire.



Map 67: Annualized Frequency of Strong Wind National Risk Index

CAUSES AND CHARACTERISTICS OF WINDSTORMS IN THE LAS VIRGENES-MALIBU REGION

Windstorm events in the Las Virgenes-Malibu Region can be caused by short term, topographically influenced, high wind gusts as well as extended duration Santa Ana wind conditions. "Santa Ana Winds" typically occur between October and February. Santa Ana winds are characterized by strong dry offshore winds originating from the Great Basin and Upper Mojave Desert. Wind temperatures can range from extremely hot to cold. Damage can occur directly from the high wind speeds generated or from the secondary effects of very low humidity, which increases the threat of wildfires, particularly in the fire-prone chaparral country.

WINDSTORM HAZARD IDENTIFICATION

Given the location and topography of the area, severe windstorms are a possibility. While the historic occurrence of these events on the Las Virgenes-Malibu Region has been minimal (when they occur) these events do pose a threat to life, property, utility delivery systems, infrastructure, and transportation. Furthermore, if a severe windstorm results in a prolonged utility disruption, it may be necessary to utilize private and public resources to aid in the care and sheltering of displaced residents. High winds also increase the threat posed by wildfires and can lead to major losses to the region. In addition, the economic impact of providing shelter, conducting repairs, and the disruption to local businesses can result in economic losses to the entire area. Finally, a severe windstorm can cause the loss of historic trees in the area and require the services of certified arborists.

The risk of trees falling is one of the more significant hazards resulting from high wind events. The leafy canopy and structural elements of a tree crown present a drag type barrier to winds. Trees naturally minimize wind drag through the re-orientation of leaves and through the independent motion of limbs and branches, thus reducing the transfer of uniform sway motion forces to the trunk. The Beaufort Wind Scale (BWS) specifically notes problems with trees as wind speeds increase. The BWS references the likelihood of whole tree motion as wind speeds exceed 32 miles per hour (MPH), twig breakage at 39 MPH and whole tree wind-throw as wind speeds exceed 55 MPH. The susceptibility of trees to wind-throw can be influenced by the general structural condition of the trees, the location of the trees in reference to wind patterns and the level and frequency of pruning maintenance.

The following chart depicts the Beaufort scale which is used to estimate wind strengths.

Beaufort Force	Speed (MPH)	Wind Description - State of Sea - Effects on Land
0	Less 1	Calm - Mirror-like - Smoke rises vertically
1	1-3	Light - Air Ripples look like scales; No crests of foam - Smoke drift shows direction of wind, but wind vanes do not
2	4-7	Light Breeze - Small but pronounced wavelets; Crests do not break - Wind vanes move; Leaves rustle; You can feel wind on the face
3	8-12	Gentle Breeze - Large Wavelets; Crests break; Glassy foam; A few whitecaps - Leaves and small twigs move constantly; Small, light flags are extended
4	13-18	Moderate Breeze - Longer waves; Whitecaps - Wind lifts dust and loose paper; Small branches move
5	19-24	Fresh Breeze - Moderate, long waves; Many whitecaps; Some spray - Small trees with leaves begin to move
6	25-31	Strong Breeze - Some large waves; Crests of white foam; Spray - Large branches move; Telegraph wires whistle; Hard to hold umbrellas
7	32-38	Near Gale - White foam from breaking waves blows in streaks with the wind - Whole trees move; Resistance felt walking into wind
8	39-46	Gale - Waves high and moderately long; Crests break into spin drift, blowing foam in well-marked streaks - Twigs and small branches break off trees; Difficult to walk
9	47-54	Strong Gale - High waves with wave crests that tumble; Dense streaks of foam in wind; Poor visibility from spray - Slight structural damage
10	55-63	Storm - Very high waves with long, curling crests; Sea surface appears white from blowing foam; Heavy tumbling of sea; Poor visibility - Trees broken or uprooted; Considerable structural damage
11	64-73	Violent Storm - Waves high enough to hide small and medium sized ships; Sea covered with patches of white foam; Edges of wave crests blown into froth; Poor visibility - Seldom experienced inland; Considerable structural damage
12	>74	Hurricane - Sea white with spray. Foam and spray render visibility almost non-existent – Widespread damage. Very rarely experienced on land.

Table 153: Beaufort Scale

Estimated Impact of an Event

If a severe windstorm were to occur, the consequences to local populations and housing could be significant. The table below provides the estimated impact of a disaster using a 1% loss baseline for the impact to the total population of the LVMCOG and to Owner-Occupied housing units.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 1% Loss Occurs
Population	20,362	23,410	2,182	10,915	8,081	640
Total Owner-Occupied Units	5,861	6,010	603	3,395	2,492	184
Median Home Value	$857,700	$1,141,600	$2,000,000+	$2,000,000+	$1,029,100	More than $258M (based on an average home value of $1,405,680 x Total Owner Occupied Units Impacted)

Table 154: Estimated Population and Economic Loss of Multiple Landslides

Source U.S. Census Bureau 2021 American Community Survey 5-Year Estimate

Based on a 1% loss projection, more than 640 people could be significantly impacted, and an estimated 184 homes damaged resulting in over $258 million in losses for owner-occupied housing units (see Community Profile section for population, housing, and economic data).

Risk of Future Severe Windstorm

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 3.93 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Severe Windstorm	4.33	3.67	3	4.33	3.93

WINDSTORM VULNERABILITIES

Windstorms can result in damage to structures, disrupt utilities, and require emergency tree services (i.e. limb failures, clearance of private property trees fallen into roadways, etc.). With regards to wind related damage to structures; the Las Virgenes-Malibu Region has not experienced significant damage due to windstorms during the last decade. Nevertheless, the impact of a severe windstorm can be significant and mitigation planning can reduce losses if an event were to occur. Specific windstorm related issues are outlined below.

Life and Property

Detached tree limbs and building elements present a hazard to life and property as well as infrastructure. Furthermore, utility providers and emergency services can be overwhelmed during a major event. At risk populations include assisted care facilities and home-bound residents that are dependent on electrical power (see Utilities and Infrastructure section below). For example, in December 2011, the City of Pasadena, California experienced a severe windstorm with reported gusts near 100 MPH. The resulting power outages and debris impacted residents for weeks.

Utilities and Infrastructure

Windstorms can cause structural damage to buildings and other critical infrastructure. Overhead electrical and telephone lines are particularly vulnerable to damage from wind and debris as are microwave and satellite facilities. High winds commonly occur during winter storms and can cause trees to bend, sag, or fail (tree limbs or entire trees) which then come into contact with nearby power lines. Fallen trees can cause short-circuiting and conductor overloading. Wind-induced damage to the power system causes power outages to customers, incurs cost to make repairs, and in some cases can lead to ignitions that start wild land fires. In order to prepare for such events, Southern California Edison (SCE) has developed its own Hazard Mitigation Plan.

Transportation

Windblown debris, tree limbs and wind thrown trees can damage traffic control apparatus, block roadways, damage vehicles, and cause extreme traffic congestion - impeding emergency and vehicles and hampering repair efforts.

Increased Fire Threat

The Las Virgenes-Malibu Region is subject to Santa Ana Winds with regards to their impact on fire conditions. Winds can serve as a catalyst in the canyons to spread fire at a rapid rate. Prolonged winds during the warmer months of the year can decrease vegetation moisture levels and increase the ignition potential in dry underbrush. When urban/wildland interface fires occur, Santa Ana Wind conditions can drive flames and increase the spread speed and severity of the fire. This is a significant concern near homes, especially where brush clearance has been lax.

During high wind periods, there is also a threat of downed power lines causing wildfires. In response, SCE began a public notice campaign to reiterate its policy that utility power may be shut-off during high fire risk periods when extreme weather threatens the power lines.

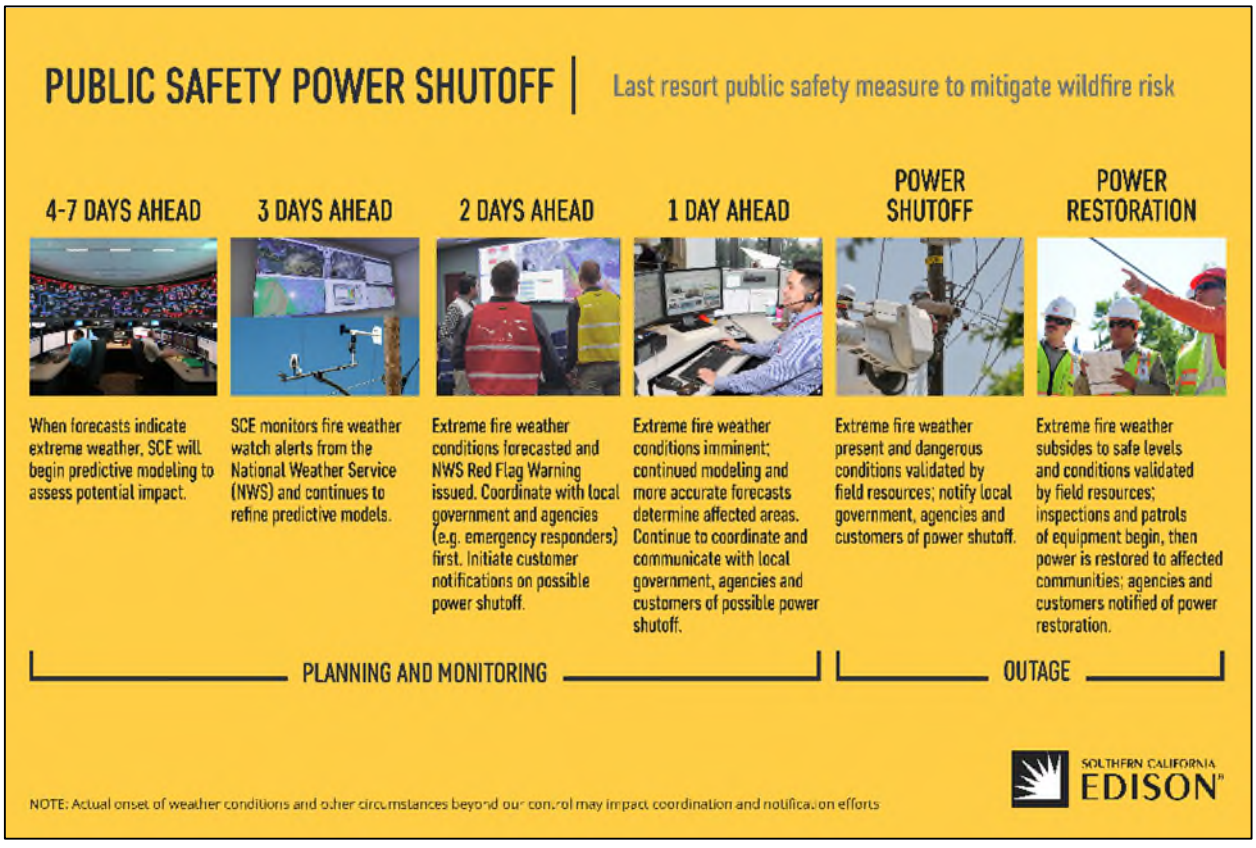


Figure 118: SCE Public Safety Power Shutoff Process

In addition, on April, 14,2021 Southern California Edison provided a presentation to the Agoura Hills Council meeting to provide an overview of its Vegetation Management Program. The purpose of the program is to reduce of wildfire due to downed power lines during severe weather events such as severe winds.

Santa Ana Winds

"Santa Ana Winds" are generally defined as warm, dry winds that blow from the east or northeast (offshore). Commonly, Santa Ana winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Mountains and west of the Rocky Mountains including most of Nevada and Utah). These regional winds typically occur from October to March and, according to most accounts, are named either for the Santa Ana River Valley where they originate or for the Santa Ana Canyon, southeast of Los Angeles, where they pick up speed. These winds occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles basin.

Map 68: Santa Ana Wind Circulation Pattern

The complex topography of Southern California combined with various atmospheric conditions creates numerous scenarios that may cause widespread or isolated Santa Ana events. Santa Ana winds often blow with exceptional speed in the Santa Ana Canyon. Forecasters at the National Weather Service offices in Oxnard and San Diego usually place speed minimums on these winds and reserve the use of "Santa Ana" for winds greater than 25 knots 28.8 mph). These winds accelerate to speeds of 35 knots (40.3 mph) as they move through the canyons and passes, with gusts up to 50 to 60 knots (57.5 mph to 69.0 mph).

Figure 119: Santa Ana Wind Satellite Image

Source: NASA / JPL-Caltech, 2002

The Santa Ana Wind Circulation Map (Photojournal JPL NASA) shows the direction of the Santa Ana winds as they travel from the stable, high-pressure weather system called the Great Basin High through the canyons and towards the low-pressure system off the Pacific. Clearly, the City of Santa Clarita is in the direct path of the ocean-bound Santa Ana winds Clockwise circulation around the center of this high-pressure area forces air down slope from the high plateau. The air warms as it descends toward the California coast at the rate of 5 degrees Fahrenheit per 1000 feet due to compressional heating. Thus, compressional heating provides the primary source of warming. The air is dry since it originated in the desert and it dries out even more as it is heated. Resulting in low humidity and increase risk of wildfires.

WINDSTORM MITIGATION STRATEGIES

Interagency Efforts

In the case of buildings and structures, the likelihood of structural element detachment is influenced by local building code requirements, the location of buildings in reference to wind patterns and in the level of maintenance and upkeep. In addition, one of the strongest and most widespread existing mitigation strategies pertains to tree clearance.

Currently, California State Law and LA County Fire Code requires utility companies to maintain specific clearances (depending on the type of voltage running through the line) between electric power lines and all vegetation (Fire Code section 325.1 Electrical Transmission Lines). Furthermore, homeowners are required to allow a utility company to comply with the law.

Failure to provide access to utility power lines can result in liability to the homeowner for damages or injuries resulting from a vegetation hazard. Many insurance companies do not cover these types of damages if the policy owner has refused to allow the hazard to be eliminated.

Continuous upgrades to engineering design criteria based on the latest industrial progress, geotechnical findings, and Code revisions are being conducted. For instance, Dynamic Shake Table Tests were recently made mandatory for certain equipment in addition to analytical design.

LVMCOG Mitigation Activities

Agoura Hills

In order to mitigate the impact of windstorms, the City of Agoura Hills maintains an inventory that currently has 4,236 trees listed (as of 2023). The tree inventory is segmented into grids (1,2,3,4,5) and the goal is to maintain each grid every two years then the inventory is updated accordingly. The online inventory is updated whenever any tree trimming or maintenance is performed.

Local codes on tree pruning are reviewed and updated when new codes regarding tree maintenance were implemented. Per the Agoura Hills Planning Department there is a reduced fee for an oak tree trimming permit application for members of the community.

Calabasas

The Environmental Commission of the City of Calabasas among other duties is responsible for maintaining the Urban Forestry Master Plan and making recommendations to carry out the policies and goals of that plan. The Urban Forestry Master Plan includes the monitoring and maintenance of the city's tree population.

Additionally, the city has a program that grants free Healthy Oak Tree permits. The intent of this program is to encourage proper maintenance of privately owned oak trees in order to reduce safety hazards.

Hidden Hills

The City of Hidden Hills has had no incidents of loss of property or life due to windstorm activity therefore it does not take any steps with regards to current mitigation activities.

Malibu

The City of Malibu has begun a citywide tree pruning program. In addition, the city is using aerial photographs to update their GIS and map every tree on public property.

Westlake Village

The City of Westlake Village has completed a census and assessment of all trees on public property. Hazardous trees were removed. Further, the city has mapped all of its trees using a GIS program and prunes trees on a three-year cycle.

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SECTION 12. FLOOD / TSUNAMI & STORM SURGE / SEVERE WINTER STORM

THE NATURE OF THE FLOOD, TSUNAMI, AND SEVERE WINTER STORM THREAT

The Las Virgenes-Malibu area is situated near the western portion of the Santa Monica Mountains and has experienced flooding in the past from major winter storm events. Flooding poses a threat to life and safety and can cause severe damage to public and private property. Due to the natural mountainous terrain as well as changes in the landscape (due to development) and natural disasters such as wildfire, flooding can be a factor in the area. In addition, the City of Malibu coastline is at risk of tsunami. Although the risk is relatively low, flooding due to tsunami can occur.

HISTORICAL RECORD OF FLOODING

History of Flooding in Southern California

Historically, the region has experienced extended periods (on the order of years) of either wet or dry weather. Additionally, in any given year the amount of precipitation can vary widely. The National Weather Service has documented the following significant flood and flash flood events in Southern California since 2014.

Date(s)	Weather	Adverse Impacts
8/20/2023 to 8/21/2023	Tropical storm Hilary made landfall in Southern California resulting in 4 to 5 inches of rain in the valley region that includes the LVMCOG though the most severe rain fell to the east and in the mountain regions.	Street and freeway flooding, fast moving storm channels, and cancelled flights at local airports.
12/31/2022 to 1/1/2023	A potent storm moved in late on 12.31.2022 and continued into 1.1.2023. The heaviest band of rain straddled the region just as the clock struck midnight. Many mountain locations recorded over 4" of precipitation, mostly rain. Lytle Creek took top honors with 5.85". Lower elevations generally got 1-2", but Coto de Caza overachieved with 3.62".	Street and stream flooding was observed in many areas and was particularly serious next to the Fairview burn scar south of Hemet.
12/11/2022 to 12/12/2022	An atmospheric river was steered into Southern California by a deep trough and brought heavy rain, ranging from 0.50-2" in the lowlands, generally 24" in the mountains (except outlier Lytle Creek with 5.03"), and 0.03" to about one-third inch in the deserts.	Areas of urban flooding developed, and swift-water rescues were made in Ontario and Anaheim.
11/8/2022 to 11/9/2022	A deep trough of low pressure with copious moisture brought heavy rain to the region. Total rainfall amounted to 1 to 2" coast and valleys, and 3 to 5" in the mountains. A peak of 9" was recorded in Lytle Creek.	Heavy rain resulted in urban flooding, including three fatalities in a channel in Cucamonga creek.

Date(s)	Weather	Adverse Impacts
9/12/2022	Moisture from remnants of Tropical Cyclone Kay brought precipitable water measured at 2.35" inches, a record level for September and the second wettest all-time in the sounding record back to 1956. Rainfall ranged from 2 to 6" from the Anza Borrego Desert to Mt. Laguna on 9.9. Thunderstorms erupted in the mountains and desert and Inland Empire from 9.10 to 9.12. Including one storm producing a rain rate of 2.44" in one hour at Raywood Flats on 9.12.	On 9.12, flash floods and debris flows flowed into Forest Falls and Oak Glen, where 30 homes and businesses were damaged. Search and rescue operations found all missing persons but one, a woman who was killed in Forest Falls. 14 evacuees spent at least one night at a Red Cross shelter. Several roads and highways in this area were blocked by debris and closed. Other massive debris flows, including large trees and boulders, flowed down Banning and Mias Canyons above Banning. Flash floods were also reported in Barona and Temescal Valley.
8/13/2022	Thunderstorms hit the San Bernardino Mountains. 2.28" at Yucaipa Ridge.	The rain came in a short time and triggered debris flows and flash floods into Forest Falls.
8/8/2022	Heavy thunderstorms struck Mt. San Jacinto. 1.98" fell. A heavy thunderstorm complex struck the southern Anza Borrego Desert. Its giant anvil plume with light rain spread all the way to the coast across much of the San Diego metro area.	A serious flash flood in Chino Canyon closed the Palm Springs Tram and stranded visitors for a time. Another flash flood took out part of Highway S2 in the Anza Borrego Desert.
7/31/2022	Numerous heavy thunderstorms struck the El Dorado burn scar (above Yucaipa). Rainfall intensities exceeded 1" in 1 hour and a couple approached 2" per hour. Some weakening thunderstorms managed to drift across southern Orange County to the coast.	Significant flash floods and debris flows that closed parts of highway 38 near Angelus Oaks for days. Storms in the high desert led to several flash floods.
12/28/2021 to 12/30/2021	A wet and powerful storm struck the region, with emphasis on Ventura and Los Angeles Counties, where rainfall ranged from 3 and 7 inches with local amounts up to 9 inches in the mountains. 2 to 5 inches fell in far western San Bernardino County.	Flooding of streets filled with water to the curbs in Seal Beach. Boulders fell onto Highway 138 in Crestline.
12/23/2021 to 12/24/2021	A series of storms paraded through the region, each bringing heavy rain during late December. Two-day totals for this storm reached 6" in the mountains, but Lytle Creek alone achieved just over 8". The northern Inland Empire got 2-5", while most other lower elevation stations received 0.75-3". Even parts of the lower deserts got more than one inch.	Several mountain roadways were washed out, including Highways 18 and 243. Flooding was observed in the Mojave River in Hesperia, along Indian Canyon Road near Palm Springs, in San Bernardino, in Cherry Valley just below the Apple Fire burn scar, and in nearby Oak Glen. Debris flows inundated parts of Silverado Canyon within the Bond Fire burn scar.
12/14/2021	A significant winter storm brought heavy rain to lower elevations. 5 to 6" of rain fell on the southwest slopes of the San Gabriel and San Bernardino Mountains, with Lytle Creek singularly achieving 7.06".	Several debris flows occurred, in the Bond Fire burn scar in eastern Orange County and below the Apple Fire burn scar near Beaumont. Localized flooding was common across the region. Rocks and debris closed some mountain highways.
10/21/2021 to 10/25/2021	A significant storm for October tapped into a weakening atmospheric river to bring over 2" of rain to the region including over 1.4 inches in Malibu. In the San Bernardino Mountains. 1-2" were common in the mountains, while 0.25- 1" was common at lower elevations, including the high desert.	The rain combined with vulnerable burn scars to produce rock slid mud and debris flows that closed es, off several highways in the mountains. These closures were near Big Bear Dam, Oak Glen and Forest Falls.

Date(s)	Weather	Adverse Impacts
8/10/2021	A mesoscale convective system (organized thunderstorms) produced heavy showers and thunderstorms in the desert, mountains and even to the coast near San Diego. San Felipe received 2.49", Ranchita 2.27", and Mason Valley 1.84".	Flash flooding occurred all around Borrego Valley, Desert Research Institute, Airport, Coyote Canyon and adjacent citrus tree fields.
7/30/2021	A surge of monsoon moisture produced numerous heavy thunderstorms across the mountains. Rain rates of 1.0 to 1.5 inches per hour were observed in the heavier storms.	Several flash floods and debris flows occurred, particularly on the El Dorado Fire burn scar along Highway 38 near Angelus Oaks.
7/26/2021	Widespread showers and thunderstorms hit the entire region, even to the coast. Many locations in mountains and deserts received over one inch of rainfall, with Lake Cuyamaca topping the list at 2.32", Indio 1.60" and Apple Valley 1.34". West of the mountains, amounts ranged from 0.01" to 0.83" inch at Rincon Springs. Distribution was not uniform in any respect.	A flash flood spread sand and rocks across Dillon Road and Ramon Road near Thousand Palms. Several Indio streets were flooded with water.
3/11/2021	A powerful storm contained a heavy burst of rain in eastern Orange County that struck the Bond Fire burn scar in Silverado Canyon. 0.20 inch of rain fell in 15 minutes.	A debris flow went over roads and into homes, damaging six homes and eight vehicles in Silverado. The flow also closed a stretch of Silverado Canyon Road.
1/28/2021 to 1/29/2021	A powerful winter storm and atmospheric river brought heavy rain. 4 to10 inches fell across San Luis Obispo and Santa Barbara Counties, 2 to 6 inches fell in Ventura County and 1 to 4 inches fell in Los Angeles County. 1.5 inches of rain fell across Santiago Canyon in eastern Orange County.	Many areas flooded, including Santiago Canyon where mud and debris flows covered roads and damaged homes. A vehicle got stuck in floodwaters in Perris, prompting a water rescue. 8 people were trapped in a flooding storm drain between Otay Mesa and San Ysidro. 7 were helped to safety, but one perished.
4/8/2020 to 4/10/2020	A warm front moved through the region on 4/8 and brought waves of showers from south to north. Following the warm front, an upper low moved into the California Bight and stalled on 4/9, bringing 3 to 5 inches of rain to Orange County and San Diego County through 4/10. Many locations recorded their highest daily rainfall record: San Diego (1.98"), Chula Vista (1.56"), and Vista (3.18"). Oceanside Harbor recorded their wettest 24-hours on record with 3.06". Six-day storm totals were 3 to 7 inches along the coast and valleys, 4 to 8 inches with locally 10 in the mountains, and 1 to 2 inches in the deserts. Rainfall in San Diego County was 3-4" inches in a 24 hour period. All-time daily rainfall records were broken on 4/10 in Oceanside and Vista, each recording over 3". Monthly rainfall records were broken for April at those locations, each receiving over 6" in just six days.	Numerous flash floods and floods resulted. Flood waters combined with mud, boulders and debris in Bonsall, Oceanside, Carlsbad, Encinitas, Vista, Pacific Beach, Del Mar, Valley Center, Rancho Penasquitos and several spots in Mission Valley. Highway 78, a major freeway corridor between Oceanside and Escondido, was closed in both directions from flooding on adjacent Buena Vista Creek. Numerous swift-water rescues were made all across San Diego County. The San Diego River at Fashion Valley reached a peak of 12.5 feet.

Date(s)	Weather	Adverse Impacts
3/12/2020	An atmospheric river brought heavy rain and thunderstorms, especially to the deserts where 1 to 2 inches fell. 550 lightning strikes occurred.	Flash flooding was observed near Canebrake, Borrego Springs, Lakeview, Riverside, Corona, parts of the Coachella Valley, Apple Valley. A mudslide occurred near Pinyon Pines. A road was eroded near Mentone. Water rescues happened in Glen Avon and Corona.
12/26/2019	A powerful winter storm brought intense rain and thunderstorms that measured 1 to 3.5 inches from the coast to the mountains.	Flooding of intersections and low lying areas were widely observed during the most intense rainfall, including in San Marcos and Mission Valley. Vehicle rescues were needed.
11/28/2019	A powerful storm struck the region on this Thanksgiving Day. Heavy rainfall of 1 to 3 inches fell at the coast and in the valleys.	Numerous roadways were damaged from flooding and erosion. There was a large boulder on Ortega highway and a sinkhole in Redlands. A swift-water rescue was needed in National City. An RV park in La Mesa was heavily damaged.
9/2/2019	Nocturnal thunderstorms migrated from the east and hit the Coachella Valley early in the morning this Labor Day. Other thunderstorms struck the mountains that afternoon. Sky Oaks was the standout, receiving 2.71 inches, while many other mountain locations received 0.50 to 1.50 inches.	Several flash floods impacted the Coachella Valley.
2/14/2019	A major atmospheric river pummeled Southern California with heavy rain. Many mountain locales recorded 8 to 10 inches of rain, with Palomar Mountain recording over 10 inches. Palm Springs recorded 3.69 inches, the third wettest day on record.	Flash flooding resulted with damage to roads. High snow levels resulted in flooding in the San Bernardino Mountains. Flash flooding and debris flows occurred at and below the Holy Fire burn scar near Lake Elsinore. Highways ripped out by water and debris on both sides of Mt. San Jacinto were closed for weeks for major repairs.
2/2/2019	A strong downpour across the burn scar of the 2017 Whittier Fire triggered a debris flow in Duval Canyon (Giorgi 2019).	The event clogged and damaged a culvert beneath Highway 154, shutting down the highway for a month between Highway 246 in Santa Ynez to Highway 192 in Santa Barbara for clearing, severing a key north-south arterial linking north county and south county.
1/15/2019	A winter storm brought a band of very heavy rain to northwest Orange County. Seal Beach, Huntington Beach and Fountain Valley each reported roughly 2 inches of rain in 2 hours.	The intense rain produced flash flooding. Water was up to doorways outside of homes, and the Pacific Coast Highway was closed for over a day in Huntington Beach.
9/30/2018	Remnant moisture from Tropical Storm Rosa advanced into Southern California, bringing rain and widespread thunderstorms to the region, particularly the mountains and deserts. In the Coachella Valley, a strong thunderstorm accumulated up to 3.5” of rain in 2 hours near Mecca.	One fatality resulted from the storm near Mecca. An individual was swept away on Box Canyon road.

Date(s)	Weather	Adverse Impacts
1/19/2018	On Tuesday, January 9, 2018, following the 2017 Thomas Fire, which burned 281,893 acres in Ventura and Santa Barbara Counties, a reported 0.54 inches of rain fell within 5 minutes in the burn scars from the Thomas Fire in the foothills of Montecito. Over two days a total of four inches of rain fell in the area.	The heavy rains caused massive debris flows and flooding that damaged or destroyed 408 homes, killed 23 residents, and led to the closure of Highway 101 and the UPRR for more than 3 weeks, cutting off the county from communities to the south. California Geological Survey scientists estimated the Montecito debris flow as having speeds of 10-15 mph, being up to 25-30 feet deep, and capable of carrying boulders as large as a tow truck. (California Geological Survey 2019b).
1/9/2018	A potent winter storm struck Southern California. Intense rainfall around Santa Barbara and Ventura measured as high as 0.54 inches in 5 minutes.	A 15 foot deadly mud and debris flow hit the community of Montecito, around the burn scar of the Thomas fire, where 23 lost their lives, 128 residences were destroyed, and 307 others were damaged. Highway 101 was closed for days due to the mud and debris.
9/9/2017	Thunderstorms struck the deserts with heavy rains, including a daily record of 1.20 inches at Palm Springs.	Intense flash flooding in Palm Springs and Cathedral City, where structures throughout the city were flooded and roads were covered in debris. At Palm Springs High School, 31 classrooms were inundated. Major flood damage also occurred at a mobile home park.
8/12/2017	Two giant supercell thunderstorms unleashed their fury on the Anza Borrego Desert.	Flash flooding and wind damage occurred around Agua Caliente Springs and Canebrake.
8/1/2017	Numerous monsoon thunderstorms struck the valleys. 1.56 inches fell in Alpine in a short period.	Flash flooding, downed trees and power outages were reported in Corona, Perris, San Bernardino, Temecula, and Alpine.
2/27/2017 to 2/28/2017	An atmospheric river storm struck mainly San Diego County with 2-9 inches of rainfall in 24 hours. The San Diego River in Mission Valley crested at 14.15 feet, the third highest stage all-time.	Numerous roadways were closed, the Fashion Valley Mall parking structure was closed and the Fashion Valley Transit Center was closed to bus traffic. Numerous water rescues were conducted along the San Diego River including 20 people rescued from hotels in Mission Valley. Many vehicles were also flooded and destroyed.
1/19/2017 to 1/23/2017	A series of three winter storms hit during five days. Total rainfall reached 10-13 inches along the coastal slopes from San Bernardino to San Diego County. Over the coast and valleys 2-7 inches of rain occurred with 0.5-3 inches in the deserts.	Widespread flooding, including damage to homes and businesses and numerous stranded vehicles in several feet of water. Dozens of high water rescues were made, 29 in San Diego County on 1.20 alone. One boy was swept away to his death in floodwaters in Rainbow. The governor declared a State of Emergency in San Diego County.
7/1/2016	Strong thunderstorms formed over the Mojave Desert and San Bernardino Mountains. Up to three inches of rain fell between Helendale and Victorville. This was the only significant round of thunderstorms during the 2016 monsoon season.	Significant flash flooding that forced closure of Highway 66 near Bryman.

Date(s)	Weather	Adverse Impacts
1/5/2016 to 1/7/2016	A strong, low latitude jet stream brought a series of storms through Southern California with periods of moderate to heavy rain. Three-day rainfall totals were around 2-7" for the coast, valley and foothill areas, and 1- 3" for the deserts. After several years of drought, this was the only precipitation event of significance during an otherwise disappointing strong El Niño season.	Flooding resulted nearly everywhere, with southwestern San Diego County being hardest hit. Floods buried cars in Ocean Beach and Mission Valley. High water rescues occurred on 1.6 around San Diego. Small mudslides, including boulders on highways were reported near Ramona, Redlands, Crestline, Orange, Rancho San Diego and De Luz. Three debris flows in Silverado Canyon below a burn scar.
11/3/2015 to 11/4/2015	A wet winter storm brought locally heavy rain to Southern California. San Diego recorded a one-day total of 1.09" on 11.3, setting a daily rainfall record. 0.10" to 1.5" fell elsewhere, heaviest in southern San Diego County. Hail of one quarter inch was reported in Dana Point and southern San Diego County.	Urban flooding in Spring Valley and Lemon Grove with water up to the doors of some vehicles and several roads closed.
10/18/2015	Thunderstorms dropped very heavy rainfall in Death Valley. Scotty's Castle measured 2.72 inches of rain in roughly five hours.	Major flash flooding hit the Grapevine Canyon area of Death Valley National Park. Mesquite Springs Campground and Grapevine Ranger Station were evacuated; eight vehicles full of visitors and three park rangers were stranded overnight near Ubehebe Crater. Trenches up to six feet deep were cut into Scotty's Castle Road. 24 power poles were downed. Mud and debris damaged or destroyed the water supply infrastructure, stables, visitors center, and the cookhouse.
10/16/2015	Strong thunderstorms hit northern Ventura and LA counties.	Flash flooding and mud and debris flows occurred in the San Gabriel Mountains, Cuyama, and the Antelope Valley.
9/15/2015	A Pacific trough tapped into remnant moisture from tropical cyclone Linda. 1-2" of rain was common across the entire region.	Major traffic jam during the morning commute in LA and Orange County, along with a debris flow in Silverado Canyon, and widespread urban flooding.
9/7/2015 to 9/8/2015	Subtropical moisture from remnants of Hurricane Linda brought thunderstorms to most of the region. Additional thunderstorms on 9.8 developed over the mountains and spread into the Inland Empire and Orange County, as well as near I-15 in San Diego County. Hail was mostly nickel-sized, but a few larger. A small dust storm hit Riverside.	Flash floods hit Victorville (which included a swift water rescue). Another flash flood in Forest Falls also had a swift water rescue, but also one drowning death. On 9.8 several trees and poles were downed in the Riverside area from the dust storm.
7/29/2015 to 7/30/2015	Scattered thunderstorms occurred mainly over the mountains and deserts with wide-ranging rainfall totals from a few tenths of an inch to locally over 2".	Flash flooding occurred in Idyllwild, Timoteo Canyon, Calimesa and Moreno Valley.

Date(s)	Weather	Adverse Impacts
7/18/2015 to 7/19/2015	Moisture from Hurricane Dolores, along with monsoon moisture resulted in showers and thunderstorms over most Southern California. Rainfall ranged from 0.5-4", including a record 1.71" at San Diego on 7.18 (unprecedented rainfall: single-day and July monthly total). The San Diego River at Fashion Valley had 2 crests above monitor stage, 7.7 feet on the 18th and 8.8 feet on 7.19. On 7.19 over 6" of rain fell over several hours just west of Desert Center.	A debris flow hit the burn scar of Silverado Canyon. Flash floods hit Moreno Valley, Perris, and La Mesa on 7.19. A wet microburst struck Tierrasanta on 7.18, causing wind damage. A haboob caused wind damage in the Anza Borrego Park and in Palm Desert. The rain caused the first rain-out of a Los Angeles Angels baseball game since 1995, and a rare 2-hour rain delay at the San Diego Padres baseball game. Over 2000 lightning strikes were reported on 7.18, some starting small brush fires. Near Desert Center on 7.19 eastbound lanes of Interstate 10 collapsed where they crossed a heavily flowing wash. A vehicle drove into the hole in the collapsed bridge, trapping the driver and requiring rescue. I-10 was closed in both directions causing huge traffic backups.
7/6/2015	Monsoon thunderstorms hit the mountains and upper desert. A few spots received up to around one-third of an inch, including a portion of the Lake Fire burn area south of Big Bear Lake.	Several debris flows resulted, including one consisting mostly of ash and mud over portions of Highway 38, up to a foot deep in some areas.
5/14/2015	A strong late-season winter storm, along with some thunderstorms, hit the region. San Diego reported 1.30" of rain in one hour. A nine-minute period within that main hour, totaled 0.71", which is near the 1/100 return interval.	Flooding in Mission Hills and Midway District of San Diego was up to 4 feet deep. Several swift water rescues.
12/12/2014 to 12/13/2014	A strong Pacific storm brought heavy rain. Widespread rainfall amounts of 1 to 1.5" in the coast and valley areas. Mountain locations got up to 4".	River rises in the San Diego River resulted in a levee breach which flooded the parking lot of Qualcomm Stadium. Several other roadways in San Diego County were closed due to flooding with mud and debris in the road, especially near the Tijuana River Valley.
12/3/2014 to 12/4/2014	A Pacific storm brought moderate to heavy rain. Two-day rainfall totals of 1-2" were recorded west of the mountains, while the southern slopes of the San Bernardino County mountains saw up to 5" of rain (isolated amount of 14.5" at Yucaipa Ridge).	Flooding resulted, with mud, debris and water closing several roadways and stranding vehicles. Mud with debris 10 feet high piled up on Soboba Rd. north of San Jacinto. A swift water rescue was needed.
9/7/2014 to 9/8/2014	Weakening Hurricane Norbert brought moisture to produce thunderstorms mainly in Riverside and San Diego Counties. Rainfall amounts of 1 to 2 inches fell over the city of Riverside, San Bernardino and Hemet, while the mountains in that county saw up to 0.60" near Sky Valley. Early morning thunderstorms on 9.8 drenched parts of the Coachella Valley which received 0.33" up to just over 3 inches near the lower foothill in Thousand Palms and La Quinta.	Widespread flash flooding, most notably in the Coachella Valley on 9.8. Mud and water closed roads and stranded vehicles in La Quinta, Palm Desert, and Thousand Palms. Homes in La Quinta were surrounded by water. Moving water was 3 feet deep on roads and 4 to 5 feet of standing water submerged vehicles. Mud was several feet deep on Varner Road.
8/12/2014	A heavy thunderstorm struck east of Julian.	A debris flow blocked Hwy. 78 east of Julian on the Banner Grade that was one to two feet deep. The Banner Fire burn scar contributed to this flow.

Date(s)	Weather	Adverse Impacts
8/3/2014	Heavy thunderstorms hit the Inland Empire, the mountains and the lower desert. Mt. Baldy Village got 4.40 inches, with four inches falling in 60 minutes.	Flash flooding and debris flows were common. Road closures and damage.
7/27/2014	Thunderstorms erupted in the mountains of San Diego County and even along the coast.	Flash flooding occurred in La Jolla Shores and near Warner Springs along Hwy 79.
7/5/2014	Thunderstorms erupted in the Inland Empire, San Bernardino Mountains, and the High Desert.	Flash flooding closed roads in the High Desert along I-15 and Hwy. 247 and required a swift water rescue in Yucaipa. On 7/5 flash flooding occurred along Hwy. 247 in Landers.
5/23/2014	Thunderstorms over the San Diego County mountains drifted over the adjacent deserts.	Flash flooding occurred along and north of Highway 78, south of Borrego Springs.
2/28/2014 to 3/1/2014	A very wet storm was the only significant storm of the 2013-14 wet season. Rainfall ranged from 1 inch at the coast to up to 8 inches in the mountains. Up to 1 inch fell in the desert. Yucaipa Ridge measured over 11 inches.	Urban and flash flooding with mud/debris flows, causing numerous road closures and swift water rescues in and around Anaheim, San Diego-Fashion Valley, Escondido, Fallbrook and Lake Elsinore. Mud slides closed Hwy. 74 (Ortega Highway) stemming from the Falls Fire burn scar. Many road closures in the Coachella Valley where rivers saw rises of 2 to 5 feet, in some instances within 12 hours. On 3.1, flooding resulted in Oceanside, Temecula, Sea World San Diego, as well as minor street flooding in Mission Viejo.

Table 155: Significant Flood Events in Southern California 2014 - 2022

Significant Floods in the Las Virgenes-Malibu Region

The National Flood Insurance Program tracks flood losses for the U.S. The following table lists the NFIP loss totals for the cities within the Las Virgenes-Malibu area from 1992 through 2019.

City and Year of Claim	Number of Claims	Amount Paid on Building Claims	Amount Paid on Contents Claims	Total NFIP Claim Payments
Agoura Hills	**34**	**$282,822**	**$34,754**	**$317,576**
1992	2	$11,152	$-	$11,152
1993	3	$7,844	$-	$7,844
1995	2	$2,563	$58	$2,621
1997	1			$-
1998	9	$29,530	$5,016	$34,546
2001	3			$-
2003	1			$-
2004	2	$11,242	$58	$11,300
2005	2	$7,146	$3,219	$10,364
2008	1			$-
2011	2	$5,190	$-	$5,190
2017	3	$180,681	$26,404	$207,085
2019	3	$27,474	$-	$27,474
Calabasas	**12**	**$48,032**	**$1,278**	**$49,310**
1998	3	$774	$-	$774
2004	2	$5,704	$-	$5,704
2005	2	$4,422	$1,278	$5,701
2011	1			$-
2017	3	$7,911	$-	$7,911
2019	1	$29,220	$-	$29,220
Hidden Hills	**13**	**$250,680**	**$15,972**	**$266,652**
1992	2	$10,322	$3,218	$13,540
1993	1	$1,261	$-	$1,261
1998	2	$3,932	$-	$3,932
2000	1			$-
2001	2	$31,085	$8,946	$40,031
2005	4	$204,079	$3,808	$207,888
2017	1			$-
Malibu	**113**	**$2,033,041**	**$258,818**	**$2,291,859**
1994	2	$51,612	$-	$51,612
1995	9	$227,170	$13,220	$240,390
1996	3			$-
1997	1			$-
1998	15	$282,741	$585	$283,326
2000	1	$39,384	$17,851	$57,235
2001	4			$-
2003	1			$-

City and Year of Claim	Number of Claims	Amount Paid on Building Claims	Amount Paid on Contents Claims	Total NFIP Claim Payments
2004	5	$57,837	$16,244	$74,081
2005	6	$126,283	$4,676	$130,959
2008	4	$67,842	$270	$68,112
2009	1	$33,034	$10,972	$44,006
2010	6	$26,476	$18,193	$44,669
2011	6	$500,000	$134,730	$634,730
2014	17	$307,629	$-	$307,629
2015	4	$35,400	$-	$35,400
2016	10	$56,790	$-	$56,790
2017	12	$133,427	$-	$133,427
2018	3			$-
2019	3	$87,415	$42,077	$129,493
Westlake Village	**2**			$-
1995	1			$-
2010	1			$-
Grand Total	**181**	**$2,687,355**	**$333,562**	**$3,020,917**

Table 156: Flood Loss Statistics for California (From January 1, 1992 to December 31, 2019)

SOURCE: NFIP https://nfipservices.floodsmart.gov/reports-flood-insurance-data

Severe Repetitive Losses

The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program (NFIP). The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

(a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
(b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart.

In terms of the Las Virgenes-Malibu area, while there have been losses from flooding within the five city Las Virgenes-Malibu Council of Governments region, there are no properties that have sustained severe repetitive losses.

CAUSES AND CHARACTERISTICS OF FLOODS

A flood, as defined by the National Flood Insurance Program is: A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual or rapid accumulation or runoff of surface waters from any source, or mudflow.

Flooding may occur as a result of sustained heavy rainfall, microbursts (short periods of large volumes of rain), large wave activity on the coast, or reservoir/dam failure. A "100-Year Recurrence Interval" is defined as a flood that according to historical data has a probability of occurrence once in 100 years. This benchmark used by FEMA to establish a regulatory baseline for all flooding events. Similar benchmarks are defined for 25, 50, 500-year events.

Annual Rainfall

Rainfall in the LVMCOG region averages nearly 18 inches per year. However, the term "average rainfall" is misleading because over the recorded history of rainfall in the region, rainfall amounts have ranged from no rain at all in some years to well over normal averages in very wet years. Furthermore, actual rainfall in Southern California tends to fall in large amounts during sporadic and often heavy storms rather than in consistent amounts throughout the year (*See Community Profile Section for additional details).* For example, the 2022 and 2023 years experienced greater than average rainfall including Tropical Storm Hilary in August 2023 which was the first severe storm of this type to reach Southern California since the 1930's.

Dam and Reservoir Failure

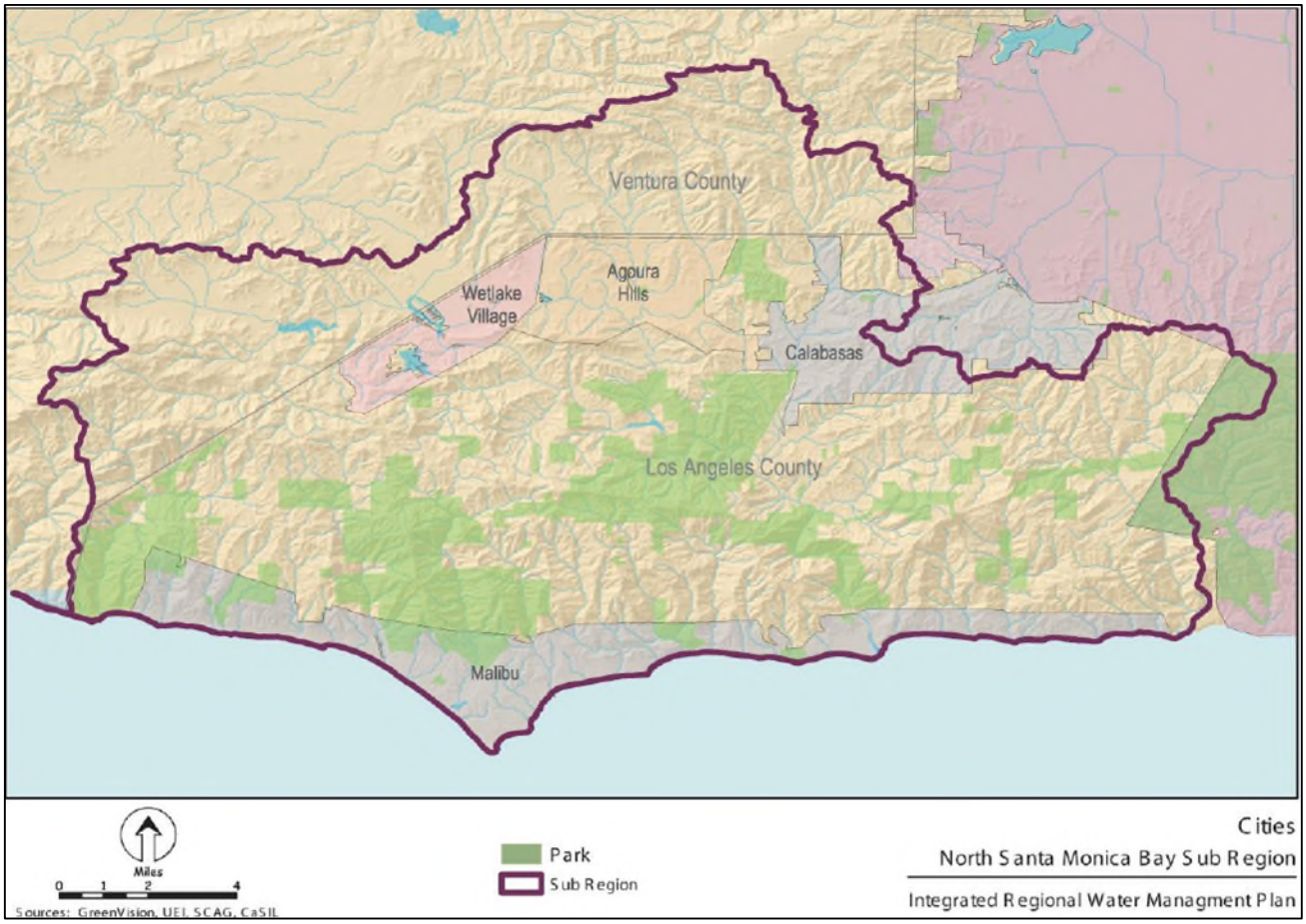
Loss of life and damage to structures, roads, and utilities may result from a reservoir or dam failure. Several factors influence the severity of a full or partial reservoir or dam failure: the amount of water released, topography, and the density of downstream populations and structures.

The Las Virgenes Municipal Water District (LVMWD) serves the cities of Agoura Hills, Calabasas, Hidden Hills and Westlake Village (the City of Malibu is served by Los Angeles County Water District 29). The LVMWD maintains two major facilities in Westlake Village:

- The Las Virgenes Reservoir is located at 2860 Three Springs Drive
- The Westlake Filtration Plant located at 32601 Torchwood Place (filters water from the Las Virgenes Reservoir prior to delivery to customers)

According to the Las Virgenes Water District, the Las Virgenes Reservoir has a surface area of approximately 160 acres and contains nearly 3 billion gallons of water. The reservoir was built from 1970 to 1972 and is comprised of two earthen dams built on a bedrock foundation. The main dam is 160 feet high, 2,000 feet long, 20 feet wide at the top, and 750 feet wide at the bottom. The saddle dam is 50 feet high, 750 feet long, 20 feet wide at the top, and 425 feet wide at the bottom.

The Malibu Creek Watershed is made up of 60,760 acres and is comprised of 80 percent vacant undeveloped land. The Malibu Creek Watershed is part of the larger North Santa Monica Bay Watershed Management Area that drains into the Santa Monica Bay. The cities within the LVMCOG lie (either entirely or partially) within the North Santa Monica Bay Watershed.



Map 69: North Santa Monica Bay Watershed

SOURCE: Draft General National Pollutant Discharge Elimination System Permit Letter, City of Malibu (9/06/2011)

FLOOD, TSUNAMI, STORM SURGE, AND SEVERE WINTER STORM HAZARD IDENTIFICATION

Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course. As described earlier, due to the close proximity to the Santa Monica Mountain range and variations of topography, there is a potential for flood throughout the entire area. Furthermore, due to continued growth, economic development and an increase of impermeable areas, the region's storm water collection and conveyance system may become overwhelmed.

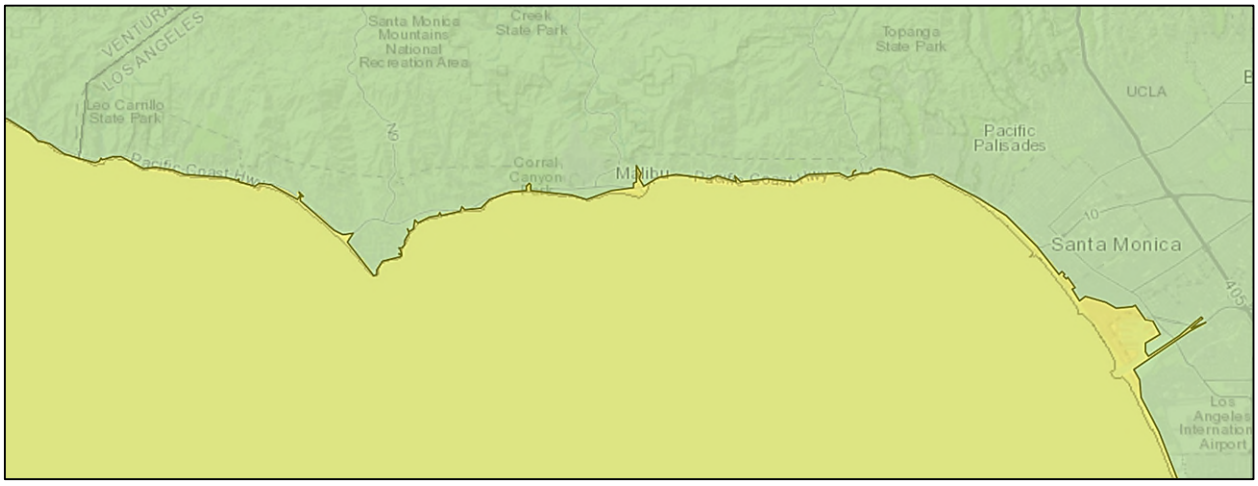
Tropical Storms and El Nino Conditions

Another source of heavy rainfall is from summer tropical storms. These tropical storms usually coincide with El Nino years. El Nino is a disruption of the ocean-atmosphere system in the tropical Pacific Ocean having important consequences for weather in California. Among these consequences is increased rainfall across the southern tier of the U.S. and Peru.

During El Nino periods, trade winds begin to relax in the central and western Pacific Ocean leading to a depression of the thermocline in the eastern Pacific Ocean and an elevation of the thermocline in the west. The result is a rise in sea surface temperature and heavier than normal rainfall in Southern California. In the past, El Nino conditions have caused damage to the Las Virgenes-Malibu area, particularly in the City of Malibu.

Tsunami

The City of Malibu is the only city within the LVMCOG that is adjacent to the Pacific Ocean and does not have a record of a tsunami in the past, however the risk cannot be fully eliminated. In 2021, Los Angeles County updated its Tsunami Hazard Maps to include a 1,000-year event and a presentation given to the community on April 13, 2021. The California Geological Survey mapped the areas of tsunami risk in the state which included the entire Malibu coastline.



Map 70: Malibu Tsunami Risk

Source: California Geological Survey

Specific parts of Malibu most at tsunami risk include lower lying stream run-off / canyon areas and Malibu Lagoon (Source: Los Angeles, Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, and USDA).

Map 71: Malibu Lagoon Tsunami Risk

Map 72: Corral Canyon Tsunami Risk

Map 73: Escondido Beach Tsunami Risk

Map 74: Zuma Beach Tsunami Risk

A 2013, a USGS study[34] developed a hypothetical but plausible tsunami scenario created by an earthquake of magnitude 9.1 along a fault length of 360 km in the Semidi subduction sector off the coast of Alaska. Based on this scenario, the study stated that, *"The SAFRR tsunami scenario demonstrates that many of the currently eroding beaches will have severe tsunami impacts and are at risk of beach loss. Malibu Beach will experience tsunami amplitudes of up to 2.5 m. Current velocities will average 2–3 m/s with some shoreline velocities of 5–8 m/s. The results show that much of the beach will be repeatedly inundated, as will several beach-front properties, including many high value homes."*

Map 75: Tsunami Malibu Flood Zone Scenario of a M9.1 Alaska Earthquake

[34] Brosnan, Wein, and Wilson, SAFRR Tsunami Scenario – Impacts on California Ecosystems, Species, Marine Natural Resources, and Fisheries, 2013 (USGS Open File Report 2013-1170-G).

Storm Surge

As a coastal community, the City of Malibu is vulnerable to high waves and storm surge. For example, in August 2023 the entire region was threatened by Tropical Storm Hilary a Category 4 event which resulted in heavy rains and a potential for storm surge.

In December 2021, an atmospheric river brought heavy rain to Southern California and produced a high threat of storm surge in Malibu. Also in August 2014, Hurricane Marie caused extremely high surf in the region which resulted in the closure of several beaches in Los Angeles County and damage to the Malibu Pier. During this event, wave heights peaked from 10 to 15 feet. The damage to the pier took more than 2 years to completed at an estimated cost of $4.6 million which included the replacement of at least 59 pilings.[35]

Figure 120: Topanga State Beach

Source: Source: California Department of Parks & Recreation

Figure 121: Malibu Pier

Source: California Department of Parks & Recreation

This risk of storm surge is related to the continued impact of sea-level rise (see Climate Change section) and will continue to escalate as a risk in terms of life, safety, and economic impact into the future. In order to mitigate the threat of sea-level rise, the City of Malibu regulates development activities along the coast in conjunction with the regulatory authority of the State of California.

Geography and Geology

The Las Virgenes-Malibu Region geologic features mainly consist of un-consolidated and semi-consolidated alluvial materials underlain and bounded on the north and east by consolidated sediments and crystalline rocks. These deposits consist of a shallow layer of Quaternary fill that has been washed down from the Santa Monica Mountains.

The materials are generally poorly sorted sands and gravels, intermingled with silts and clays. This lack of open ground forces water to remain on the surface and rapidly accumulate. If it were not for the existing flood control system in the area with its concrete lined river and stream beds, flooding would be a much more common occurrence.

[35] Tallal, The Malibu Times, Phase II of Malibu Pier Repairs to Being This Week, December 21, 2016.

Urban Development

The trend towards development has resulted in less open land and greater flood potential. In-fill building is becoming a much more common practice in many areas. Developers tear down an older home which typically covers up to 40% of the lot size and replace it with a single massive home or multi-unit town homes or apartments which may cover 90-95% of the lot. The consequence is less surface area for water to seep into the ground causing excessive run-off.

Another potential source of flooding is "asphalt creep." The street space between the curbs of a street is a part of the flood control system. Water leaves property and accumulates in the streets, where it is directed towards the underground portion of the flood control system. The carrying capacity of the street is determined by the width of the street and the height of the curbs along the street. Often, when streets are being resurfaced, a one to two-inch layer of asphalt is laid down over the existing asphalt. This added layer of asphalt subtracts from the rated capacity of the street to carry water. Thus, the original engineered capacity of the entire storm drain system is marginally reduced over time. Subsequent re-paving of the street will further reduce the engineered capacity even more.

Dam Failure

There are four dams in the Westlake Village area that are listed with a downstream hazard as Extremely High or High:[36]

Map 76: LVMCOG Dams with Inundation Maps

Source: California Department of Water Resources https://fmds.water.ca.gov/maps/damim/

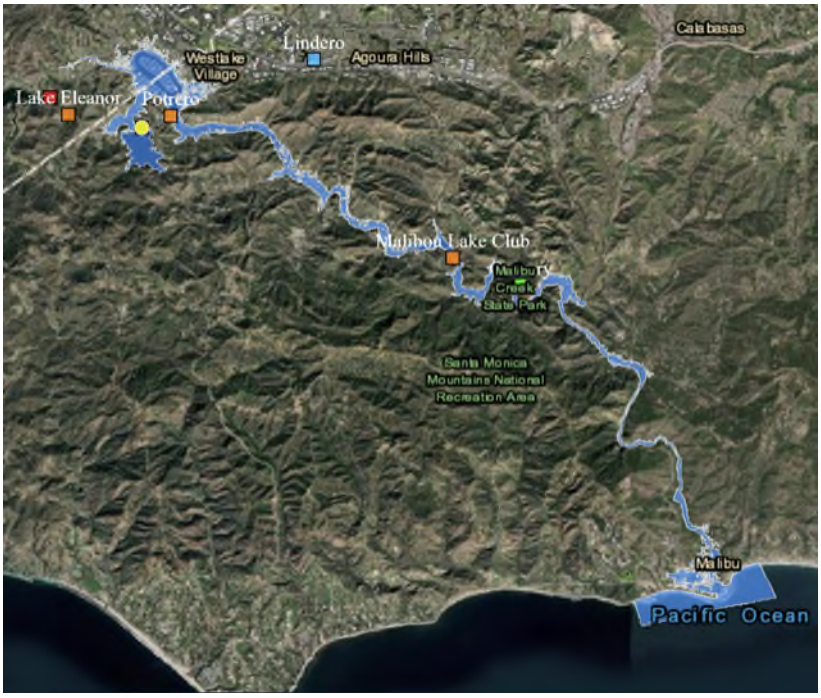
[36] The CA Department of Water Resources (DWR), Division of Safety of Dams (DSOD) reviews and approves inundation maps prepared by licensed civil engineers and submitted by dam owners for extremely high, high, and significant hazard dams and their critical appurtenant structures. Inundation maps approved by DSOD are a tool used to develop emergency action plans, and the maps are intended to provide general information for emergency planning. DWR assumes no legal responsibility resulting from the use of this information. Actual evacuation zones and timing will be determined by local emergency managers who are responsible for specific evacuation procedures in an emergency event.

Extremely High

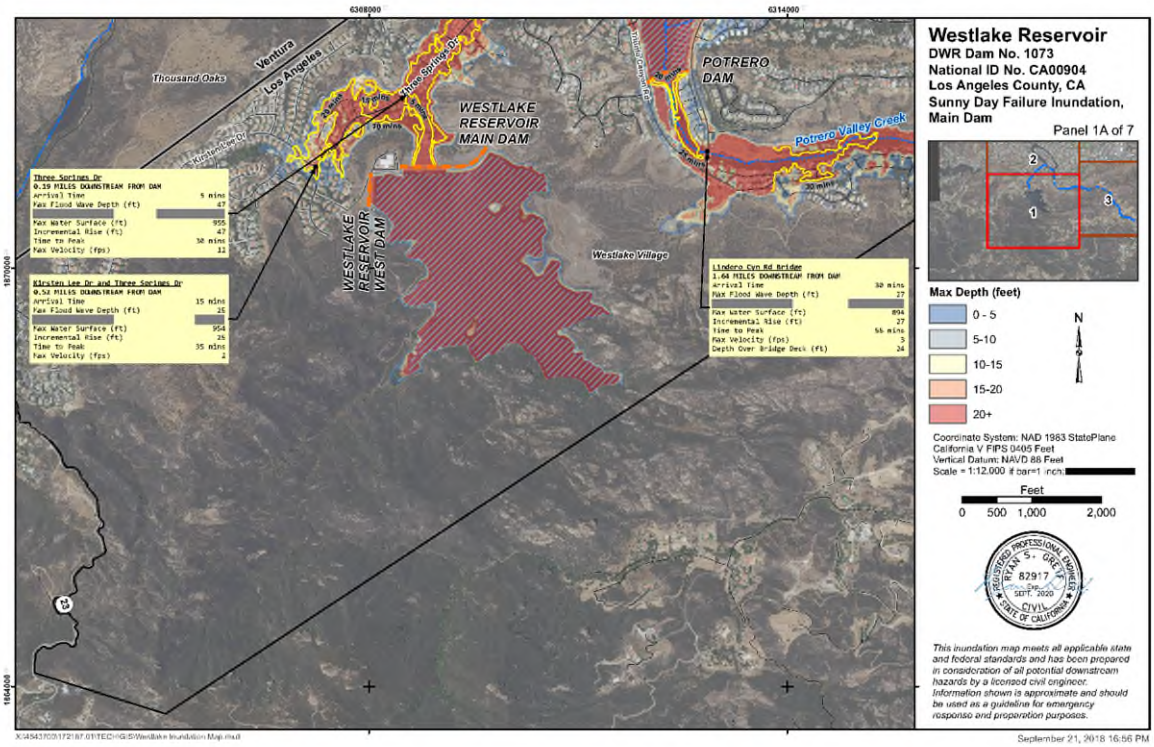
- Westlake Reservoir (Dam ID CA00904)
- Lake Sherwood (Dam ID CA00736)

Westlake Reservoir

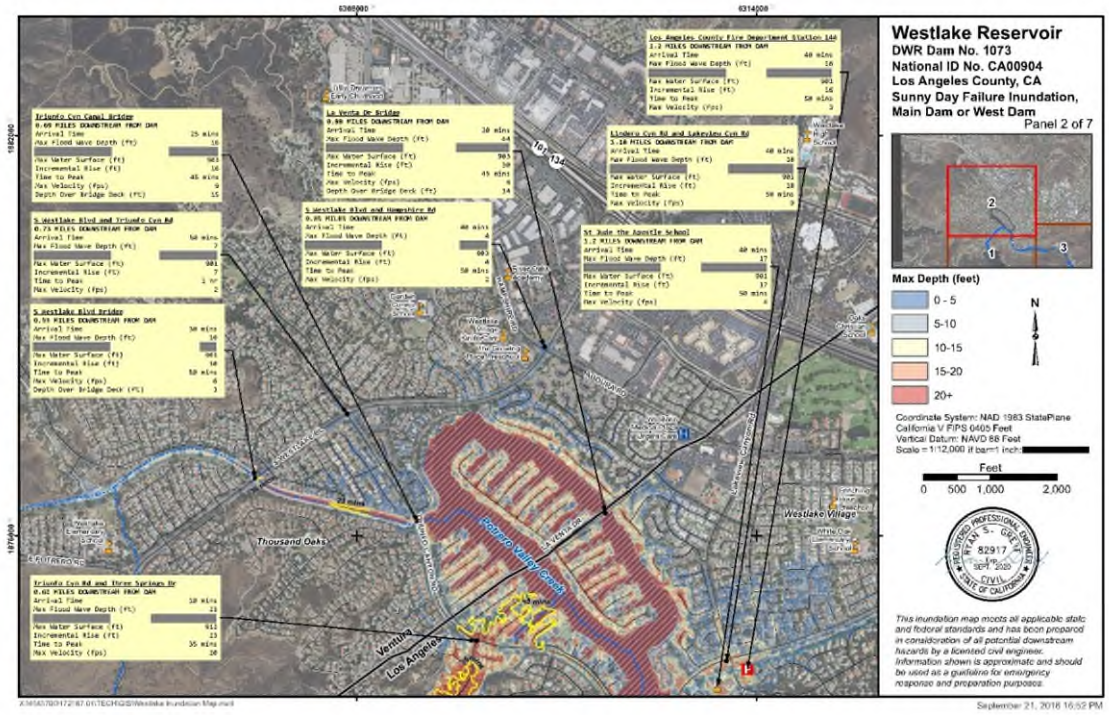
If the Westlake Reservoir were to fail, the projected inundation flow would move north to Three Springs Drive then east past Westlake Blvd. Bridge and down Westlake Blvd./Triunfo Canyon Road. Then flow past the Triunfo Canyon Canal Bridge to Westlake Village and down Potrero Valley Creek to Malibu Creek and Malibu Lake then eventually downstream to Malibu Lagoon (Source: CA Department of Water Resources (DWR), Division of Safety of Dams (DSOD) and the Las Virgenes Municipal Water District and Mead & Hunt).



Map 77: Westlake Reservoir Inundation Map Westlake Reservoir Inundation Map



Map 78: Westlake Reservoir Inundation Timeline Map 1

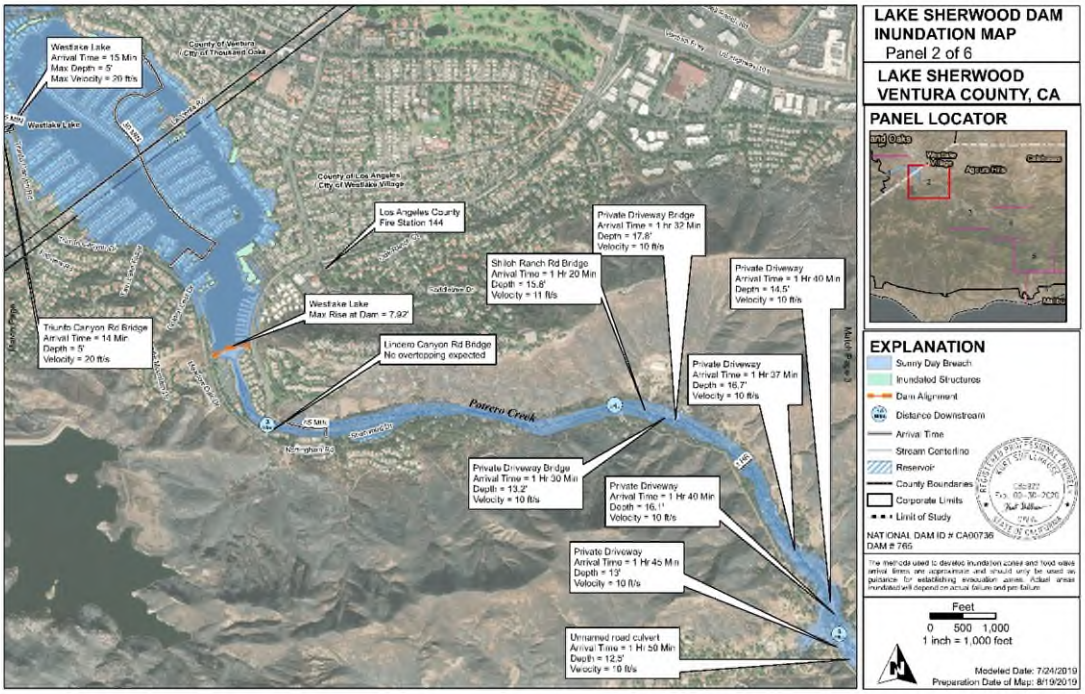


Map 79: Westlake Reservoir Inundation Timeline Map 2

Lake Sherwood

In the event of a Lake Sherwood dam failure, the flow would travel down Potrero Creek from Thousand Oaks past Triunfo Canyon Road Bridge towards Westlake Lake. Then eventually flow down Malibu Creek Malibu Lake then down to Malibu Lagoon.

Map 80: Lake Sherwood Inundation Map



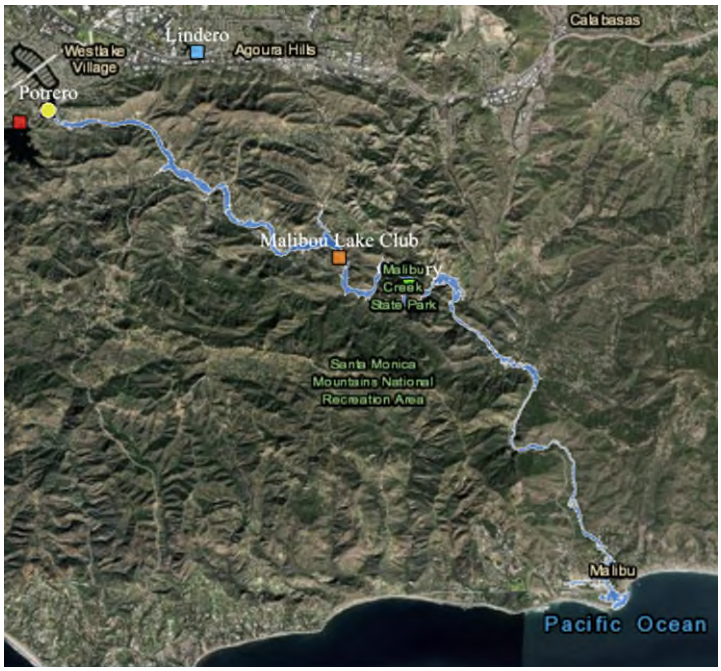
Map 81: Lake Sherwood Inundation Timeline Map

High

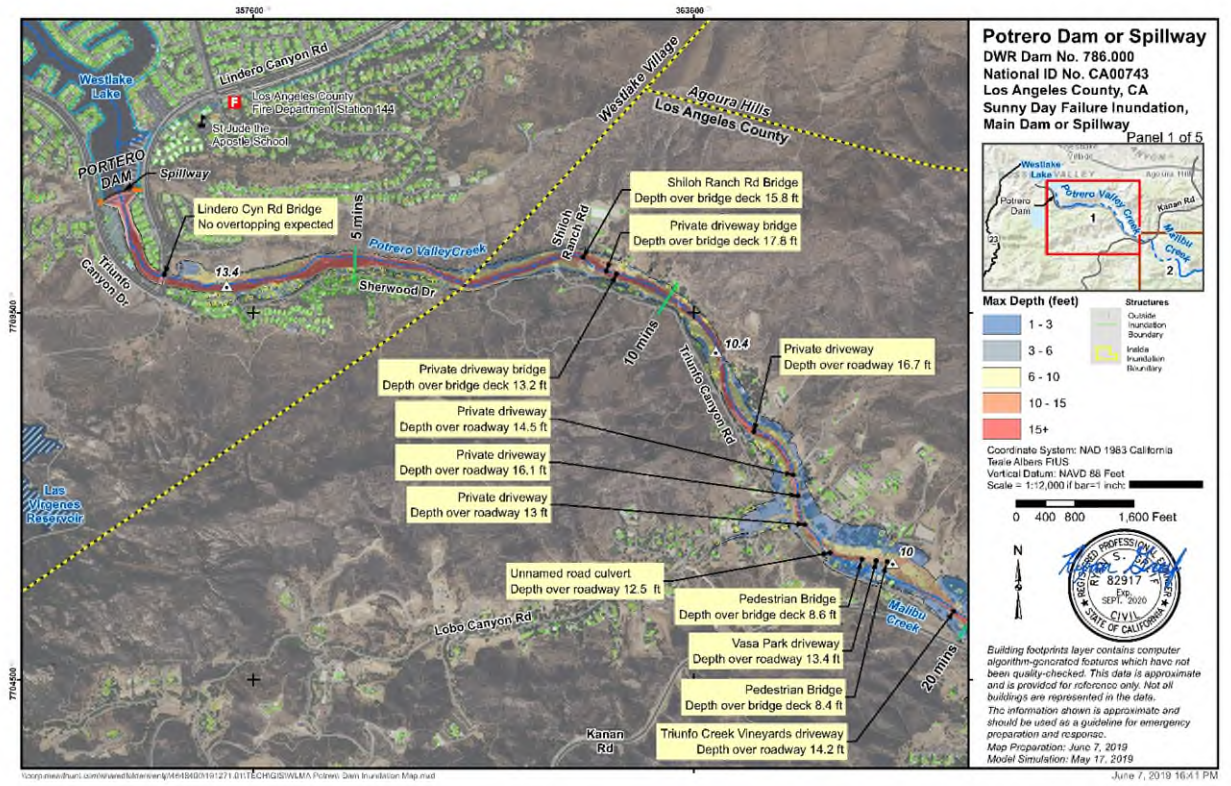
- Potrero (Dam ID CA00743)
- Lake Eleanor (Dam ID CA00737)

Potrero Dam

In the event of a Potrero Dam failure, the water flow would progress from Southeast Westlake Village down Potrero Valley Creek to Malibu Creek Malibu Lake then down to Malibu Lagoon.
(Source: CA Department of Water Resources (DWR), Division of Safety of Dams (DSOD) and the Westlake Village Management Association and Mead & Hunt).



Map 82: Potrero Dam Inundation Map

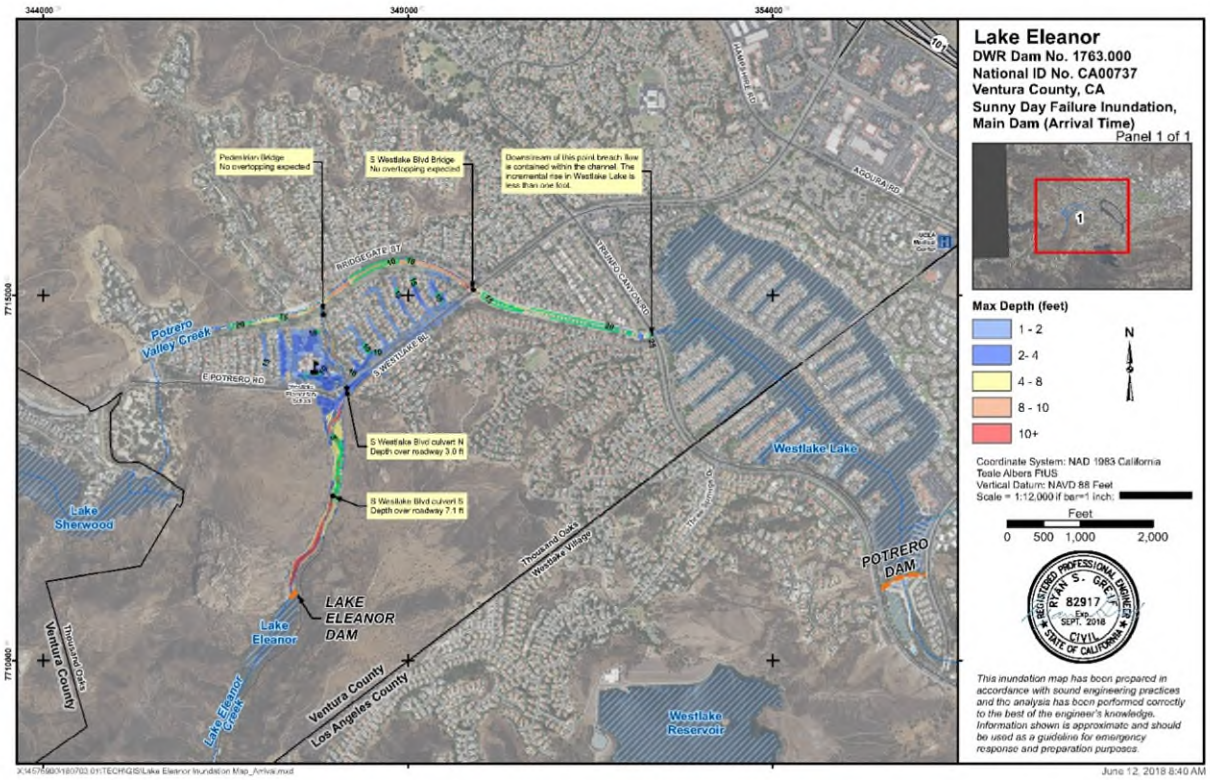


Map 83: Potrero Dam Inundation Timeline Map

Lake Eleanor

In the event of a Lake Eleanor Dam failure, the water flow would travel down the South Westlake Blvd. culvert north then east down Potrero Valley Creek towards Westlake Village Lake (Source: CA Department of Water Resources (DWR), Division of Safety of Dams (DSOD) and Conejo Recreation & Park District and Mead & Hunt).

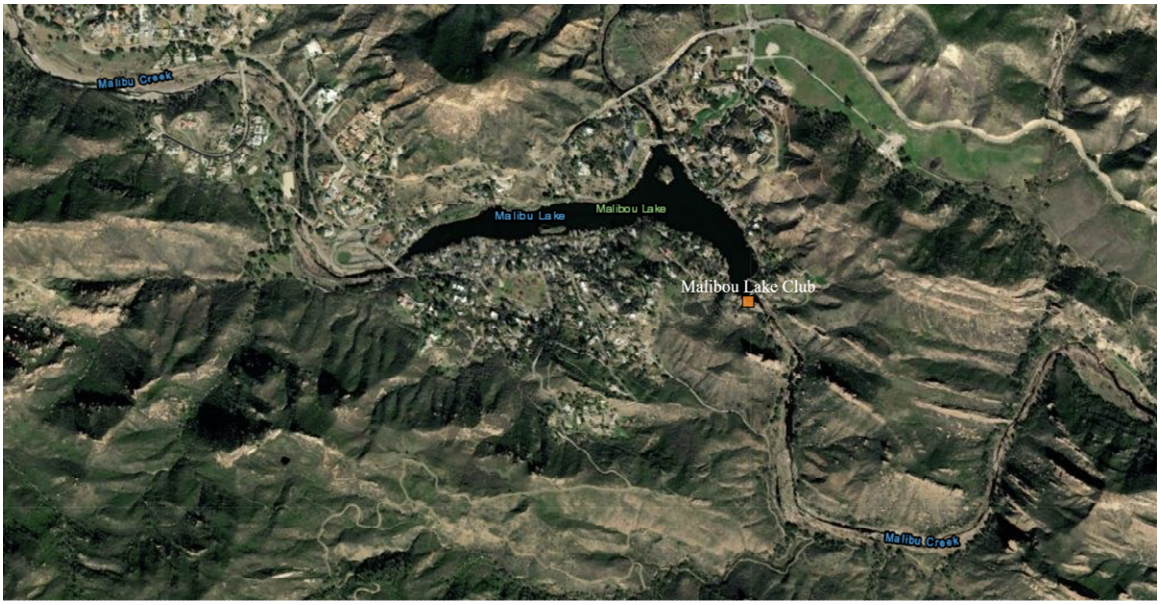
Map 84: Lake Eleanor Inundation Map



Map 85: Lake Eleanor Inundation Timeline Map

Malibu Lake

In addition to the four dams listed in the LVMCOG, Malibu Lake Club (Dam ID CA00739) located in the Santa Monica Mountain National Recreation Area.



Map 86: Malibu Lake

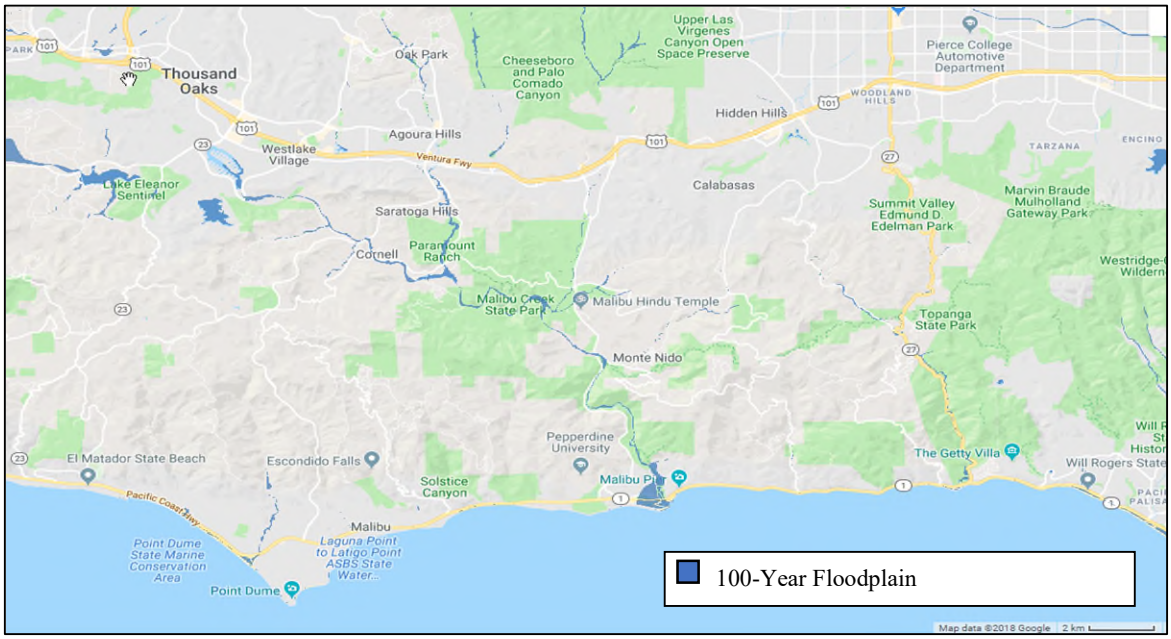
In the event of a Malibu Lake dam failure the water would flow down Malibu Creek down to Malibu Lagoon which could cause local flooding in the City of Malibu. Specifically it is projected that Cross Creek Road Bridge would be overflowed by 1.8 feet and areas of Malibu Lagoon would face rising water levels from 1 to 2 feet (Source: CA Department of Water Resources (DWR), Division of Safety of Dams (DSOD) and Malibu Lake Mountain Club and Mead & Hunt).

Map 87: Malibu Lake Inundation Map

Map 88: Malibu Lake Inundation Timeline Map of Malibu Lagoon

Flood Maps and Flood Insurance Studies

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The National Flood Insurance Program (NFIP) was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and sound floodplain management. NFIP regulations (44 Code of Federal Regulations Chapter 1, Section 60, 3) require that all new construction in floodplains must be elevated at or above base flood level. Furthermore, the Las Virgenes-Malibu Council of Government cities have municipal codes that provide for the protection of residential and non-residential structures in Flood Hazard areas.



Map 89: FEMA 100-Year Floodplain Map

Source: CA.gov

Flood Insurance Rate Maps (FIRM)

A Flood Insurance Rate Map (FIRM) is an official map produced by FEMA which delineates communities where NFIP regulations apply. FIRMs are used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply (see **Annex F Flood Insurance Rate Maps** section for maps of each city).

FIRMs combine water surface elevations with topographic data to illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases, they also include base flood elevations (BFEs) and areas located within the 500-year floodplain. Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. However, it is important to note that these studies and maps represent flood risks at a point in time and do not incorporate subsequent floodplain changes due to new development or other changes in the geography of the area.

FIRM Revisions and Amendments

The following revisions and/or amendments were made to the FIRMs for the LVMCOG since 2018:

Agoura Hills

<table>
<tr><th>Reference No.</th><th>Date</th><th>FIRM Change Description</th></tr>
<tr><td>18-09-0469P-065072
FIRM 06037C1244F</td><td>5/18/2018</td><td>Medea Creek from approximately 640 feet downstream of Kanan Road to approximately 80 feet downstream of Kanan Road the following revisions were implemented:
<table>
<tr><th>Effective Flooding</th><th>Revised Flooding</th><th>Increases</th><th>Decreases</th></tr>
<tr><td>Zone A</td><td>Zone AE</td><td>YES</td><td>NO</td></tr>
<tr><td>No BFEs*</td><td>BFEs</td><td>YES</td><td>NO</td></tr>
<tr><td>Zone AE</td><td>Zone AE</td><td>YES</td><td>YES</td></tr>
<tr><td>BFEs*</td><td>BFEs</td><td>YES</td><td>YES</td></tr>
</table>
*Base Flood Elevations</td></tr>
<tr><td>18-09-0955P-065043
FIRM 06037C1244F</td><td>5/02/2018</td><td>Medea Creek from approximately 4,100 feet downstream of Silver Creek Road to approximately 1,100 feet upstream of Silver Creek Road Letter of Map Revision (LOMR) received to partially reissue the LOMR dated 9/30/2013which revised the Special Flood Hazard Area (SFHA) which incorporated an update to FIRM panel 06037C1244F.</td></tr>
</table>

Table 157: FEMA Flood Map Revisions - Agoura Hills

Calabasas and Hidden Hills

Due to their close proximity and downstream impacts, the revisions to the FIRMs for the cities of Calabasas and Hidden Hills have been combined.

<table>
<tr><th>Reference No.</th><th>Date</th><th>FIRM Change Description</th></tr>
<tr><td>21-09-0727P-060137
FIRM 06037C1267F</td><td>3/21/2022</td><td>Unnamed tributary to Arroyo Calabasas.
<table>
<tr><th>Effective Flooding</th><th>Revised Flooding</th><th>Increases</th><th>Decreases</th></tr>
<tr><td>No BFEs*</td><td>Depths</td><td>YES</td><td>NONE</td></tr>
<tr><td>Zone A</td><td>Zone X</td><td>NONE</td><td>YES</td></tr>
<tr><td>Zone X</td><td>Zone AO</td><td>YES</td><td>NONE</td></tr>
</table>
*Base Flood Elevations</td></tr>
<tr><td>21-09-0727P-060125
FIRM 06037C1267F</td><td>3/21/2022</td><td>Unnamed tributary to Arroyo Calabasas from approximately 850 feet downstream to approximately 2,600 feet upstream of Orville Avenue.
<table>
<tr><th>Effective Flooding</th><th>Revised Flooding</th><th>Increases</th><th>Decreases</th></tr>
<tr><td>No BFEs*</td><td>Depths</td><td>YES</td><td>NONE</td></tr>
<tr><td>Zone A</td><td>Zone AO</td><td>YES</td><td>YES</td></tr>
<tr><td>Zone X</td><td>Zone AO</td><td>YES</td><td>NONE</td></tr>
<tr><td>Zone A</td><td>Zone X</td><td>NONE</td><td>YES</td></tr>
</table>
*Base Flood Elevations</td></tr>
<tr><td>18-09-1642P-060125
FIRM 06037C1267F</td><td>3/18/2020</td><td>Unnamed tributary to Arroyo Calabasas an area approximately 580 feet north east of the intersection of Long Valley Road and Twin Oaks Road.
<table>
<tr><th>Effective Flooding</th><th>Revised Flooding</th><th>Increases</th><th>Decreases</th></tr>
<tr><td>Zone A</td><td>Zone AO</td><td>YES</td><td>YES</td></tr>
<tr><td>No BFEs*</td><td>Depths</td><td>YES</td><td>NONE</td></tr>
</table></td></tr>
</table>

Reference No.	Date	FIRM Change Description
		*Base Flood Elevations
17-09-0821P-060749 FIRM 06037C1269F FIRM 06037C1267F	2/05/2018	McCoy Canyon Creek from approximately 270 feet upstream of Calabasas Road to approximately 1,830 feet upstream of Calabasas Road. **Effective Flooding** / **Revised Flooding** / **Increases** / **Decreases** Zone X / Zone AE / YES / NONE No BFEs / BFEs / YES / NONE *Base Flood Elevations

Table 158: FEMA Flood Map Revisions - Calabasas and Hidden Hills

Malibu

Reference No.	Date	FIRM Change Description
23-09-0599P-060745 FIRMS : 06037C1511G 06037C1562G 06037C 1561G 06037C1543G 06037C1542G 06037C1541G 06037C1539G 06037C1538G 06037C1537G 06037C1536G 06037C1519G 06037C1513G 06037C1514G	04/21/2021	Pacific Ocean - From approximately 1,660 feet east of the intersection of Broad Beach Road and Victoria Point Road to approximately 670 feet east of the intersection of Broad Beach Road and State Route 1; From just west of to approximately 1,600 feet east of the intersection of Escondido Beach Road and State Route 1; From approximately 400 feet west to approximately 1,150 feet east of the intersection of Latigo Shore Place and Latigo Shore Drive; From approximately 560 feet west of the intersection of Corral Canyon Road and State Route 1 to approximately 440 feet east of the intersection of Puerco Canyon Road and State Route 1; From approximately 700 feet west of the intersection of Malibu Road and Malibu Colony Drive to just east of the intersection of Serra Road and State Route 1; From approximately 390 feet east of the intersection of Rambla Vis to approximately 1,290 feet west of the intersection of State Route 1 and Topanga Canyon Lane. **Effective Flooding** / **Revised Flooding** / **Increases** / **Decreases** BFEs* / BFEs / YES / YES Zone VE / Zone VE / YES / YES Zone VE / Zone VE / YES / YES Zone VE / Zone VE / YES / YES *Base Flood Elevations

Table 159: FEMA Flood Map Revisions – Malibu

On February 27, 2023 Malibu City staff presented the Council with an update on the New FEMA Floodplain maps that were approved by FEMA. The new FEMA floodplain maps will become effective 120 days after FEMA has notified the public through publication. The City completed a final analysis of 14 separate cross sections within the City and concluded that flood levels in the FEMA April 14, 2021 revised flood maps should be lower. FEMA preliminary approved the revisions and will create new revised maps.

Approximately Western Extent	Old Base Flood Elevation (BFE)	New BFE	Change (feet)
31340 Broad Beach Rd	31	25	-6
Escondido Canyon	23	21	-2
26770 Latigo Shore Dr	20	19	-1
26122 E Pacific Coast Hwy	20	13	-7

Approximately Western Extent	Old Base Flood Elevation (BFE)	New BFE	Change (feet)
25442 Malibu Rd	31	24	-7
25302 Malibu Rd	31	29	-2
23832 Malibu Rd	19	18	-1
21756 E Pacific Coast Hwy	19	18	-1
21200 E Pacific Coast Hwy	20	19	-1
20806 E Pacific Coast Hwy	21	19	-2
20624 E Pacific Coast Hwy	21	19	-2
19936 E Pacific Coast Hwy	25	22	-3
19600 E Pacific Coast Hwy	28	27	-1
19252 E Pacific Coast Hwy	24	23	-1

Table 160: FEMA Flood Map Revision Update - Malibu

Westlake Village

No revisions to the FIRMs were made since 2018 however several amendments were implemented.

<table>
<tr><th>Reference No.</th><th>Date</th><th>FIRM Change Description</th></tr>
<tr><td>21-09-1113A-060744
FIRM : 06037C1239G</td><td>05/19/2021</td><td>Amendment: Lot 16 Tract 46039
<table>
<tr><th>Outcome</th><th>Flood Zone</th><th>1% Annual Chance Flood Elevation</th><th>Lowest Adjacent Grade Elevation</th></tr>
<tr><td>Structure</td><td>X (unshaded)</td><td>-</td><td>851.1 feet</td></tr>
</table>
Structure removed from the SFHA. A portion of this property is located within the Special Flood Hazard Area and the National Flood Insurance Program (NFIP) regulatory floodway for the flooding source indicated on the Determination/Comment Document while the subject of this determination is not. Flooding Source: Triunfo Creek</td></tr>
<tr><td>20-09-2091A-060744
FIRM : 06037C1239G</td><td>12/07/2020</td><td>Amendment: Lot 17 Tract 46039
<table>
<tr><th>Outcome</th><th>Flood Zone</th><th>1% Annual Chance Flood Elevation</th><th>Lowest Adjacent Grade Elevation</th></tr>
<tr><td>Structure</td><td>X (unshaded)</td><td>-</td><td>849.0 feet</td></tr>
</table>
Using the information submitted and the effective National Flood Insurance Program (NFIP) map, we have determined that the structure(s) on the property(ies) is/are not located in the SFHA, an area inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood). This document amends the effective NFIP map to remove the subject property from the SFHA located on the effective NFIP map; therefore, the Federal mandatory flood insurance requirement does not apply. However, the lender has the option to continue the flood insurance requirement to protect its financial risk on the loan. A Preferred Risk Policy (PRP) is available for buildings located outside the SFHA. Information about the PRP and how one can apply is enclosed. Flooding Source: Triunfo Creek</td></tr>
</table>

<table>
<tr><th>Reference No.</th><th>Date</th><th>FIRM Change Description</th></tr>
<tr><td>20-09-2072A-060744
FIRM : 06037C1239G</td><td>10/26/2020</td><td>Amendment: Lot 57 Tract 46039
<table>
<tr><th>Outcome</th><th>Flood Zone</th><th>1% Annual Chance Flood Elevation</th><th>Lowest Adjacent Grade Elevation</th></tr>
<tr><td>Structure</td><td>X (shaded)</td><td>-</td><td>846.5 feet</td></tr>
</table>
This document revises the effective NFIP map to remove the subject property from the NFIP regulatory floodway and the SFHA located on the effective NFIP map; therefore, the Federal mandatory flood insurance requirement does not apply. However, the lender has the option to continue the flood insurance requirement to protect its financial risk on the loan. A Preferred Risk Policy (PRP) is available for buildings located outside the SFHA. Flooding Source: Triunfo Creek</td></tr>
<tr><td>19-09-0387A-060744
FIRM : 06037C1239G</td><td>02/25/2019</td><td>Amendment: Lot 56 Tract 46039
<table>
<tr><th>Outcome</th><th>Flood Zone</th><th>1% Annual Chance Flood Elevation</th><th>Lowest Adjacent Grade Elevation</th></tr>
<tr><td>Structure</td><td>AE</td><td>845.7 feet</td><td>844.8 feet</td></tr>
</table>
Using the information submitted and the effective National Flood Insurance Program (NFIP) map, we have determined that the structure(s) on the property(ies) is/are located in the SFHA, an area inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood). Therefore, flood insurance is required for the property described above. The lowest adjacent grade elevation to a structure must be at or above the Base Flood Elevation for a structure to be outside of the SFHA. This determination is based on the flood data presently available. Flooding Source: Triunfo Creek</td></tr>
<tr><td>19-09-0334A-060744
FIRM : 06037C1239G</td><td>12/28/2018</td><td>Amendment: Lot 69 Tract 26936
<table>
<tr><th>Outcome</th><th>Flood Zone</th><th>1% Annual Chance Flood Elevation</th><th>Lowest Adjacent Grade Elevation</th></tr>
<tr><td>Structure</td><td>AE</td><td>877.1 feet</td><td>876.0 feet</td></tr>
</table>
This document provides the Federal Emergency Management Agency's determination regarding a request for a Letter of Map Amendment for the property described above. Using the information submitted and the effective National Flood Insurance Program (NFIP) map, we have determined that the structure(s) on the property(ies) is/are located in the SFHA, an area inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood). Therefore, flood insurance is required for the property described above. The lowest adjacent grade elevation to a structure must be at or above the Base Flood Elevation for a structure to be outside of the SFHA. Flooding Source: Westlake Lake</td></tr>
</table>

Table 161: FEMA Flood Map Amendments - Westlake Village

Estimated Impact of an Event

If major flooding were to occur, the consequences to local populations, employment, and housing could be significant. The table below provides the estimated impact of a disaster using a 1% loss baseline (see Community Profile section for detailed demographic and economic data).

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 1% Loss Occurs
Population*	20,362	23,410	2,182	10,915	8,081	650
Total City Employment	11,100	11,800	4.5	6,483	3,700	330
Economy** (in thousands)	$621,000	$1,011,348	N/A	$578,443	$576,306	$27,871
Total Owner-Occupied Units	5,861	6,010	603	3,395	2,492	184
Median Home Value	$857,700	$1,141,600	$2,000,000+	$2,000,000+	$1,029,100	More than $258M (based on an average home value of $1,405,680 x Total Owner Occupied Units Impacted)

Table 162: Estimated Population and Economic Loss of Floods

***Source U.S. Census Bureau 2021 American Community Survey 5-Year Estimate**

****2017 U.S. Economic Census (in thousands)**

Based on a 1% loss projection, approximately 650 people could be displaced or significantly impacted, and approximately 184 homes could be damaged or destroyed resulting in over $258 million in losses based on an average home value of $1,405,680 and damage to 184 owner occupied units (see Community Profile section for population, housing, and economic data).

Risk of Future Severe Winter Storm (including Flood)

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 4.57 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Severe Winter Storm (including Flood)	4.33	6	3	3.67	4.57

Risk of Future Tsunami

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 1.95 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Tsunami	1.67	1.67	2.25	3.67	1.95

FLOOD, TSUNAMI, STORM SURGE, AND SEVERE WINTER STORM VULNERABILITIES

The major concern regarding the impact on communities from flood events is the loss of life and property. Critical infrastructure failures are also a threat and may require days or weeks to repair. Similarly, the impact to business and industry can result in immediate and long term economic loss.

Property Loss

Extensive damage can be caused by flooding and landslide damage related to soil saturation from flood events. The type of property damage caused by flood events depends on the location, depth, and velocity of flood waters. Flood waters can wash buildings off foundations and sweep personal property downstream. For the cities within the LVMCOG residential, commercial, and public properties are subject to flood (see Annex F: Flood Insurance Rate Maps for specific areas at higher risk).

In addition, as a coastal community multiple properties in the City of Malibu are at risk from flooding from tsunami, storm surge, and/or severe winter storms. For example, numerous beach front properties are sometimes located very close to the surf line.

Map 90: Malibu Flood Insurance Rate Map, Panel 1511

Properties along the coast include private homes, businesses, and recreational areas including Malibu Lagoon. High surf can have a significant impact on these locations. Furthermore, storm run-off areas where mountain streams travel to the ocean are at risk of flood during severe storms.

Critical Infrastructure

Critical infrastructure can be damaged during floods especially when high water levels combine with flood debris. Damage can occur to water and sewer systems, electrical supplies, pipelines, transportation networks, emergency facilities, communications networks, and other essential sites. Furthermore, contamination of underground wells and reservoirs can impact local water supplies. Finally, flood waters and debris can overflow local storm water systems causing traffic disruptions and pose a hazard to the health of the local community. Furthermore, Pacific Coast Highway is the major transportation route and means of ingress/egress for the City of Malibu and sections of the highway are located very close to the shoreline.

Map 91: Malibu Coastline Example

Business and Industry

Flood events impact businesses by damaging property and interrupting access by employees, suppliers, and customers. Furthermore, a loss of utilities caused by flooding can prevent businesses and industry from functioning. In addition, local or regional flooding can result in lower worker productivity, disrupt traffic, and increase commute times. Moreover, multiple businesses in the City of Malibu are located along the coastline and are at greater risk of flooding from tsunami, storm surge, and/or severe winter storms. Also, many of these businesses in Malibu are dependent on tourism (e.g., hotels/rental housing, attractions, gift shops, restaurants, etc.) as well as ocean recreation and commerce such as boating, fishing, kayaking/wind sailing, surfing, and beach traffic.

FLOOD, TSUNAMI, STORM SURGE, AND SEVERE WINTER STORM HAZARD IDENTIFICATION MITIGATION STRATEGIES

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a Federal program created by Congress to mitigate future flood losses nationwide through sound, community-enforced building and zoning ordinances and to provide access to affordable, federally backed flood insurance protection for property owners. The NFIP is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act (NFIA) of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act (NFIRA) of 1994 and the Flood Insurance Reform Act (FIRA) of 2004.

The NFIP is administered by the Federal Emergency Management Agency (FEMA), a component of the U.S. Department of Homeland Security (DHS). In support of the NFIP, FEMA identifies flood hazard areas throughout the United States and its territories. Most areas of flood hazard are commonly identified on Flood Insurance Rate Maps (FIRMs). A FIRM is an official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community.

Areas not yet identified by a FIRM may be mapped on Flood Hazard Boundary Maps (FHBMs). Several areas of flood hazards are identified on these maps. One of these areas is the Special Flood Hazard Area (SFHA).

The SFHA is a high-risk area defined as any land that would be inundated by a flood having a 1-percent chance of occurring in a given year (also referred to as the base flood). The high-risk-area standard constitutes a reasonable compromise between the need for building restrictions to minimize potential loss of life and property and the economic benefits to be derived from floodplain development. Development may take place within an SFHA, provided that development complies with local floodplain management ordinances, which must meet the minimum Federal requirements. Flood insurance is required for insurable structures within high-risk areas to protect Federal financial investments and assistance used for acquisition and/or construction purposes within communities participating in the NFIP.

Flood is defined in the Standard Flood Insurance Policy (SFIP), in part, as: A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is your property) from overflow of inland or tidal waters, from unusual and rapid accumulation or runoff of surface waters from any source, or from mudflow.

The National Flood Insurance Act of 1968 allows FEMA to make flood insurance available only in those areas where the appropriate public body has adopted adequate floodplain management regulations for its flood-prone areas. Individual citizens cannot regulate building or establish construction priorities for communities. Without community oversight of building activities in the

floodplain, the best efforts of some to reduce future flood losses could be undermined or nullified by the careless building of others. Unless the community as a whole is practicing adequate flood hazard mitigation, the potential for loss will not be reduced sufficiently to affect disaster relief costs. Insurance rates also would reflect the probable higher losses that would result without local floodplain management enforcement activities.

Participation in the NFIP is based on an agreement between local communities and the Federal Government that states that if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses.

Each city within the Las Virgenes-Malibu Council of Governments participates in the National Flood Insurance Program (see FEMA Community Status Book Report: California table following) and the ongoing eligibility requirements are specified under 44CFR§59.21. Copies of current FIRMs are provided in **Annex F: Flood Insurance Rate Maps**.

CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date	Tribal
065072C	AGOURA HILLS	LOS ANGELES		03/04/86	04/04/18	03/04/86	No
060749#	CALABASAS	LOS ANGELES		12/2/80	12/21/18	03/10/93	No
060125#	HIDDEN HILLS	LOS ANGELES	04/23/76	09/07/84	(NSFHA)	09/07/84	No
060745#	MALIBU	LOS ANGELES		09/26/08	04/21/21	10/01/92	No
060744C	WESTLAKE VILLAGE	LOS ANGELES		09/26/08	04/04/18	10/1/92	No

Table 163: FEMA Community Status Book Report: California

Source: https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book

Note: A Non-Special Flood Hazard Area (NSFHA) is an area that is in a moderate-to-low risk flood zone (Zones B, C, X Pre- and Post-FIRM). An NSFHA is not in any immediate danger from flooding caused by overflowing rivers or hard rains. However, it's important to note that structures within a NSFHA are still at risk

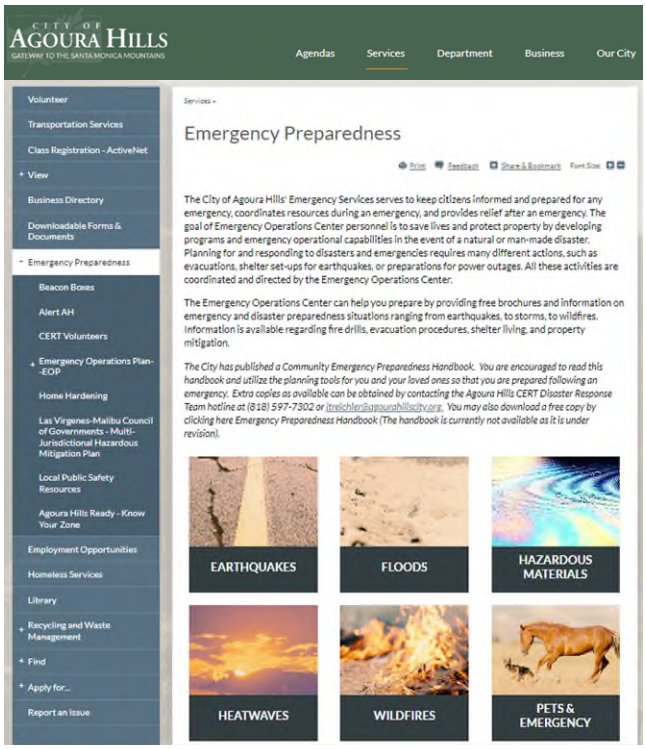
LVMCOG Mitigation Activities

Flooding is often a regional problem that crosses multiple jurisdictional boundaries. Flood risks are greatest and flood hazards most severe during the winter "wet season" when water bodies may become full and soils saturated. Although flooding is primarily a natural process and is therefore difficult to prevent, urbanization, land use, and development decisions have a significant effect on the frequency and severity of floods.

Flood mitigation activities include enforcement of building codes, zoning codes, and various planning strategies to address development in areas of known hazards and applying the appropriate safeguards. Furthermore, all cities within the Las Virgenes Malibu Council of Governments have assessed their flood hazards and participate in the National Flood Insurance Program (NFIP). The Los Angeles County Department of Public Works (LACDPW) is responsible for regional flood control within the County. Flood mitigation measures include an extensive storm drain and flood control system.

Agoura Hills

The City of Agoura Hills provides residents with flood facts via its web site. This includes general information and response guidance.

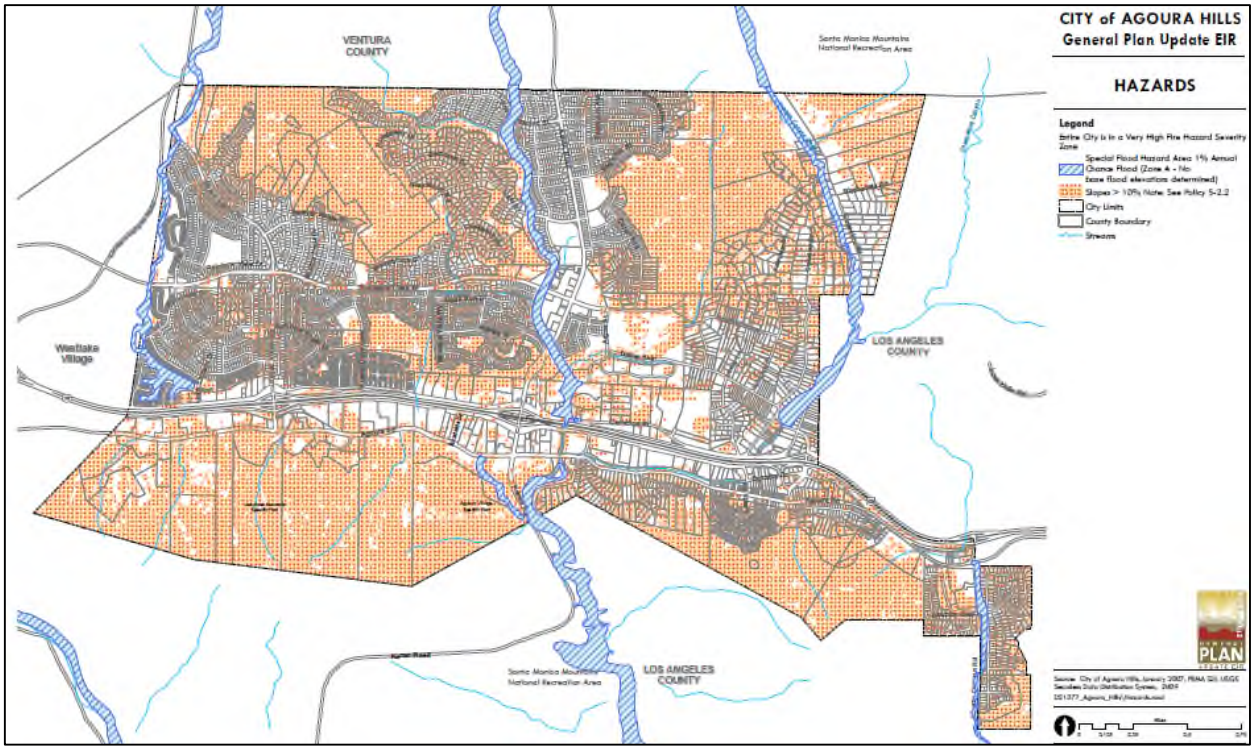


Further, the Los Angeles County Department of Public Works (LACDPW) presently owns and maintains three major flood control facilities in Agoura Hills. These facilities are the Lindero Canyon Channel, the Chesebro Canyon Channel, and parts of Medea Creek. Two major drainage channels not maintained by the LACDPW are the Palo Comado Canyon and Liberty Canyon. With the exception of the Palo Comado Canyon, these drainages are unchannelized or are maintained as semi-natural and are located in open space corridors.

- The Lindero Canyon Channel provides flood protection for the west drainage flow from Lindero Canyon. This canyon extends into Ventura Canyon, well beyond the City of Agoura Hills northerly boundary.
- The Chesebro Canyon Channel provides controlled drainage for the east drainage area of the City. Chesebro Canyon Channel intercepts the flows from Chesebro Canyon, and Palo Comado Canyon. Both canyons extend into Ventura Canyon, beyond the City of Agoura Hills northern boundary line.
- Medea Creek is partially improved between the Ventura Freeway and north to the Ventura County line. Medea Creek provides flood control protection for the central drainage area of the City. Medea Creek intercepts flow from Medea Creek Canyon, extending into Ventura County.

FEMA has identified several Special Flood Hazard Areas (SFHA) within Agoura Hills. Within these zones, the City of Agoura Hills enforces floodplain management standards as issued by FEMA. These standards are designed to prevent new development from increasing the flood threat and protect new and existing buildings from anticipated flood events.

Per FEMA, a SFHA is an area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM) Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE or V. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. For the purpose of determining Community Rating System (CRS) premium discounts, all AR and A99 zones are treated as non-SFHAs.



Map 92: City of Agoura Hills Flood Areas

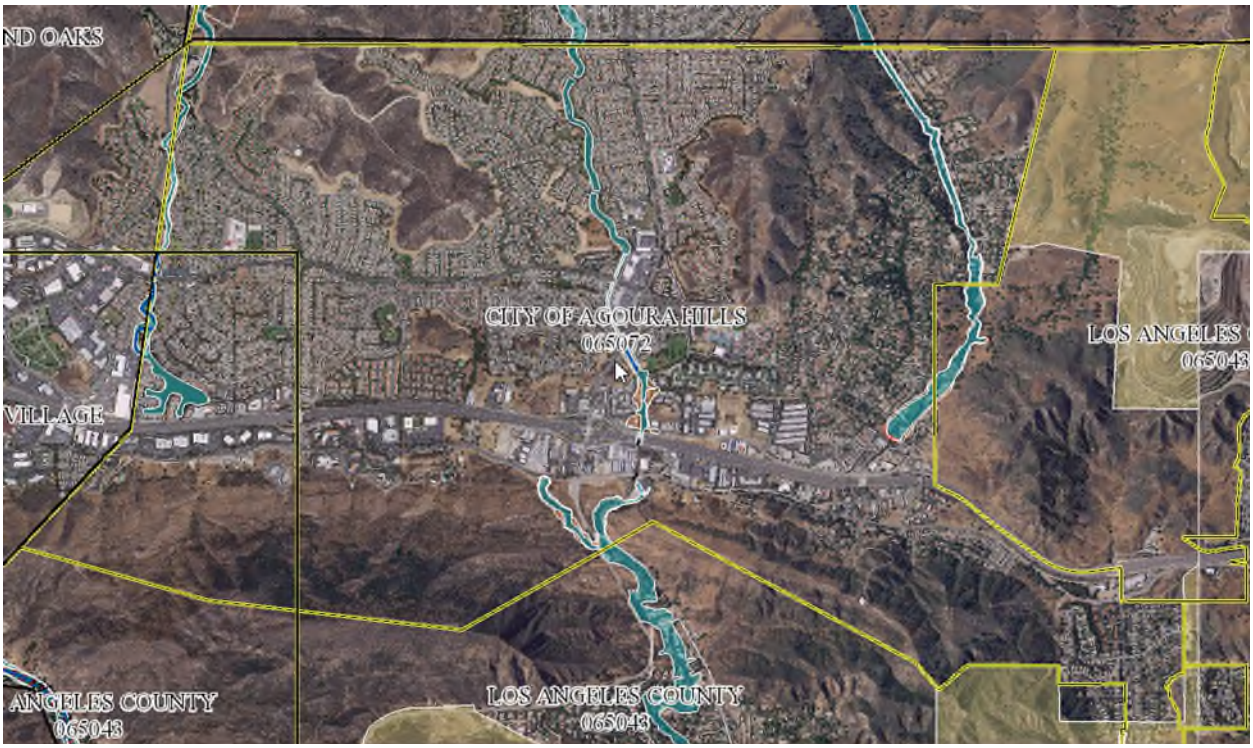
Source: City of Agoura Hills, General Plan 2035 EIR

Development under the City's General Plan could place structures within the SFHA, but not in a manner that would substantially impede or redirect flows. Adherence to development policies as well as state and federal regulations reduces the flood threat. Furthermore, as part of development project reviews, the City requires that a drainage plan and study be submitted, as appropriate. The following policies have been implemented in Agoura Hills. These policies guide the City in its continued compliance with NFIP guidelines and in reducing present and future flood hazards.

Policy	Description
S-1.1	**Coordination of Drainage Improvements**. Locate and improve deficiencies in the storm drain system to prevent local flooding problems in the City.
S-1.2	**New Development.** Require new development to upgrade storm drains to handle the increased runoff generated from the development sites.
S-1.3	**Facility Use or Storage of Hazardous Materials.** Require that all facilities storing, using, or otherwise involved with substantial quantities of on-site hazardous materials within flood zones comply with applicable standards of elevation, anchoring, and flood proofing, and that hazardous materials be stored in watertight containers.
S-1.4	**SEMS Plan.** Ensure that the City's Standardized Emergency Management System (SEMS) Plan is evaluated annually and revised as required, that the current mitigation strategies addressing flood hazards are implemented, and that effective public outreach and education are included.
S-1.5	**Preservation of the Flood Plains.** Preservation of the flood plains as open space shall be considered, as feasible, as an alternative to channelization.

Policy	Description
S-1.6	**Floodplain Requirements.** Regulate development within floodplains in accordance with the County, state, and federal requirements, and maintain the City's eligibility under the National Flood Insurance Program.
S-1.7	**Flood Mitigation Design.** Require that new development incorporates sufficient measures to mitigate flood hazards, including the design of on-site drainage systems linking with citywide storm drainage, grading of the site so that runoff does not impact adjacent properties or structures on the site, and elevation of any structures above any flooding elevation.

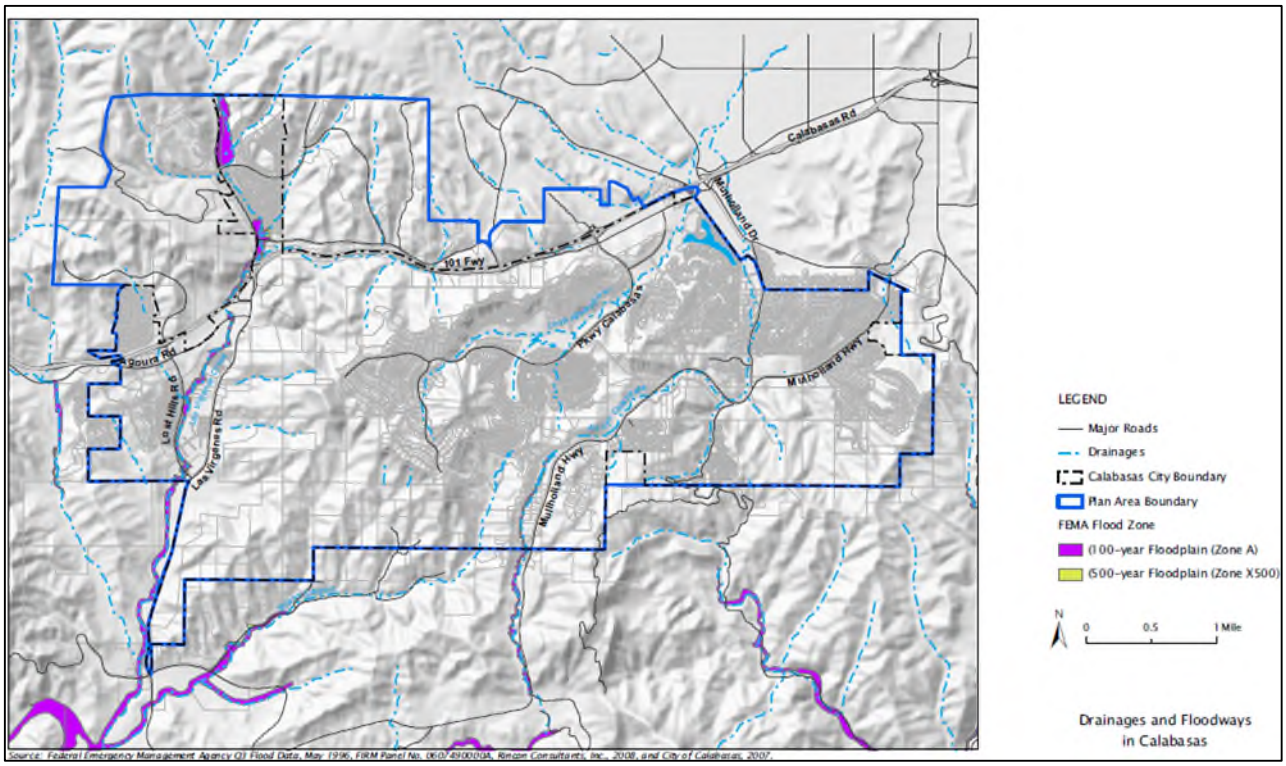
The map below provides a view of the Flood Insurance Rate Map area for the City of Agoura Hills. Flood Insurance Rate Maps (FIRM) are located in **Annex F**.



Map 93: City of Agoura Hills Flood Insurance Rate Map

Calabasas

Calabasas facilitates efforts with local, state, and federal agencies, including special districts to address flooding issues. Development is generally discouraged in flood-prone areas and individual developers in Calabasas are required to mitigate their potential contributions to downstream flooding problems. Any structures placed within the SFHA, will not be built in a manner that would substantially impede or redirect flows. Adherence to development policies as well as state and federal regulations reduces impacts from flooding in Calabasas to less than significant levels. The map below depicts FEMA designated flood zones in Calabasas. Small portions of western Calabasas (purple shaded areas) is within the 100-year floodplain; however, the majority of the City is not located within any designated Special Flood Hazard Areas.



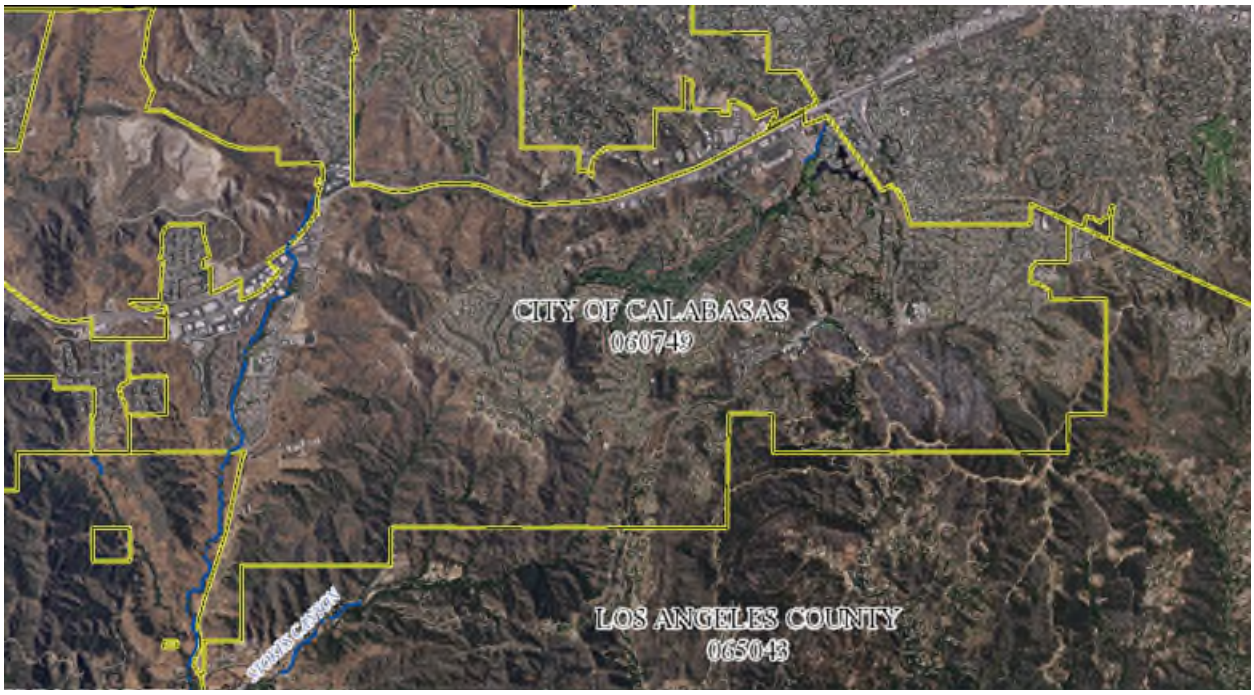
Map 94: Drainages and Floodways in Calabasas

The following policies are outlined in the 2030 City of Calabasas General Plan Safety Element. These policies guide the City in its continued compliance with NFIP guidelines and in reducing present and future flood hazards.

Policy	Description
VII-11	Incorporate adequate mitigation measures into proposed development projects to achieve an acceptable level of risk from potential flooding hazards. Mitigation measures should also address projected flooding impacts from climate change.
VII-12	Strongly discourage development within flood hazard areas and encourage retention of natural drainage as the City's preferred management strategy, and as a higher priority than attempting to implement engineering solutions.
VII-13	Ensure that new flood control and drainage facilities as well as improvements to existing facilities are consistent with the General Plan's environmental protection standards.

Policy	Description
VII-14	For discretionary development projects, limit new impervious surfaces to those that will not individually or cumulatively increase harmful runoff into natural stream channels downstream.
VII-15	Setbacks from stream beds should be sufficient to avoid possible adverse effects associated with future stream bank erosion.
VII-16	Whenever feasible, locate essential public facilities, including health care facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities, outside flood hazard zones.

The map below provides a view of the Flood Insurance Rate Map area for the City of Calabasas. Flood Insurance Rate Maps (FIRM) are located in **Annex F**.



Map 95: City of Calabasas Flood Insurance Rate Map ID

Hidden Hills

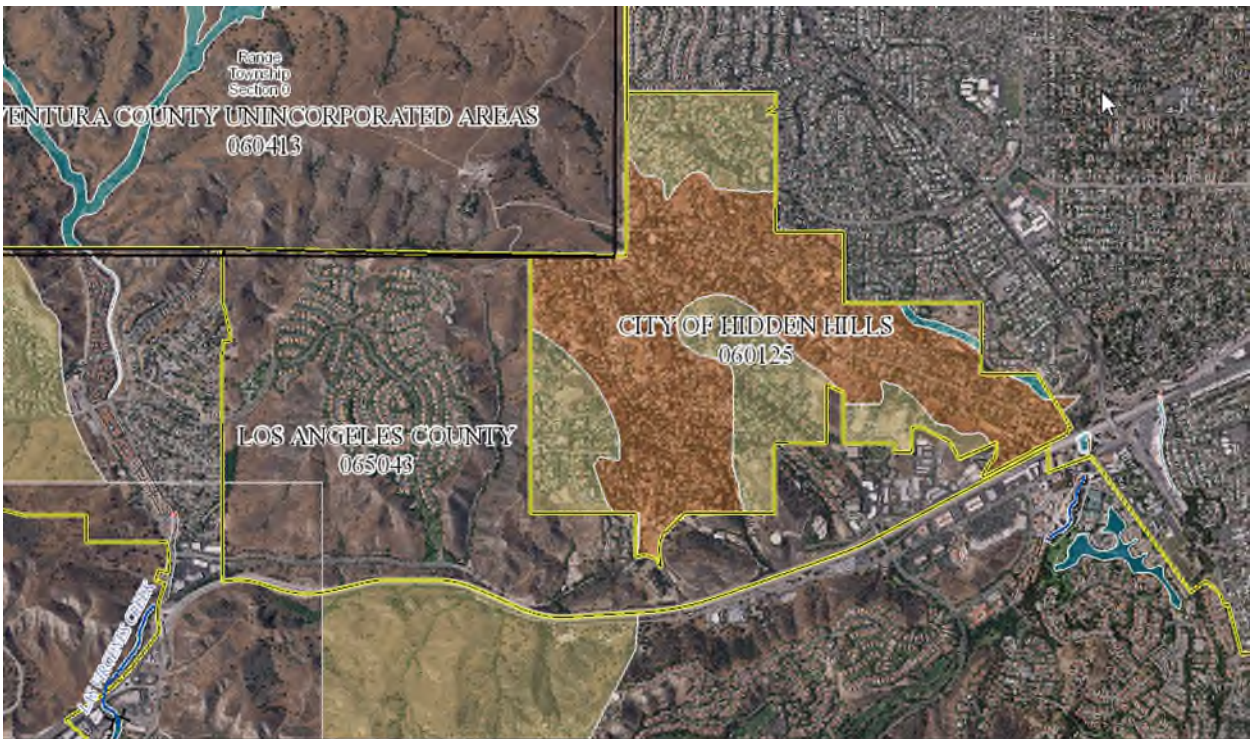
There are no year-round streams or ponds within the city. Surface water runoff only occurs during and after periods of intense rainfall. The City's topography and soil conditions subject Hidden Hills to flood hazards from storm drain overflow, erosion, mudflows, and debris deposits. There are no Special Flood Hazard Areas (SFHA) in the city of Hidden Hills. For this reason, there are no FEMA mandated floodplain management requirements to which Hidden Hills must adhere in order to participate in the NFIP.

Hidden Hills has implemented building code 3319.1 as a preventative measure for loss of life and property due to a flood event. Key Provisions of section 3319.1 include:

Category	Description
Building Limitations	Buildings are not permitted in an area determined by the City Engineer to be subject to flood hazard by reason of inundation, overflow or erosion, or where the placement of a building or other structures on the site is such that water or mud flows will be a hazard to buildings on adjacent property. The building official, in application of this subsection shall enforce, as a minimum, the current Federal Flood Plain Management Regulations defined in Title 44, Code of Federal Regulations, Section 60.3.
Site Restrictions	A person shall not perform work for which a building or grading permit is required within the boundaries of an established floodway, as determined by the City Engineer, if such work increases the flood hazard to adjacent properties by either increasing the capital flood water surface elevation, deflecting flows or increasing bank erosion. Such work may be performed within an established floodway and a building or grading permit therefore may be issued, where provisions are made to the satisfaction of the City Engineer to avoid such as increase in the flood hazard.
Los Angeles County Flood Control District	The Los Angeles County Flood Control District shall act as a consultant to the City Engineer in permit matters relating to flood control and flood hazard identification, avoidance and mitigation in all areas defined on maps furnished to the Engineer.

These standards are designed to prevent new development and site modifications from increasing the threat of flood and to protect new and existing buildings from future flood events.

The map below provides a view of the Flood Insurance Rate Map area for the City of Hidden Hills. Flood Insurance Rate Maps (FIRM) are located in **Annex F**



Map 96: City of Hidden Hills Flood Insurance Rate Map ID

Malibu

The City of Malibu is the only coastal community within the Las Virgenes-Malibu Council of Governments. The City extends 21 miles along the Pacific coast. In addition to its proximity to the Pacific Ocean, the City also contains multiple riparian zones that are subject to flood. Development under the City's General Plan could place structures within the SFHA, but not in a manner that would substantially impede or redirect flows. Adherence to development policies as well as state and federal regulations reduces impacts from flooding to less than significant levels.

FEMA has identified areas within Malibu as Special Flood Hazard Areas (SFHA). The map below provides a view of the Flood Insurance Rate Map zones for the City of Malibu. Flood Insurance Rate Maps (FIRM) are located in the **Annex F.**

Map 97: City of Malibu Flood Insurance Rate Map ID and Zones

All development, redevelopment, remodels and repairs in a mapped FEMA Flood Zone must meet FEMA and City of Malibu Floodplain Ordinance. All development projects submitted to the Planning Department will be reviewed by the Public Works Department to verify that the project will meet the FEMA Regulations and the City's Floodplain Ordinance. Some projects may be required to elevate the structure above the flood base flood elevation and execute a FEMA Elevation Certificate.

The following policies are outlined in the City of Malibu General Plan. These policies guide the City in its continued compliance with NFIP guidelines and in reducing present and future flood hazards.

General Plan Section	Description
Objective 1.2	Risks to residents and businesses from development in hazardous areas are minimized.
Policy 1.2.3	The City shall require development to provide for safety from coastal storm flooding, coastal erosion, surfacing septic effluent, and tsunami.
Policy 1.2.4	The City shall require development to be consistent with minimum Federal Management Agency (FEMA) guidelines for flood plain management.
Implementation Measure 40	Adopt and update as appropriate maps of extreme fire danger areas, 100-year flood plains, landslide and debris flow danger, active and potentially active faults, tsunami, and any other hazard areas; and inform residents of those areas of risks and possible mitigation measures.
Implementation Measure 43	Encourage area residents to participate in the National Flood Insurance Program.
Implementation Measure 44	Design coastal development, except supporting structure, to be above the wave uprush level for storms within the past 100-Years, and above the 100-year flood plain.
Implementation Measure 51	Evaluate proposed development for its impact on and from, geologic hazards, flood and mud flow hazard, and fire hazard.

In 2008 the City of Malibu received the Nation Weather Service "Storm Ready" Award. As a consequence, the City is eligible for NFIP premium reductions.

Tsunami Planning

To plan for and mitigate the impact of a tsunami to the general public, the City of Malibu has developed a tsunami information brochure and has designated several Tsunami Safe Areas and evacuation routes.

Tsunami Safe Areas
• Malibu Bluffs Park • Hughes Research Labs parking lot • Malibu Creek State Park • Salvation Army Camps (behind Tapia Park)
Evacuation Routes
• Topanga Canyon Blvd. • Malibu Canyon Road • Kanan Road • Encinal Canyon Road • Mulholland Highway

Table 164: City of Malibu Tsunami Safe Areas and Evacuation Routes

In 2021, the City of Malibu hosted a Tsunami Preparedness Week from March 22 to 26. In addition, on April 13, 2021 a presentation Los Angeles County was provided with update Tsunami Hazard Maps which included a 1,000 year event.

Finally, the City of Malibu web site provides the community with links to mitigation information including The Tsunami Zone California website or download the National Tsunami Hazard Mitigation Program (NTHMP) Tsunami Information Guide offered by the National Weather Service.

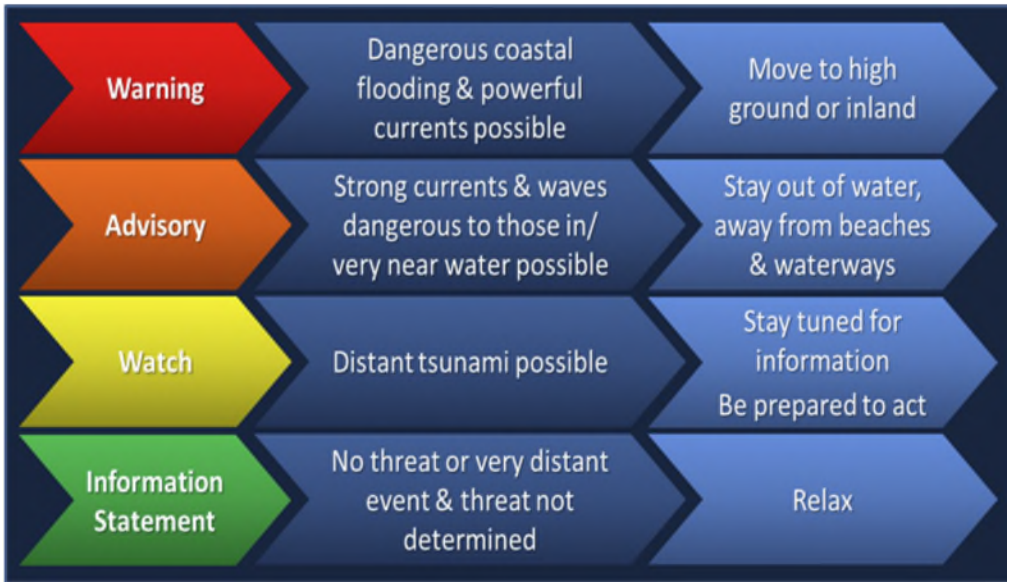


Figure 122: National Weather Service Tsunami Alert Categories

Westlake Village

Flood hazard areas within the City of Westlake Village are focused on the Triunfo Canyon drainage below Westlake Lake and the banks of the lake itself. A storm drain system has been constructed in the vicinity of the canyon to moderate the effects of storm runoff.

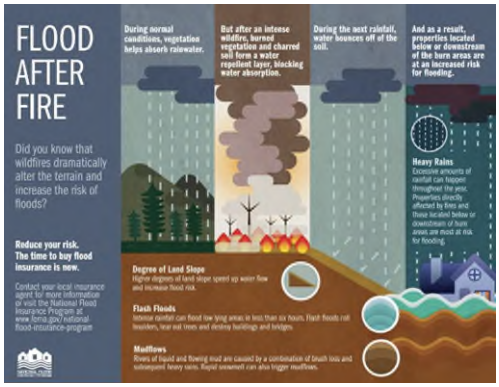
The Los Angeles County Flood Control District has prepared a Triunfo Creek Floodway Map (LACFCD 154-ML2, Ord. 81-0021), which defines the physical limits of the flood hazard and the minimum floor elevations required for structures outside the hazard area. Any development within the canyon will be subject to the review and approval of the District.

Development on the shores of Westlake Lake has been set back several feet from the highest water level which could be expected to occur. This setback is recognized as a flood hazard area and is maintained as open space. The "spillover" design of the Westlake Lake dam ensures that flooding beyond the lake's banks cannot occur.

Urban flooding can sometimes be possible due to debris accumulation on storm drains and in flood control channels and basins, over-burdened pumping stations and aged drainage systems. Low-lying areas are particularly susceptible to urban flooding.

There are no specific areas identified as frequent drainage problems. However, the general areas most susceptible are those around the Westlake Lake since this is the lowest elevation level in the City. These areas include First Neighborhood, Lakeshore, and Southshore.

In addition, the City of Westlake Village web site provides flood and mudflow preparation and mitigation guidance to residents following wildfires (such as post Woolsey Fire preparation). This information includes where to obtain sandbags; precautions for areas around flood control channels, catch basins, canyons and natural waterways; road hazards; burn debris removal; utilities (electrical and gas shutoffs); and flood insurance.



Further, the site provides links to social media sources for alerts and information:

Los Angeles County Fire Department (on "X")	Twitter @LACoFDPIO
Los Angeles County Sheriff Department (on "X")	Twitter @LASDHQ
Los Angeles County Public Works (on "X")	Twitter @LACoPublicWorks
City of Westlake Village	Facebook @CityofWestlakeVillage

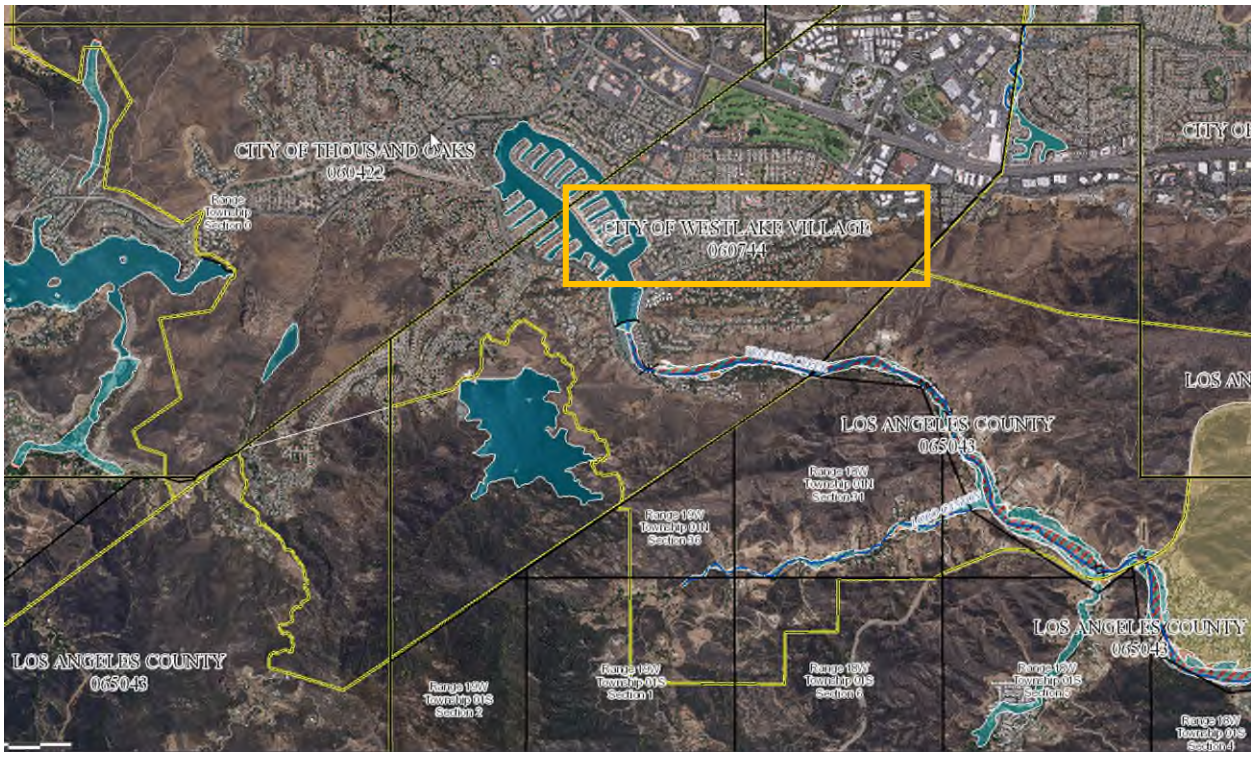
The City complies with program requirements through the adoption and implementation of a flood plain management ordinance, which is coordinated by the City Engineer. This ordinance requires new development to meet certain standards to reduce the risk of future flood damage. Implementation of the program on the local level ensures that flood insurance will be available to local residents.

The following goals, policies, and programs are outlined in the City of Westlake Village General Plan Hazards Section. The goals and policies described guide the City in its continued compliance with NFIP guidelines and in reducing present and future flood hazards.

General Plan Section	Description
Goal	It shall be the goal of the City of Westlake Village to: Minimize hazards to public health, safety, and welfare which may result from geologic conditions, seismic activity, and flooding.
Objective 1 and Policy	It shall be the objective of the City of Westlake Village to: Provide for an efficient and safe evacuation of the community in the event of a major disaster. It shall be the policy of the City of Westlake Village to: 1-1 Maintain an effective Citywide Emergency Preparedness Plan. 1-2 Encourage community volunteers to assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.
Objective 2 and Policy	It shall be the objective of the city of Westlake Village to: Ensure that construction and development activities within the community do not expose residents to avoidable natural hazards. It shall be the policy of the City of Westlake Village to: 2-1 Require the preparation of a detailed geologic and soils report to accompany each grading permit application in all hillside management areas. 2-2 Prohibit the placement of structures for human habitation within flood prone areas unless the flood hazard is eliminated by measures that do not impair the carrying capacity of the watercourse. 2-3 Enforce the provisions of the Uniform Building Code, specifically Chapters 23 and 70 as they related to earthquake-resistant design and excavation and grading.
Implementation Programs	I-1 Continue to update the Citywide Emergency Preparedness Plan as new information becomes available. I-2 Periodically distribute an updated pamphlet which informs individual residents of their responsibilities for emergency preparedness. I-3 Support training programs to train volunteers to assist police, fire protection and civil defense personnel during and after a seismic, fire or flooding event. I-4 Continue to implement the provisions of the Hillside Management ordinance and coordinate with the Los Angeles County Building and Safety Department so all applicable grading and development standards are implemented. I-5 Coordinate with the Los Angeles County Flood Control district to ensure that potential flooding hazards associated with proposed new development are fully mitigated. I-6 Coordinate with the Los Angeles County Building and Safety Department in the review of all development proposals, ensuring Chapters 23 and 70 of the Uniform Building Code are enforced.

FEMA has identified areas within Westlake Village as Special Flood Hazard Areas (SFHA), including Lindero Canyon which mostly lies within Agoura Hills. Within these zones Westlake Village has chosen to adopt and enforce minimum floodplain management standards as dictated by FEMA. These standards are designed to prevent new development from increasing the flood threat and to protect new and existing buildings from anticipated flood events.

The map below provides a view of the Flood Insurance Rate Map area for the City of Westlake Village. Flood Insurance Rate Maps (FIRM) are located in **Annex F**.



Map 98: City of Westlake Village Flood Insurance Rate Map ID

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SECTION 13. PANDEMIC

THE NATURE OF THE PANDEMIC THREAT

Oxford Languages defines a pandemic as a "widespread occurrence of an infectious disease over a whole country or the world at a particular time." According to Duke Global Health Institute, in any given year, there is a 2% chance of a major pandemic with effects similar to COVID-19 occurring.

Major Factors

While there have been significant advancements in health and medical technologies, according to the National Library of Medicine, major factors such as the frequency of international travel, climate change, ongoing human to animal contact, and urbanization contribute to an increased risk of pandemics happening in the future.

The Continuum of Pandemic Phases

The emergence of a pandemic can lead to various consequences, including higher healthcare demands, strained medical resources, economic disruptions, social impacts, loss of life and long-term disability. Given the continuing risk of a pandemic, the Centers for Disease Control and Prevention (CDC) have identified four phases of the pandemic continuum. In the risk assessment continuum below, there are three stages: "preparedness," "response," and "recovery." During the "preparedness" stage, global cases are lowest, representing the interpandemic phase. Cases rise significantly during the "alert" and "pandemic" phases. These phases overlap with the "response" stage. Subsequently, in the "transition" phase, cases decrease, coinciding with the "recovery" stage. A slight increase in cases during the "transition" phase suggests a potential second wave. Eventually, cases return to the original interpandemic levels, aligning with the "preparedness" stage.

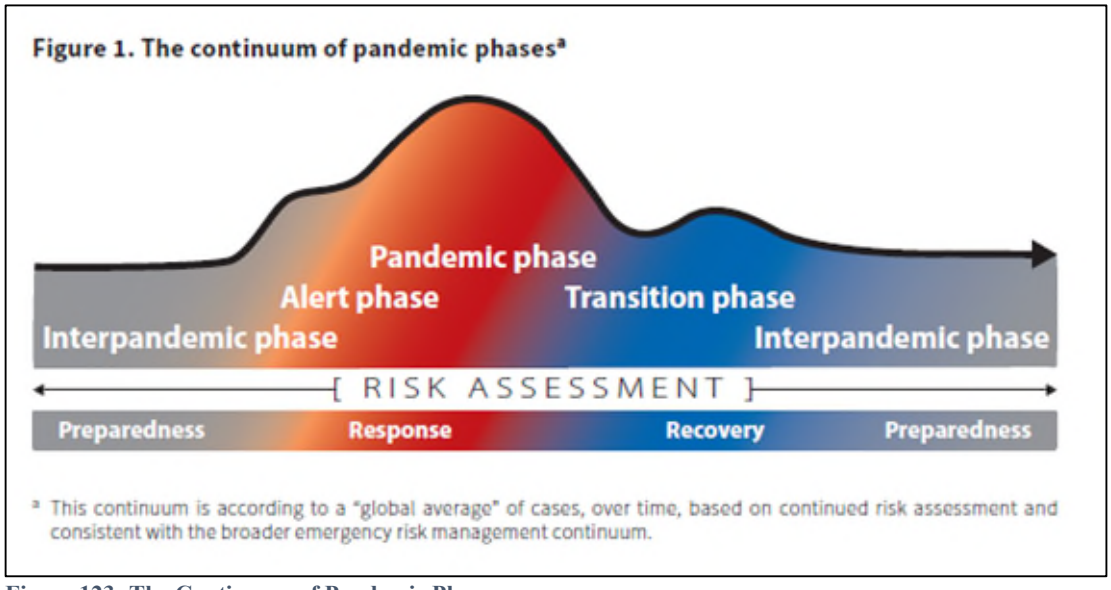


Figure 123: The Continuum of Pandemic Phases
Source: CDC (https://www.cdc.gov/flu/pandemic-resources/planning-preparedness/global-planning-508.html)

Phases of a Pandemic

Pandemics are comprised of 6 phases, according to the World Health Organization (WHO). The pandemic phases progress as follows: Phase 1 has no reported animal-to-human virus infections. In Phase 2, animal viruses infect humans, raising concerns. Phase 3 involves sporadic human cases but no widespread transmission. Phase 4 sees confirmed human-to-human transmission with community outbreaks. Phase 5 includes human-to-human spread in two countries in one WHO region. Finally, Phase 6 is the pandemic phase, which signifies global community-level outbreaks.

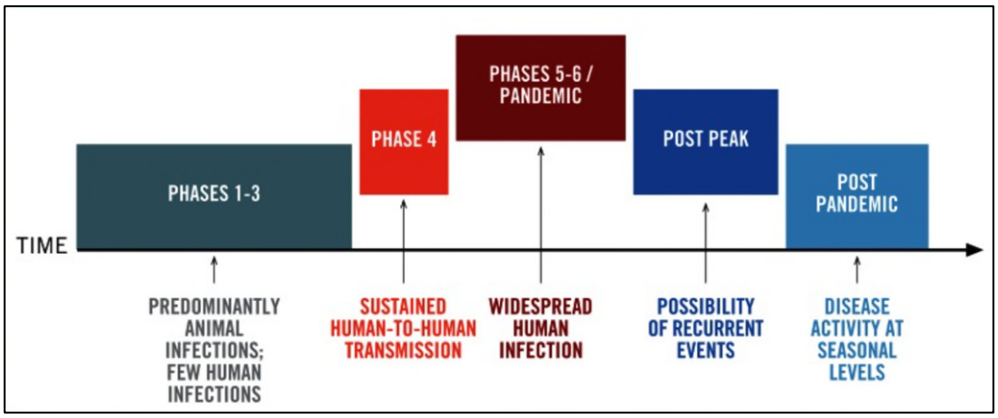


Figure 124: Phases of a Pandemic
Source: National Library of Medicine (https://www.ncbi.nlm.nih.gov/books/NBK143061/)

HISTORICAL RECORD OF WORLDWIDE PANDEMIC EVENTS

Numerous pandemics have occurred throughout history. The table below provides a summary of major worldwide pandemics.

Years	Pandemics	Pathogens	Vectors
2019-ongoing	COVID-19	SARS-CoV-2	Bats, pangolins?
2015-ongoing	Middle East Respiratory Syndrome (MERS)	MERS-CoV	Bats, dromedary camels
2009–2010	Swine Flu	Influenza A/H1N1	Pigs
2002–2003	Severe Acute Respiratory Syndrome SARS)	SARS-CoV	Bats, palm civets
1968–1970	Hong Kong Flu	Influenza A/H3N2	Avian
1961-ongoing	Seventh Cholera Pandemic	Vibrio cholerae	Contaminated water
1957–1959	Asian Flu	Influenza A/H2N2	Avian
1918–1919	Spanish Flu	Influenza A/H1N1	Avian
1899–1923	Sixth Cholera Pandemic	Vibrio cholerae	Contaminated water
1889–1893	Russian Flu	Influenza A/H3N8?	Avian?
1885–ongoing	Third Plague	Yersinia pestis	Fleas associated to wild rodents
1881–1886	Fifth Cholera Pandemic	Vibrio cholerae	Contaminated water
1863–1875	Fourth Cholera Pandemic	Vibrio cholerae	Contaminated water
1839–1856	Third Cholera Pandemic	Vibrio cholerae	Contaminated water
1827–1835	Second Cholera Pandemic	Vibrio cholerae	Contaminated water
1817–1824	First Cholera Pandemic	Vibrio cholerae	Contaminated water
1347–1351	Black Death	Yersinia pestis	Fleas associated to wild rodents
541–543	Plague of Justinian	Yersinia pestis	Fleas associated to wild rodents

Table 165: Pandemics Throughout History
Source: Pandemics Throughout History, Piret and Bolvin, 2021

CAUSES AND CHARACTERISTICS OF COVID-19

The Coronavirus disease (COVID-19), as defined by the World Health Organization (WHO), "is an infectious disease caused by the SARS-CoV-2 virus" which originated in China in 2019, spreading around the globe rapidly.

The virus primarily spreads through respiratory droplets, making close person-to-person contact a significant mode of transmission. It is characterized by a range of symptoms, including fever, cough, and difficulty breathing, with some cases progressing to severe respiratory distress. Additionally, COVID-19 exhibits a wide range of severity, from asymptomatic carriers to severe cases requiring intensive medical intervention.

Additionally, the COVID-19 pandemic has resulted in substantial disruptions worldwide due to the significant number of cases and associated fatalities. The table below provides the estimated number of cases and fatalities within the Las Virgenes-Malibu region. In comparison to the United States fatality rate (1.1%)[37], the LVMCOG Region has a lower fatality rate (-0.5%), suggesting variations in healthcare infrastructure, public health measures, or demographics.

City	Confirmed Cases	Reported Fatalities	% of Fatalities
Agoura Hills	6,429	29	0.5%
Calabasas	5,956	47	0.8%
Hidden Hills	390	2	0.5%
Malibu	2,927	15	0.5%
Westlake Village	457	3	0.7%
Total	**16,159**	**96**	**0.6%**

Table 166: Estimated COVID-19 Cases and Deaths within LVMCOG Region

** Source: City of Los Angeles Public Health (http://publichealth.lacounty.gov/media/coronavirus/locations.htm) (as of 9/7/23)

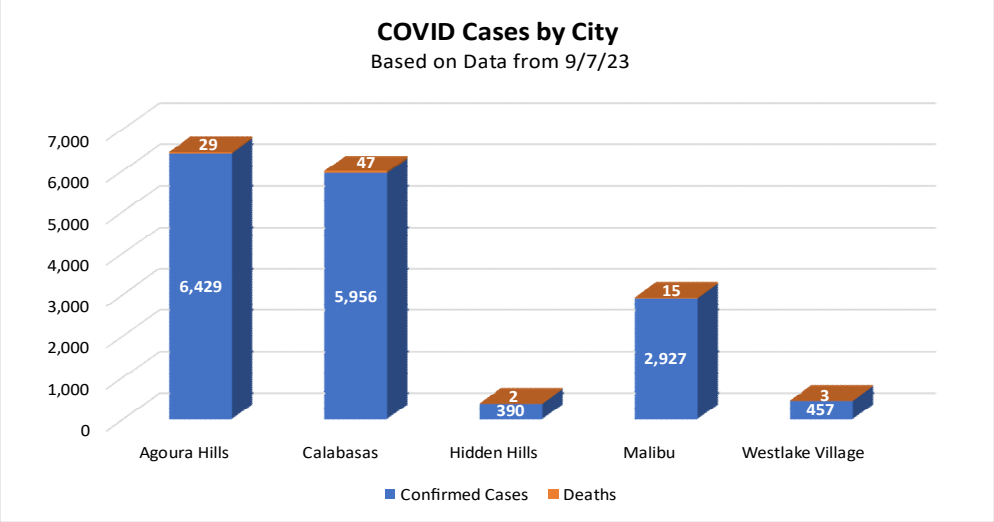


Figure 125: Covid-19 Cases by City

[37] WHO (https://covid19.who.int/) (as of 9/6/23)

PANDEMIC HAZARD IDENTIFICATION

World Health Organization (WHO) Declaration

The declaration of the beginning and end of a pandemic is typically made by the World Health Organization (WHO). The WHO assesses global health situations and provides recommendations based on epidemiological data and expert analysis. When a new infectious disease spreads internationally and poses a significant threat, the WHO may declare a pandemic. The declaration is based on criteria related to the geographic spread and severity of the disease.

White House Emergency Declaration

The President of the United States has the authority to declare a federal state of emergency. This declaration grants the President certain powers and allows for the allocation of federal resources and assistance to affected states or regions. It facilitates a coordinated response across federal, state, and local agencies to address the emergency effectively.

Centers for Disease Control and Prevention (CDC) Pandemic Declaration

The Centers for Disease Control and Prevention (CDC) is a key agency within the U.S. Department of Health and Human Services responsible for protecting public health and safety through the control and prevention of diseases, injuries, and disabilities. The CDC may issue a pandemic declaration based on its assessment of the global spread and severity of a disease. This declaration serves as a significant public health alert, triggering coordinated efforts at the national and international levels to combat the spread of the infectious disease. It often leads to the implementation of various containment and mitigation strategies to protect public health.

Federal Emergency Management Agency (FEMA)

FEMA, the Federal Emergency Management Agency, plays a critical role in pandemics by coordinating and supporting the federal government's response efforts. This includes allocating and distributing essential resources, issuing emergency declarations to unlock federal resources, and providing logistical support. They also facilitate communication and information sharing, conduct training and exercises, participate in strategic planning, and engage in community outreach and education. FEMA's overarching goal is to ensure a unified and efficient response to pandemics, working closely with federal, state, and local partners to safeguard public health and safety.

Governor Emergency Declaration

In California, the Governor is responsible for declaring a state of emergency in the state. This declaration grants the Governor certain powers to respond effectively to emergencies, such as natural disasters or public health crises. It allows for the mobilization of resources, coordination of agencies, and implementation of emergency measures to protect public safety and well-being. The decision to declare an emergency is based on an assessment of the situation's severity and the need for an organized and coordinated response.

Stay at Home Order

A stay-at-home order is typically issued by relevant public health authorities such as the Los Angeles County Department of Public Health, often in consultation with government officials. It is a directive aimed at limiting non-essential activities and movement of individuals within a specific region or jurisdiction. The goal is to reduce the spread of a contagious disease, such as a pandemic. This order may specify exceptions for essential activities like obtaining food, seeking medical care, or engaging in essential work. Compliance with the order is crucial in minimizing the impact of the public health crisis.

Estimated Impact of an Event

The consequences to local populations and employment of a pandemic is difficult to measure. However, it is anticipated that a severe pandemic will cause health problems, reduce economic output, and lead to unemployment. The table below provides the estimated impact of a disaster using an overall 20% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 20% Loss Occurs
Population*	20,362	23,410	2,182	10,915	8,081	12,990
65 Years and Older*	3,164	3,873	326	3,149	2,103	2,523
Total City Employment	11,100	11,800	4.5	6,483	3,700	6,618
Economy** (in thousands)	$621,000	$1,011,348	N/A	$578,443	$576,306	557,419

Table 167: Estimated Population and Economic Loss of a Pandemic

*U.S. Census – American Community Survey 2021
**2017 U.S. Economic Census (in thousands)

Based on a 20% loss projection, nearly 12,990 people could be impacted (either directly or indirectly) including over 2,500 people aged 65 years and older (high risk group) with potentially more than 6,600 jobs lost, either temporarily or permanently resulting in a negative economic impact of more than $557M.

Risk of Future Pandemic

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 7.18 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Pandemic	6	5.5	5.5	20	7.18

PANDEMIC VULNERABILITIES

Age

Over Age 65

Age represents a significant vulnerability in a pandemic. Older individuals, particularly those over the age of 65, are at higher risk of severe illness or death from infectious diseases. This demographic vulnerability necessitates targeted protective measures and healthcare resources. Long-term care facilities and nursing homes, where older populations often reside, require special attention to prevent outbreaks and ensure adequate care. Vaccination efforts should prioritize this demographic to reduce their vulnerability.

Children

In the case of influenza, according to the CDC[38], "Children younger than 5 years old–especially those younger than 2–are at higher risk of developing serious flu-related complications. Children of any age with certain chronic health conditions are also at higher risk; during the 2022-2023 flu season, 66 percent of children 0 to 17 years old hospitalized with flu had at least one underlying health condition, such as asthma, neurologic disease, obesity, or immune suppression."

Pregnancy

The CDC further notes that, "influenza is more likely to cause illness that results in hospitalization in pregnant people than in people of reproductive age who are not pregnant. Flu also may be harmful for a pregnant person's developing baby. A common flu symptom is fever, which has been associated in some studies with neural tube defects and other adverse outcomes for a developing baby."

[38] https://www.cdc.gov/flu/highrisk/children.htm

Any Age Group - Spanish Flu Example

As stated by the Cleveland Clinic, "from 1918 to 1919, the Spanish flu infected an estimated 500 million people globally. This amounted to about 33% of the world's population at the time. In addition, the Spanish flu killed about 50 million people. About 675,000 of the deaths were in the U.S. Just like the flu we get today, the Spanish flu was particularly harmful to infants under age 5 and people over the age of 65. One thing that was different about the Spanish flu was that it also killed a large number of healthy adults, aged 20 to 40 years."[39]

Business and Industry

A pandemic exposes vulnerabilities within the business and industrial sectors. Disruptions in supply chains, reduced consumer demand, and workforce (due to illness or quarantine measures) can significantly impact economic stability. Although business of any size are likely to be impacted, small businesses may face additional challenges. Industries reliant on physical presence, such as manufacturing, hospitality, and entertainment, are particularly vulnerable.

Healthcare System

The healthcare system faces extreme vulnerabilities during a pandemic. Sudden surges in patients can strain resources, leading to shortages of critical supplies, beds, and healthcare professionals. This can hinder the ability to provide optimal care, not only for COVID-19 patients but also for individuals with other medical needs. Moreover, healthcare workers themselves are at heightened risk of exposure.

Public Gatherings

Large gatherings present a significant vulnerability during a pandemic. Events such as conferences, concerts, and sports gatherings can serve as hotspots for viral transmission. Inadequate social distancing and limited adherence to preventive measures can increase the spread of a viral infection. Balancing societal and economic needs with public health measures becomes a critical challenge. Implementing restrictions on gatherings, promoting virtual alternatives, and enforcing safety protocols are vital strategies to mitigate this vulnerability.

Underlying Disease

Individuals with underlying health conditions, such as heart disease, diabetes, or respiratory conditions, are more susceptible to severe outcomes from a pandemic. These conditions can exacerbate the impact of the virus and increase mortality rates. Adequate healthcare support and targeted public health messaging are essential in protecting this vulnerable population. Additionally, vaccination campaigns and early detection and management of underlying conditions are crucial preventive measures.

[39] https://my.clevelandclinic.org/health/diseases/21777-spanish-flu

PANDEMIC HAZARD IDENTIFICATION MITIGATION STRATEGIES

National COVID-19 Preparedness Plan

The COVID-19 Preparedness Plan created by The White House aims to address the COVID-19 Pandemic, which includes measures for testing, vaccination, healthcare infrastructure, and public health initiatives.

Protect Against and Treat COVID-19

The first category, "Protect Against and Treat COVID-19," emphasizes the critical importance of vaccination. It prioritizes the administration of vaccines to all eligible individuals, with a specific focus on providing booster shots. Additionally, the plan calls for the widespread availability and accessibility of testing to facilitate early detection and containment of the virus. Equitable access to high-quality treatments for COVID-19 is also highlighted, ensuring that individuals receive the necessary care and support. The category underscores the need to equip hospitals and healthcare facilities with the resources and personnel required to effectively manage and treat COVID-19 cases.

Prepare for New Variants

The second category, "Prepare for New Variants," addresses the dynamic nature of the virus. It places a strong emphasis on genomic sequencing and surveillance to detect and monitor emerging variants. In the event of new variants, the plan calls for the development and deployment of targeted vaccines and treatments to effectively respond. International collaboration and coordination are crucial in this regard, with a focus on strengthening partnerships to collectively address challenges posed by global variants.

Prevent Economic and Educational Shutdowns

The third category, "Prevent Economic and Educational Shutdowns," emphasizes a balanced approach to public health measures. It aims to control outbreaks without resorting to widespread shutdowns of businesses and educational institutions. The plan provides support to these sectors, offering resources and guidance to ensure safe operations. Furthermore, economic relief measures are implemented to assist individuals and families facing challenges due to the pandemic, helping to maintain stability and resilience in the face of economic uncertainties.

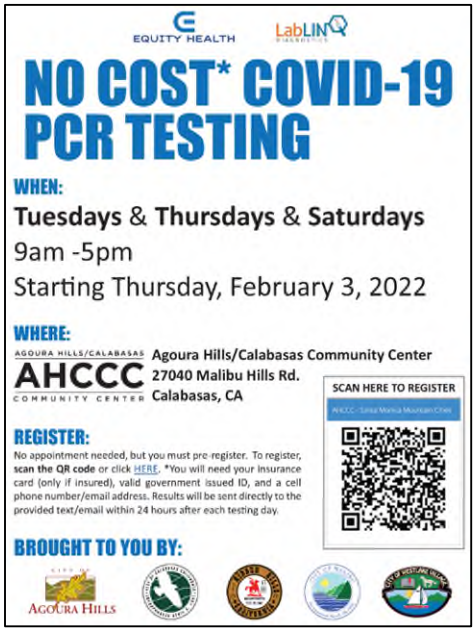
Continue to Vaccinate the World

The fourth category, "Continue to Vaccinate the World," highlights the significance of global vaccination efforts. It involves the acceleration of initiatives to share vaccine doses and support vaccine production on a global scale. The plan places an emphasis on building international partnerships and cooperation to address issues related to vaccine access and distribution. Additionally, efforts are directed towards strengthening vaccine manufacturing capacity in low- and middle-income countries, ensuring equitable access to vaccines for all populations worldwide.

LVMCOG Mitigation Activities

Las Virgenes-Malibu Council of Governments

In addition to the actions taken by individual cities, in 2022, the LVMCOG co-sponsored no cost COVID-19 testing for the community. Furthermore, as part of Los Angeles County, each city implemented the guidance issued by the Los Angeles County Department of Health as well as the mandates issued by the State of California.



Agoura Hills

The Agoura Hills website offers essential COVID-19 information. This encompasses details on getting fully vaccinated or receiving a booster, executive directives, rent relief information, following mask mandates, testing guidelines, obtaining complimentary rapid testing kits, and providing instructions for isolation in case of infection.

Calabasas

The Calabasas city website provides a range of COVID-19 information. This includes general details about the virus, statistics on cases and fatalities, vaccination guidance, executive directives, outreach initiatives, support for employees and businesses, as well as resources regarding eviction. Additionally, the city provides information about the L.A. County Great Plates Delivered Program, specifically tailored for senior residents.

Calabasas

The Hidden Hills city website includes a comprehensive array of COVID-19 resources. This includes links for: Vaccine Eligibility and Guidance, Testing Information, Details about the Tenant Relief Act, Health Resources, Reopening Guidelines, and Other Relevant General Information Regarding COVID-19.

Malibu

The City of Malibu is equipped and able to operate both a testing and vaccination site for future pandemics. During 2020 and 2021, the City partnered with local Urgent Care Centers and community volunteers to operate a regular testing site and a vaccination site. The relationships and capabilities that were created during that time remain intact and can be activated very quickly.

Westlake Village

The City of Westlake Village website provides a variety of COVID-19 information and vital resources about the virus, along with crucial resources like vaccination and testing information, local ordinances, support for businesses and workers, rental assistance, job loss aid, CDC travel advisories, and additional pertinent information. In addition, the city's ReadyWLV.org website provides ongoing news and information.

SECTION 14. TERRORISM AND MASS VIOLENCE

THE NATURE OF THE TERRORISM AND MASS VIOLENCE THREAT

Terrorism is a continuing threat throughout the world and within the United States. There is no history of terrorist acts or terrorist groups operating in the Las Virgenes Malibu Region. Consequently, the probability of a terrorist attack is considered low. Nevertheless, it is still important to consider the potential for terrorist activities especially since there are a variety of political, social, religious, cultural, and economic factors that underlie the broad term "terrorist". In addition, since terrorists often focus on high visibility targets and civilian populations, the potential consequences of an attack underscore the need to consider terrorism as part of this mitigation plan.

Furthermore, while Mass Violence events such as "Active Shooter" incidents are generally considered workplace or school focused and are criminal acts, they can also be considered forms of terrorism. There are specific characteristics that can link some Active Shooter cases to terrorism. Namely the targeting of vulnerable populations resulting in loss of life and an intent to intimidate. While the risk of Mass Violence events such as Active Shooter incidents is still considered low, including all forms of terrorism is an important component of a comprehensive mitigation plan.

HISTORY OF TERRORIST AND MASS VIOLENCE EVENTS IN THE LAS VIRGENES-MALIBU REGION

The Las Virgenes-Malibu Region has not experienced a terrorist act or incidence of mass violence; however, it does include a variety of important businesses, public sites, pipelines, electrical infrastructure, and high-profile individuals which could attract the attention of terrorists. In addition, there are multiple schools, shopping areas, public venues, and private businesses that could experience mass violence attacks. The consequences of a terrorist act or mass violence incident in the region could also impact the local area, e.g., disruption of CA 101, Pacific Coast Highway, local streets, etc. Furthermore, there is a possibility that extremist groups or lone attackers could operate from the area and use it as a base of operations for attacks elsewhere.

Specific Threats

Recent trends toward large scale incidents generating significant casualties make preparedness and the mechanisms for effective response essential. In addition to large scale attacks, a full range of assault styles must be considered. Terrorists or mass violence perpetrators may include a variety of methods including letter bombs, large-scale bombs, active shooter incidents, car or truck attacks, knife assaults, bio-chemical attacks, car bombs, suicide attacks, or hostage taking.

Venues likely to suffer the impact of terrorism or mass violence include government facilities, military facilities and recruiting offices, military suppliers, hospitals, entertainment and cultural facilities, religious centers, shopping malls, business complexes, movie theaters, public arenas, colleges, schools, and research centers.

Motivation

Conventional political motivation for terrorism continue, however issues involving organized crime, narcotics trafficking, ecological/animal rights, abortion/right-to-life groups, and perceived economic injustice can also involve terrorist groups or lone individual "Lone Wolf" planning, and operations. In addition, increased motivation may be attributed to the growing use of the Internet for terrorist recruitment, training, and communications as well as social media as outlets for mass violence perpetrators to publicize their activities and motivation.

CAUSES AND CHARACTERISTICS OF TERRORISM AND MASS VIOLENCE INCIDENTS

Terrorism

Defining Terrorism

There are multiple definitions of terrorism in common use. The United States Code defines terrorism as premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents usually intended to influence an audience. The United States Department of Justice defines terrorism as a violent act dangerous to human life, in violation of the criminal laws of the U.S. or any segment to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. The FBI defines terrorism as the unlawful use of force or violence against persons or property to intimidate or coerce government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

All three of these definitions share important components:

1. Criminal action
2. The action must include violence against civilians
3. The action is carried out in order to further political or social objectives
4. The action is intended to coerce a government or civilian population

Terrorism Hazard Identification

The categories below serve to differentiate terrorist organizations or individuals according to common goals and motivation. It should be noted that these categories of terrorism and terrorist groups are constantly changing. In addition, the "Lone Wolf" terrorism (individuals not connected to a terror cell or larger group, but who commit acts of public violence, often on behalf of a personal grievance) has added another dimension.

Category	Description
Separatist	Separatist groups are those with the goal of separation from existing entities through independence, political autonomy, or religious freedom or domination. The ideologies separatists subscribe to include social justice or equity, anti-imperialism, as well as the resistance to conquest or occupation by a foreign power.
Ethnocentric	Groups of this persuasion see race as the defining characteristic of a society, and therefore a basis of cohesion. There is usually the attitude that a particular group is superior because of their inherent racial characteristics.

Category	Description
Nationalistic	The loyalty and devotion to a nation, and the national consciousness derived from placing one nation's culture and interests above those of other nations or groups. This can find expression in the creation of a new nation or in splitting away part of an existing state to join with another that shares the perceived "national" identity.
Revolutionary	Dedicated to the overthrow of an established order and replacing it with a new political or social structure. Although often associated with communist political ideologies, this is not always the case, and other political movements can advocate revolutionary methods to achieve their goals
Political	Political ideologies are concerned with the structure and organization of the forms of government and communities. While observers outside terrorist organizations may stress differences in political ideology, the activities of groups that are diametrically opposed on the political spectrum are similar to each other in practice.
Religious	Religiously inspired terrorism is on the rise. While Islamic terrorists and organizations have been the most publicized, all of the major world religions have extremists that have taken up violence to further their perceived religious goals. Religiously motivated terrorists see their objectives as holy writ, and therefore infallible and non-negotiable
Social	Often particular social policies or issues will be so contentious that they will incite extremist behavior and terrorism. Frequently this is referred to as "single issue" or "special interest" terrorism. Some issues that have produced terrorist activities in the United States and other countries include animal rights, abortion, ecology/environment, and minority rights.
Domestic	These terrorists are "home-grown" and operate within and against their home country. They are frequently tied to extreme social or political factions within a particular society and focus their efforts specifically on their nation's socio-political arena.
International or Transnational	Often describing the support and operational reach of a group, these terms are often loosely defined, and can be applied to widely different capabilities. *International groups* typically operate in multiple countries but retain a geographic focus for their activities. Hezbollah has cells worldwide, and has conducted operations in multiple countries, but is primarily concerned with events in Lebanon and Israel. *Transnational groups* operate internationally, but are not tied to a particular country, or even region. Al Qaeda is transnational; being made up of many nationalities, having been based out of multiple countries simultaneously, and conducting operations throughout the world. Their objectives affect dozens of countries with differing political systems, religions, ethnic compositions, and national interests

Table 168: Terrorist Group Categories

Source: http://www.terrorism-research.com/groups/categories.php

International Terrorist Groups

International terrorist groups can operate anywhere and act without regard to national borders. U.S. Code Title 18 Part I, Chapter 113b § 2331 defines international terrorism as activities that:

(A) involve violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or of any State, or that would be a criminal violation if committed within the jurisdiction of the United States or of any State;

(B) appear to be intended:

(i) to intimidate or coerce a civilian population;

(ii) to influence the policy of a government by intimidation or coercion; or

(iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and

(C) occur primarily outside the territorial jurisdiction of the United States, or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to intimidate or coerce, or the locale in which their perpetrators operate or seek asylum

The U.S. State Department issues and maintains the Foreign Terrorist Organization (FTO) List which documents current threat groups. The current FTO is listed below:

1. Segunda Marquetalia
2. Revolutionary Armed Forces of Colombia – People's Army (FARC-EP)
3. ISIS-DRC
4. ISIS-Mozambique
5. Harakat Sawa'd Misr (HASM)
6. Asa'ib Ahl al-Haq (AAH)
7. Islamic Revolutionary Guard Corps (IRGC)
8. Jama'at Nusrat al-Islam wal-Muslimin (JNIM)
9. al-Ashtar Brigades
10. ISIS in the Greater Sahara (ISIS-GS)
11. ISIS-West Africa
12. ISIS-Philippines
13. ISIS-Bangladesh
14. Hizbul Mujahideen (HM)
15. al-Qa'ida in the Indian Subcontinent (AQIS)
16. ISIS-Libya
17. Islamic State's Khorasan Province (ISIS-K)
18. Jaysh Rijal al-Tariq al Naqshabandi (JRTN)
19. al-Nusrah Front, aka Hay'at Tahrir al-Sham (ANF/HTS)
    — Jabhat Fath al-Sham Amendment (November 14, 2016)
    — Hay'at Tahrir al-Sham Amendment (June 1, 2018)
20. ISIS-Sinai Province (formerly Ansar Bayt al-Maqdis)
    — ISIL Sinai Province Amendment (September 30, 2015)
21. Ansar al-Shari'a in Benghazi
22. Ansar al-Shari'a in Darnah
23. Ansar al-Shari'a in Tunisia
24. al-Mulathamun Battalion, aka al-Murabitoun
25. Ansaru
26. Boko Haram
27. Ansar al-Dine (AAD)
28. Haqqani Network (HQN)
29. Abdallah Azzam Brigades
    — Marwan Hadid Brigades Amendment (November 2, 2017)
30. Jemaah Anshorut Tauhid (JAT)
31. Indian Mujahedeen (IM)
39. al-Shabaab
    — al-Hijra Amendment (August 1, 2018)
40. Harakat ul-Jihad-i-Islami/Bangladesh (HUJI-B)
41. Islamic Jihad Union (IJU)
42. ISIS (formerly al-Qa'ida in Iraq)
    — Islamic State of Iraq Amendment (January 26, 2012)
    — al-Hayat Media Center and Amaq News Agency Amendments (March 22, 2019)
43. Continuity Irish Republican Army (CIRA)
44. Ansar al-Islam (AAI)
45. Lashkar i Jhangvi (LJ)
46. Jemaah Islamiya (JI)
47. Communist Party of the Philippines/New People's Army (CPP/NPA)
48. al-Qa'ida in the Islamic Maghreb (formerly Salafist Group for Call and Combat)
    — AQIM Amendment (February 20, 2008)
49. Asbat al-Ansar (AAA)
50. Al-Aqsa Martyrs Brigade (AAMB)
51. Lashkar-e-Tayyiba (LeT)
    — Tehrik-e-Tahafuz Qibla Awwal, Tehrik-e-Hurmat-e-Rasool, and Al-Anfal Trust Amendments (June 26, 2014)
    — Al Muhammadia Students Amendment (December 30, 2016)
    — Tehreek-e-Azadi-e-Kashmir and Milli Muslim League Amendments (April 4, 2018)
52. Jaish-e-Mohammed (JEM)
53. New Irish Republican Army (formerly Real IRA)
    — New IRA Amendment (June 30, 2023)
54. Islamic Movement of Uzbekistan (IMU)
55. al-Qa'ida (AQ)
56. Abu Sayyaf Group (ASG)
57. HAMAS
58. Harakat ul-Mujahidin (HUM)
    — Ansar ul-Ummah Amendment (August 8, 2014)
59. Hizballah
60. Kurdistan Workers Party (PKK)
61. Liberation Tigers of Tamil Eelam (LTTE)
62. National Liberation Army (ELN)

32. Army of Islam (AOI) 33. Jaysh al-Adl (formerly Jundallah) — Jaysh al-Adl Amendment (July 2, 2019) 34. Tehrik-e Taliban Pakistan (TTP) 35. Harakat ul-Jihad-i-Islami (HUJI) 36. al-Qa'ida in the Arabian Peninsula (AQAP) — Ansar al-Shari'a Amendment (October 5, 2012) 37. Kata'ib Hizballah (KH) 38. Revolutionary Struggle (RS)	63. Palestine Liberation Front (PLF) 64. Palestine Islamic Jihad (PIJ) 65. Popular Front for the Liberation of Palestine (PFLP) 66. PFLP-General Command (PFLP-GC) 67. Revolutionary People's Liberation Party/Front (DHKP/C) 68. Shining Path (Sendero Luminoso, SL)

Table 169: Foreign Terrorist Organizations

SOURCE: https://www.state.gov/foreign-terrorist-organizations/

International terrorist groups often have state sponsors who view terrorism as a tool of foreign policy. State sponsors of terrorism engage in anti-Western terrorist activities by funding, organizing, networking, and providing other support to many extremists.

Country	Designation Date
Cuba	January 12, 2021
Democratic People's Republic of Korea (North Korea)	November 20, 2017
Iran	January 19, 1984
Syria	December 29, 1979

Table 170: State Sponsors of Terrorism

Source: U.S. State Department

Domestic Terrorism in the United States

Domestic terrorism involves attacks within the United States perpetrated by homegrown groups or individuals. U.S. Code Title 18 Part I, Chapter 113b § 2331 defines domestic terrorism as activities that:

(A) involve acts dangerous to human life that are a violation of the criminal laws of the United States or of any State;
(B) appear to be intended—
  i. to intimidate or coerce a civilian population;
  ii. to influence the policy of a government by intimidation or coercion; or
  iii. to affect the conduct of a government by mass destruction, assassination, or kidnapping; and
(C) occur primarily within the territorial jurisdiction of the United States.

Domestic Extremist and Hate Groups

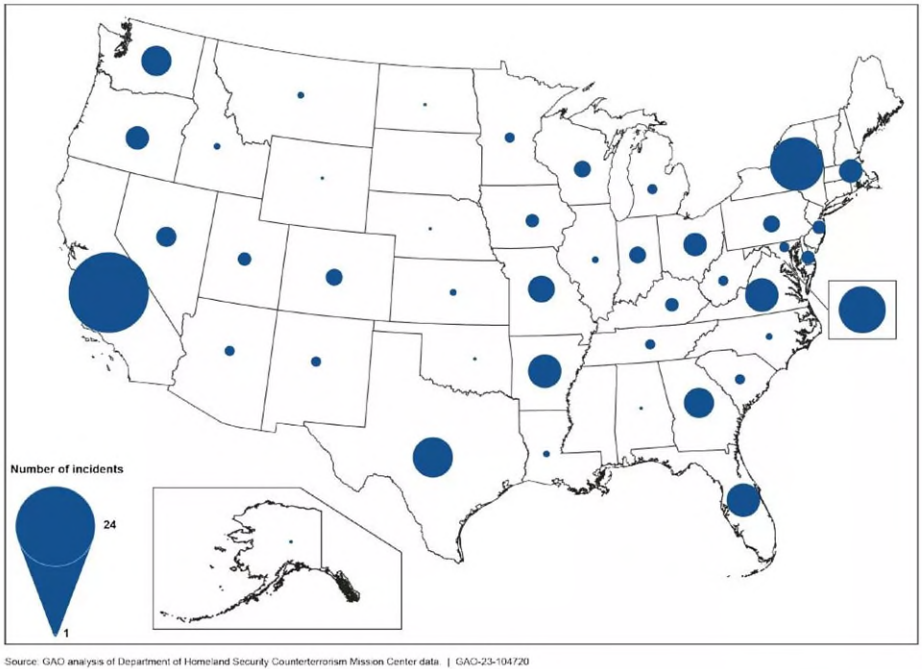
The U.S. Government Accountability Office (GAO) conducted an analysis of the Federal Bureau of Investigation (FBI) and Department of Homeland Security (DHS) documentation related to domestic terrorism and developed the following categories for the various threat groups currently operating in the U.S.

Threat Group Category	Definition
Racially or Ethnically Motivated Violent Extremism	Potentially unlawful use or threat of force or violence in furtherance of ideological agendas derived from bias, often related to race or ethnicity, held by the actor against others or a given population group. Such extremists purport to use both political and religious justifications to support their racially or ethnically-based ideological objectives and criminal activities.

Threat Group Category	Definition
Anti-Government Or Anti-Authority Violent Extremism	Potentially unlawful use or threat of force or violence in furtherance of ideological agendas derived from anti-government or anti-authority sentiment, including opposition to perceived economic, social, or racial hierarchies, or perceived government overreach, negligence, or illegitimacy.
Animal Rights/Environmental Violent Extremism	Potentially unlawful use or threat of force or violence in furtherance of ideological agendas by those seeking to end or mitigate perceived cruelty, harm, or exploitation of animals and/or the perceived exploitation or destruction of natural resources and the environment.
Abortion-Related Violent Extremism	Potentially unlawful use or threat of force or violence in furtherance of ideological agendas relating to abortion, including individuals who advocate for violence in support of either pro-life or pro-choice beliefs.
All Other Domestic Terrorism Threats	Potentially unlawful use or threat of force or violence in furtherance of ideological agendas which are not otherwise defined under or primarily motivated by one of the other domestic terrorism threat categories. Such agendas could flow from, but are not limited to, a combination of personal grievances and beliefs, including those described in the other domestic terrorism categories. Some actors in this category may also carry bias related to religion, gender, or sexual orientation.

Domestic Terrorist Incidents

According to the U.S. Government Accountability Office, "There were 231 incidents (meaning attacks or plots) that met the definition of domestic terrorism between 2010 and 2021, according to DHS. They occurred across the United States, but the greatest number of incidents occurred in states with major metropolitan areas—such as California (Los Angeles, San Diego, and San Francisco), New York (New York City), and Washington, DC."



Source: GAO analysis of Department of Homeland Security Counterterrorism Mission Center data. | GAO-23-104720

Figure 126: U.S. GAO - Domestic Terrorism Incidents by State, 2010 through 2021

The categories of incidents from 2010 to 2021 were led by Racially or Ethnically Motivated and Anti-Government / Anti-Authority Violent Extremists (RMVE).

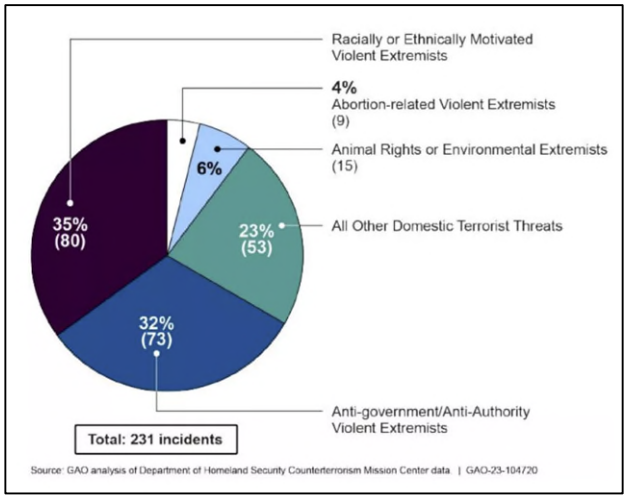


Figure 127: U.S. GAO - Domestic Terrorism-Related Incidents by Category, from 2010 through 2021

Domestic Terrorism / Hate Group Examples

Examples of domestic terrorist / hate group incidents include the following cases as reported by DHS:

- In March 2023, a RMVE driven by a belief in the superiority of the white race was arrested and charged with allegedly attempting to use an improvised incendiary device to burn down a church in Ohio that was planning to host a drag-themed event.
- In February 2023, two RMVEs driven by a belief in the superiority of the white race were arrested and are now awaiting trial for plotting an attack against electrical substations in Maryland. These arrests followed a series of recent attacks against electrical infrastructure, which some DVEs have praised and leveraged to call for more attacks on critical infrastructure.
- Since spring of 2022, alleged DVEs in Georgia have cited anarchist violent extremism, animal rights/environmental violent extremism, and anti-law enforcement sentiment to justify criminal activity in opposition to a planned public safety training facility in Atlanta. Criminal acts have included an alleged shooting and assaults targeting law enforcement and property damage targeting the facility, construction companies, and financial institutions for their perceived involvement with the planned facility.
- Meanwhile, foreign terrorists continue to use media to call for lone offender attacks in the West, condemn US foreign policy, and attempt to expand their reach and grow global support networks. Most recently, in January 2023, an individual from Maine who was inspired by a variety of foreign terrorist content was charged with federal crimes for an attack on New York City Police Department (NYPD) officers during New Year's Eve celebrations in Times Square.

Other examples of domestic terrorism events include:

Year	Event	Description
2013, April 15	Boston Marathon Bombing	Bombing at the Boston Marathon resulting in 3 deaths and several hundred injuries.
2010, February 18	Austin, Texas IRS Airplane Attack	Aircraft attack on an IRS office building by a believed anti-government / anti-corporate business extremist resulting in 1 death
2009, November 5	Fort Hood Shootings	Shooting attack of a believed Islamic extremist resulting in 13 deaths and 30 wounded
2009, May 31	Assassination of Dr. George Tiller	Murder of a nationally known physician that performed late-term abortions
2001 September 18 (start)	U.S. Anthrax Attacks	A series of letters containing anthrax spores lasting several weeks resulting in 5 deaths and 17 infections
1996, July 27	Centennial Olympic Park Bombing	1996 Summer Olympic bombing in Atlanta, GA resulting in 2 deaths and 111 injuries
1995, April 19	Oklahoma City Bombing	Truck bomb resulting in 168 people killed

Table 171: Domestic Terrorism Examples

Post 9/11

After September 11, 2001, the United States has increased its security policies and procedures at the national and local level. Since then, Federal Grants for counterterrorism have increased to approximately seventy-five billion dollars per year from federal and state governments according to Kim Murphy of Los Angeles Times in an article dated August 2011. These grants have provided local counties and cities funds to strengthen their security procedures, implement needed mitigation actions, or provide first responders with specialized training and equipment.

Weapons of Mass Destruction (WMD)

Weapons of Mass Destruction are a specific type of threat that must be considered by any community. For the Las Virgenes-Malibu Region, this may involve the activation of a WMD within the area or a large-scale attack in a nearby location. Consequently, ongoing awareness and training of local emergency responders, government, and healthcare providers is important to ensure that such events are quickly identified and managed.

Five Types of WMD That Could be Used by Terrorists

WMD can be segregated into five categories using the acronym B-NICE: Biological, Nuclear, Incendiary, Chemical and Explosive.

1. Four common types of biological agents are bacteria, viruses, rickettsia, and toxins.
2. Nuclear terrorism can occur in two different ways.
    a. Detonation or threat of detonation of a nuclear bomb
    b. Dispersion of radiological material using a conventional explosive or other dispersal device
3. An incendiary device is any mechanical, electrical, or chemical device used to intentionally initiate combustion and start a fire.
4. Chemical agents can be classified into five categories: nerve agents, blister agents, blood agents, choking agents, and irritating agents.
5. Explosive devices are the most common WMD (70% of all terrorist attacks).

While explosives are the most common method, any of the WMDs listed can be deployed at any time. Consequently, threat awareness and vigilance are critical to prevent future attacks.

In one well-known case a plot to detonate a car bomb at the Los Angeles International Airport was uncovered by an alert U.S. Customers inspector. On December 14, 1999, Ahmed Ressam (aka the Millennium Bomber) was arrested after a U.S. Customs inspector had his vehicle searched after he had successfully boarded a ferry from Canada to Port Angeles, Washington. The inspector is credited for noticing Ressam's behavior as unusual and ordering a secondary customs search and a check of his passport. As a result, chemicals and explosive timing devices were found in the trunk of his vehicle and his passport was identified as counterfeit. Ressam was subsequently jailed and convicted on multiple counts.

Mass Violence

Defining Mass Violence

Mass violence involves shootings, car or truck attacks against pedestrians, and other targeting that results in harm to multiple victims. As defined by the Federal Bureau of Investigation (FBI), an active shooter is an individual actively engaged in killing or attempting to kill people in a populated area. The federal definition of "mass killings," according to the Investigative Assistance for Violent Crimes Act is, "three or more killings in a single incident." (not including the shooter).

Mass Violence Incidents in the United States

In 2022, the FBI designated 50 shootings as active shooter incidents. Although incidents decreased by 18% from 2021 (61 incidents), the number of active shooter incidents increased by 66.7% compared to 2018 (30 incidents).[40] The 50 active shooter incidents in 2022 occurred in 25 states and the District of Columbia and represent seven location categories, including open spaces, commerce, residences, education, government, houses of worship, and a health care facility.

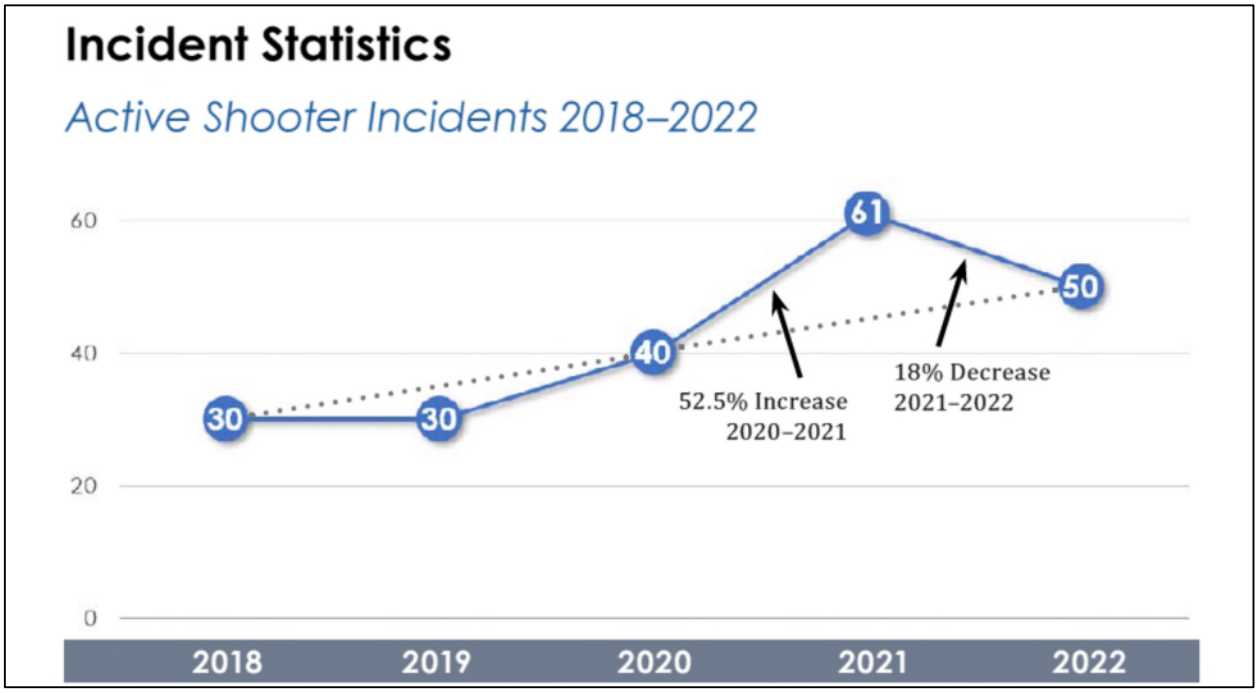


Figure 128: Active Shooter Incidents 2018 -2022

Source: Federal Bureau of Investigations

[40] Active Shooting Incidents in the U.S. in 2022, FBI April 2023

Mass Shooting Events

Mass shooting events include the following examples since 2018:

Year	Event	Description
2023, May 6	Allen Texas Premium Outlets Mall Shooting	A gunman killed 8 and injured 7 others at an outlet mall in Allen, Texas in a possible racially or ethnically motivated violent extremist (RMVE) attack
2023, March 27	Nashville School Shooting	A mass shooting killed 3 children and 3 adults at The Covenant School in Nashville, Tennessee
2023, August 26	Jacksonville Shooting / Hate Crime	An attack inside a Dollar General store in Jacksonville, Florida resulted in the deaths of 3 adults before the shooter committed suicide. The incident was believed to be a racially motivated hate crime.
2023, August 23	Trabuco Canyon Shooting	A mass shooting occurred at the Cook's Corner Bar in Trabuco Canyon, California killing 4 people and injuring 6 others before the shooter was shot and killed by law enforcement
2022, November 19	Colorado Springs Nightclub Shooting	A shooting inside the Club Q nightclub in Colorado Springs, Colorado resulting in 5 deaths and 25 injuries
2022, July 4	Highland Park Parade Shooting	A gunman opened fire on a July 4th parade in Highland Park, Illinois killing 7 and wounding 48 people before his capture
2022, June 5	Chattanooga Shooting	A shooting occurred inside a nightclub in Chattanooga, Tennessee resulting in 2 fatalities and 12 wounded
2022, May 15	Laguna Woods Shooting	A gunman inside a church in Laguna Woods, California killing 1 person and wounded 5 others in what is believed to be a racially motivated anti-Taiwanese hate crime
2022, May 14	Buffalo Tops Market Shooting	A white supremacist shooter opened fire inside a Tops Market in Buffalo, New York killing 10 and wounding 3
2021, November 30	Oxford High School Shooting	A student at Oxford High School in Oxford, Michigan shot and killed 4 while wounding 6 before being arrested
2021, May 26	Santa Clara VTA Shooting	An employee at the Santa Clara Valley Transportation Authority in San Jose, California opened fire, killing 9 before committing suicide
2021, April 15	Indianapolis FedEx Shooting	A former employee at the FedEx facility near the Indianapolis Airport shot and killed 8 people before committing suicide
2019, December 10	New Jersey Shooting	A man and a woman ambushed and killed 4 people and injured 3 at a kosher grocery store in New Jersey
2019, December 6	Naval Air Station Pensacola Shooting	A man killed 3 and injured 8 in a possible terrorist attack on the Naval Air Station in Pensacola, Florida
2019, November 14	Saugus High School Shooting	A student shot and killed 2 other students and wounded 3 others at Saugus High School in Santa Clarita, California
2019, August 3	El Paso Shooting	A gunman shot and killed 23 people and injured 23 at a Walmart in El Paso, Texas in a suspected racially motivated attack
2019, July 28	Gilroy Garlic Festival Shooting	A gunman shot 16 people and killed 4 at the Gilroy Garlic Festival in Gilroy, California
2019, April 30	University of North Carolina at Charlotte Shooting	A student shot and killed 2 people and wounded 4 at the University of North Carolina before being taken into custody
2018, November 7	Thousand Oaks Shooting	A gunman shot and killed 12 people and injured 16 at a bar at a student event in Thousand Oaks, California
2018, October 27	Tree of Life Synagogue Shooting	A man shot and killed 11 people and wounded 6 at the Tree of Life Synagogue in Pittsburgh, Pennsylvania in an antisemitic attack before being taken into custody by police
2018, May 18	Santa Fe High School Shooting	A student at Santa Fe High School in Santa Fe, Texas shot and killed 10 people and wounded 14 others before being arrested by police
2018, February 14	Parkland High School Shooting	A former student at the Marjory Stoneman Douglas High School in Parkland, Florida opened fire, killing 17 and wounding 17 others before being taken into custody by police

Table 172: Mass Shooting Examples: 2018 to 2023

ESTIMATED IMPACT OF A TERRORIST EVENT OR MASS VIOLENCE INCIDENT

If a terrorist event or mass casualty incident were to occur, the consequences to local populations and employment may be significant depending on the site or sites targeted. The table below provides the estimated impact of a disaster using a 0.1% loss baseline.

Category	Agoura Hills	Calabasas	Hidden Hills	Malibu	Westlake Village	Impact if a 0.1% Loss Occurs
Population	20,362	23,410	2,182	10,915	8,081	65
Total City Employment	11,100	11,800	4.5	6,483	3,700	33
Economy (in thousands)	$621,000	$1,011,348	$-	$578,443	$576,306	$2,787

Table 173: Estimated Population and Economic Loss of Terrorist Events
Source U.S. Census Bureau 2021 American Community Survey 5-Year Estimate

Based on a 0.1% loss projection, an estimated 65 people could be impacted (either directly or indirectly), 33 jobs lost (either temporarily or permanently), and more than $2.7M in economic losses. Since a terrorist or mass violence target will likely focus on public meeting venues, commercial structures, or transportation routes, the projected impact is focused on population and employment (see individual city Community Profile sections for population and economic data).

Risk of Future Terrorism / Mass Casualty

For the LVMCOG Region, the risk of future climate change events was estimated by the Working Group using the following weighted formula:

Risk = (0.45 x Probability) + (0.30 x Magnitude/Severity) + (0.15 x Warning Time) + (0.10 x Duration)

Probability		Magnitude / Severity		Warning Time		Duration	
Level ID	Value	Level ID	Value	Level ID	Value	Level ID	Value
Unlikely	1	Negligible	1	Less than 6 hrs	4	Less than 6 hrs	1
Possibly	2	Limited	2	6 to 12 hrs	3	Less than 24 hrs	2
Likely	3	Critical	3	12 to 24 hrs	2	Less than one wk	3
Highly Likely	4	Catastrophic	4	More than 24 hrs	1	More than one wk	4

The result was a climate change risk rating of 9.85 (see Annex C Working Group HMP Risk Assessment Survey for additional details):

Hazard	Probability	Magnitude	Warning Time	Duration	Risk
Terrorism / Mass Casualty	10	4.67	20	9.5	9.85

TERRORISM AND MASS VIOLENCE VULNERABILITIES

The probability that an individual or location will be targeted by a terrorist or mass violence perpetrator is a function of several factors including the attractiveness of target, the potential for success of the event and the potential for avoiding identification and capture. Categories of potential targets include:

Terrorism Targets	Mass Violence Targets
• Symbolic buildings • Federal, state, and local government buildings including military sites and recruiting stations • Mass-transit facilities • Public buildings and assembly areas • Controversial businesses and defense industry companies • Communications hubs • Utility production facilities and substations • Water supply locations • Research laboratories • Clinics and hospitals • Religious sites • Places where large groups of people congregate	• Universities and college campuses • Schools • Businesses (any size or type) • Government offices • Military installations (including recruiting offices) • Bars and night clubs • Theaters • Public parks • Shopping areas and malls • Stadiums and public arenas • Other places where large groups of people congregate (e.g., public events such as fairs, marathons, etc.)

Table 174: Terrorism and Mass Violence Targets

Impact on the Community

Following a terrorist attack or mass violence incident, panic, intense media interest, and the convergence of injured and possibly contaminated persons at local hospitals and urgent care centers can be expected. While local, state, and federal agencies will be mobilized to respond, it will take time for assistance to arrive. Many specialized resources (such as military or law enforcement agency response teams) may be needed, requiring local resources to manage the initial phases of an emergency – especially in the case of a mass casualty event. This initial response phase may range from hours to a day or more. Consequently, a rapid assessment of the scope of the incident and activation of local emergency response resources will be critical to manage the situation.

Key issues include:

- Activation of local and regional Emergency Operations Centers (EOCs)
- Designation of casualty collection points and field triage/treatment sites
- Transportation (for personnel, equipment, and supplies to the impact location as well as casualty and public evacuation)
- Isolation (if needed to prevent further contamination)
- Use of personal protection equipment (PPEs)
- Communications (including internal communication, media response, and public bulletins)
- Decontamination points (if required)
- Establishing a secure perimeter
- Post event site and public relations management

Efforts to assess the situation and provide clear, easy to follow emergency management instructions to the public are essential. The following table describes examples of the considerations expected during the initial stages of a terrorist event or mass casualty incident.

Condition	Description
Down Wind Evacuation	A large chemical or biological release may result in a lethal plume that may travel for miles. Emergency agencies in neighboring jurisdictions must be advised of the release and included in incident management activities.
Traffic Restrictions and Congestion	Roads, freeways and transit systems may need to be closed to contain the incident. Regardless of the need, panic may cause some persons to self-evacuate, Traffic congestion and gridlock conditions and confusion may result. These factors will slow response by emergency agencies and specialized resources to affected areas. Detailed traffic management plans will need to be developed.
Self-Transport to Medical Providers	Following a WMD incident, injured and contaminated victims may leave the immediate site of the incident and then go to hospitals. In most cases, the care provider will not be equipped to decontaminate victims or treat terrorist attack related casualties. This can extend the scope of the incident, potentially lead to secondary contamination and strain local medical and emergency response resources. Local hospitals impacted by an influx of casualties who have not been decontaminated will have to establish decontamination area and may not be able to continue providing treatment. For either a terrorist event or mass casualty incident, local hospitals may become overwhelmed with patients and be able to fully provide immediate care.
Public Panic	In the immediate aftermath of a terrorist event involving a chemical or biologic agent, responders should anticipate people who think they have been exposed to or contaminated by the agent(s) even though there has been no actual exposure. Provisions must be made to manage these persons and provide supportive care as necessary. Similarly, during and after a terrorist event or mass casualty incident may become panicked regarding the status of family members and be traumatized. As a result, responders must consider how to appropriately manage concerned family while maintaining site security.
Scarce Supplies	Equipment and supplies needed to manage the consequences of a terrorist event will be scarce. Sufficient pharmacological supplies may not be available. Antidotes and other drugs used to treat WMD victims are usually not stockpiled in sufficient quantities for use in a mass casualty incident. Efforts to secure additional supplies will be an immediate need. Personnel involved in managing potential terrorist event must be aware of these concerns. Measures to address these issues must be incorporated into the Incident Action Plan and should be considered and assessed throughout the management of the WMD incident.

Table 175: Terrorist Event and Mass Casualty Incident Considerations

LAW ENFORCEMENT ROLE IN COMBATING TERRORISM AND MASS CASUALTY INCIDENTS

The following are steps and efforts that various law enforcement agencies are taking to combat the activities of terrorists and mass casualty perpetrators:

1. On-going attention to known potential targets within the area
2. Identification of new potential targets within the area
3. Identification of suspicious persons, places, or things which may be related to potential terrorist or mass casualty incident activity
4. Recognition of potential surveillance and intelligence-gathering activities
5. Recognition of potential terrorist involvement in routine crimes (ID theft, shoplifting, credit card fraud, forgeries, etc.)
6. Organizing and informing community resources regarding anti- terrorism and the prevention of mass casualty incidents
7. Ability to respond safely and effectively to an incident including the use of a WMD
8. Identification of local terrorist groups or others that may be involved in mass casualty attacks
9. Monitoring illegal weapons traffic in the area or volatile materials purchases
10. Conducting Threat/Vulnerability assessments
11. Implementing counter-surveillance activities
12. Target hardening
13. Working with the public to promote awareness of suspicious behavior at potential target sites

REGIONAL RESPONSE, MITIGATION, AND PREVENTION ACTIVITIES

The Los Angeles County Sheriff's Department is the lead law enforcement agency for the region regarding terrorist events and mass casualty incidents. Individual cities will be responsible for consequence management. Currently the Malibu/Lost Hills Sheriff's station and individual cities implement projects and or programs to help prevent a terrorist or mass casualty situation or be prepared if one were to occur. The following are practices or projects that are currently active in the Region.

Emergency Response Actions

The Los Angeles County Sheriff's Department acts as the lead agency for crisis management, perimeter security, access control, traffic/crowd control, evacuations, notifications, and safeguarding evidence. Crisis management activities may include:

- Investigation, tracking, and maintaining scene integrity.
- Coordinating coroner issues with the Los Angeles County Coroner's Department.
- Use of Special Weapons and Tactics (SWAT) or Rapid Deployment Force (RDF) units
- Assisting with damage assessment and fatalities management.

The Los Angeles County Fire Department is the lead agency for fire response, hazardous materials events, and medical/rescue operations. The County Fire Department provides support as necessary to the Sheriff for Crisis Management activities. Existing procedures, such as the Fire Department's Hazardous Materials Response procedures and NBC Response Protocols are used as necessary. The Fire Department assists with:

- Fire and rescue operations
- Emergency medical services coordination
- Perimeter and access control
- Evacuation operations
- Notifications
- Safeguarding evidence
- Damage assessment
- Fatalities management
- Addressing environmental needs
- Obtaining personnel with radiological training
- Ensuring decontamination procedures (radiological and chemical) are in place
- Ensuring biological agents are contained

Mitigation and Prevention

The following examples provide a summary of mitigation and prevention activities related to terrorism and mass casualty incidents in the Las Virgenes-Malibu Region.

Canine Unit

The Los Angeles County Sheriff maintains 5 specially training canines to detect explosives as part of the Arson/Explosive Detail and one chemical/biological threat K-9 as part of the Hazardous Materials Detail.

Equipment and JRIC

In September 2011, Los Angeles County received an $8.9 million grant from the Department of Homeland Security. The funds were a part of a 2010 federal grant of $69.9 million to the Los Angeles-Long Beach Urban Area. The grant was intended to address the unique equipment, training and planning needs of large urban areas in managing terrorism threats.[41] The Los Angeles County Sheriff's Department received the bulk of the $8.9 million grant and will use $6.2 million for equipment, such as an aerial video downlink technology, mobile surveillance cameras, tactical robots, radiation detection devices and bomb suits.

Nearly 70 percent of the total Los Angeles-Long Beach Urban Area funds were spent on the region's Joint Regional Intelligence Center (JRIC). The JRIC is staffed by federal, state and local intelligence analysts and investigators responsible for the 44,000-square-mile territory surrounding Los Angeles. The JRIC opened in 2006 and is the largest of approximately 40 facilities nationwide and is used to coordinate data from 200 agencies in seven counties.

Terrorism Early Warning Group

In 1996, the Los Angeles County Sheriff Department established the Terrorism Early Warning (TEW) Group.[42] The purpose of the TEW Group is to act as an interdisciplinary group in which local, state, and federal agencies work together to share information and combine resources, and to enhance the ability to identify and respond to acts and threats of terrorism. This interagency approach allows for early response and enforcement by clearing the communication channels between agencies and creating an environment that facilitates information and intelligence sharing. The result is an effective network that has the ability to identify information which might indicate impending terrorist activity. This group is a significant resource for identifying and assessing potential threats, making appropriate notifications and recommendations, and aiding in mission planning and the efficient allocation of resources.

[41] http://ourweekly.com/los-angeles/sheriff%E2%80%99s-department-spend-89-million-anti-terror-equipment-training-and-intelligence

[42] http://file.lacounty.gov/lasd/cms1_144939.pdf

TERRORISM AND MASS CASUALTY INCIDENT MITIGATION STRATEGIES

LVMCOG Mitigation Activities

The LVMCOG member cities continue to work with local law enforcement agencies such as the Los Angeles County Sheriff on planning efforts to prevent and/or mitigate the impact of terrorism and mass casualty incidents. Additionally, mitigation strategies that support multi-hazard events will also address terrorist response issues, e.g., increasing the effectiveness of communications and response. Finally, each city has active C.E.R.T. programs with volunteers trained to assist in disasters.

Agoura Hills

The City of Agoura Hills website provides emergency information for residents regarding different events. Further, the City web site provides Public Safety Resource links to essential information for a variety of situations, links to the Agoura Hills Ready-Know Your Zone, and the Go-To Evacuation Platform.

Calabasas

The City of Calabasas website provides numerous emergency preparedness information bulletins including an Emergency Preparedness Guide with information regarding Terrorism. Emergency warnings and information will be provided to the public in the event of a terrorist incident. This will be accomplished via the Calabasas website, CTV Channel-3, the City's 1630 AM radio station.

Malibu

The City of Malibu maintains an ongoing Public Information Program that includes:

- A monthly series on the City website that features a different theme each month. These are adapted from the monthly Emergency Survival Program bulletins on preparing for and responding to a variety of disasters including terrorism incidents.
- A series of messages on the City's cable TV channel urge viewers to take emergency response training, to write a family emergency plan, and to contact the Emergency Preparedness Coordinator for further information.
- Ongoing meetings and presentations about emergency preparedness are made to the public at meetings of Homeowner's Associations and Emergency Preparedness Fairs.

Emergency warnings and information will be provided to the public in the event of a terrorist incident. This will be accomplished via the City of Malibu website, Cable TV Channel-3, the City's AM Radio Station (1620 AM), a telephone Hotline service (456-9982), a call center located at City's Emergency Operations Center, and an email subscription service which notifies subscribers whenever emergency information is updated on the City website

Westlake Village

The City of Westlake Village website provides numerous emergency preparedness information bulletins including the Los Angeles County Emergency Survival Guide with information regarding Terrorism. In addition, the City has an active C.E.R.T. program with volunteers trained to assist in disasters.

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