PART II: HAZARD SPECIFIC INFORMATION

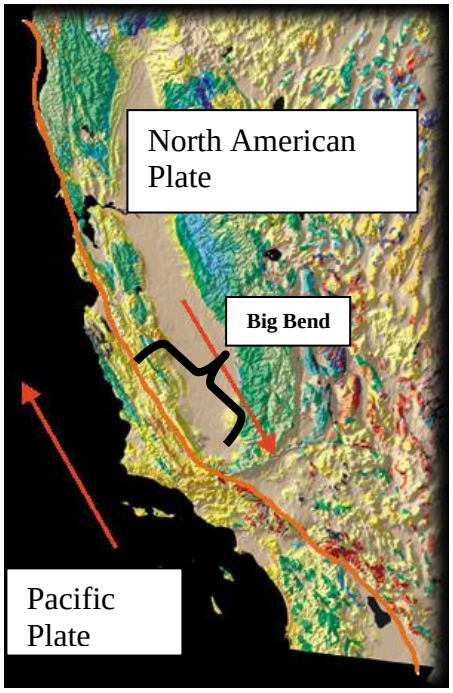
SECTION 6. EARTHQUAKE

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.

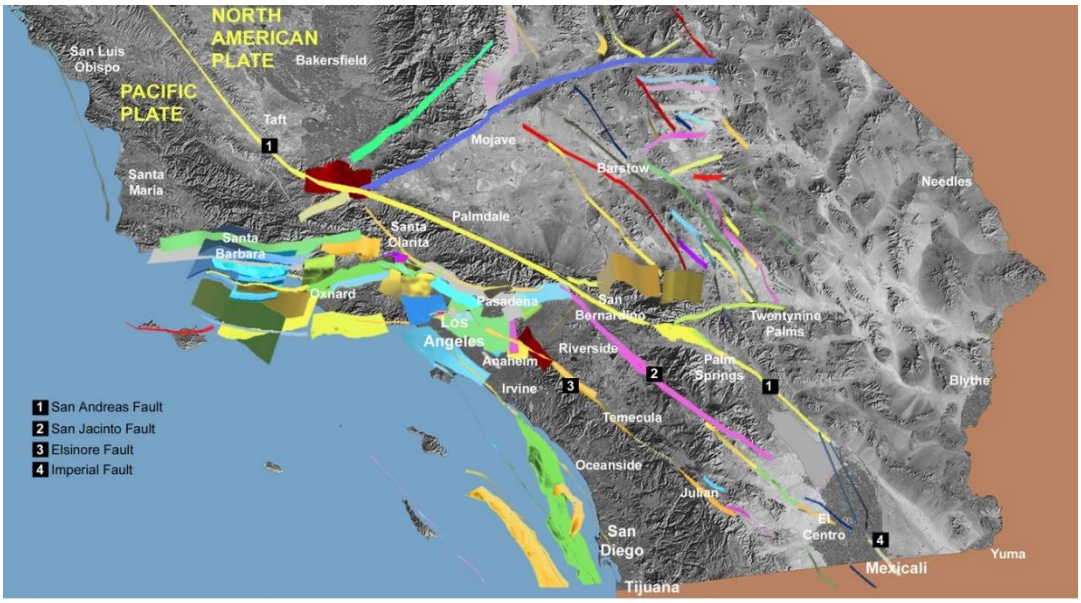
The risk of earthquakes in southern California is exacerbated by the fact that the two plates are inhibited in their motion by what is known as the "Big Bend". In this section of the San Andreas the fault curves to the west then curves back to the north. This creates a barrier to simple lateral motion. 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.

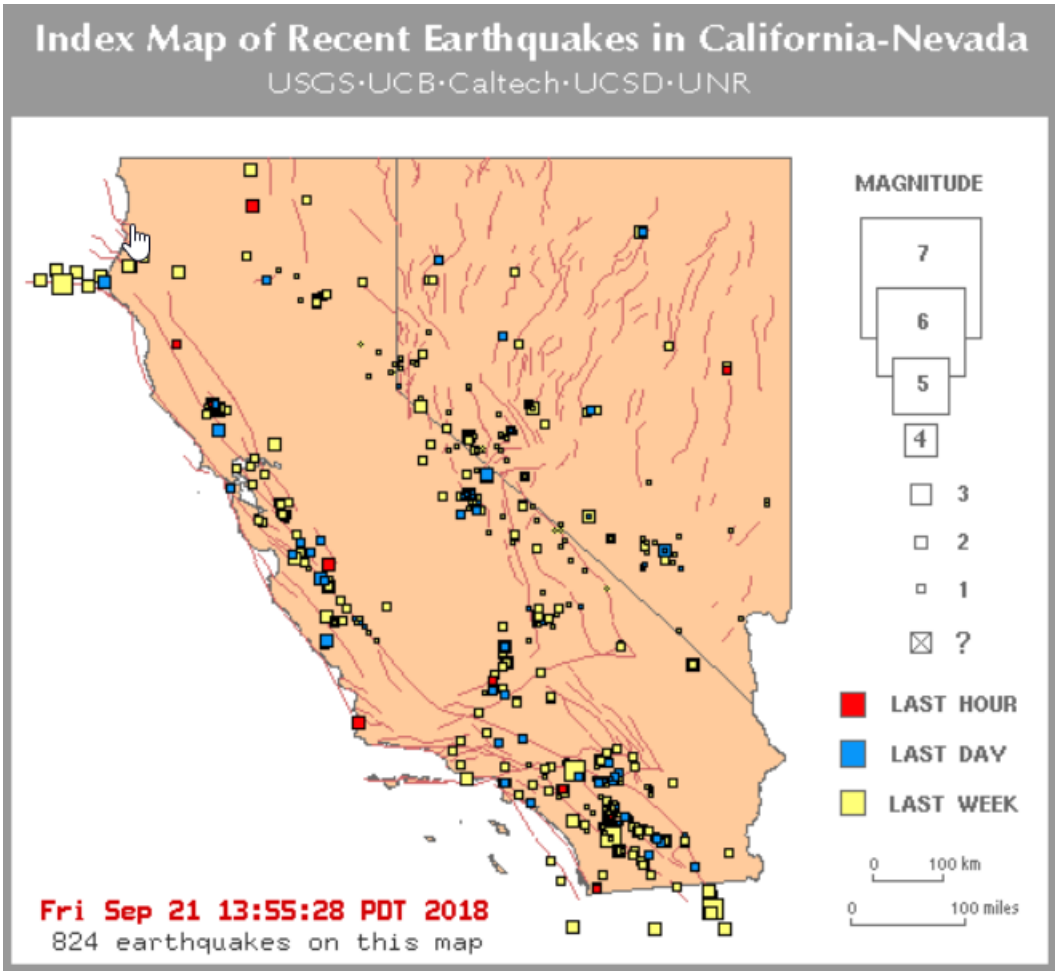


Map 41: Parallel Faults to the San Andreas Fault

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 28 significant earthquakes 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
11.04.1927	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
04.09.1968	6:29 pm	Borrego Mountain	6.6
02.09.1971	6:01 am	San Fernando	6.6
10.15.1979	4:16 pm	Imperial Valley	6.4
07.08.1986	2:21 am	North Palm Springs	5.7
10.01.1987	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
03.21.2009	1:12 pm	Salton Sea Bombay Beach	4.8
05.17.2009	8:39 pm	Inglewood	4.7
12.30.2009	10:48 am	Northern Baja	5.8
10.03.2010	4:04 am	Pico Rivera	4.4

Table 126: Significant Southern California Earthquakes Since 1857

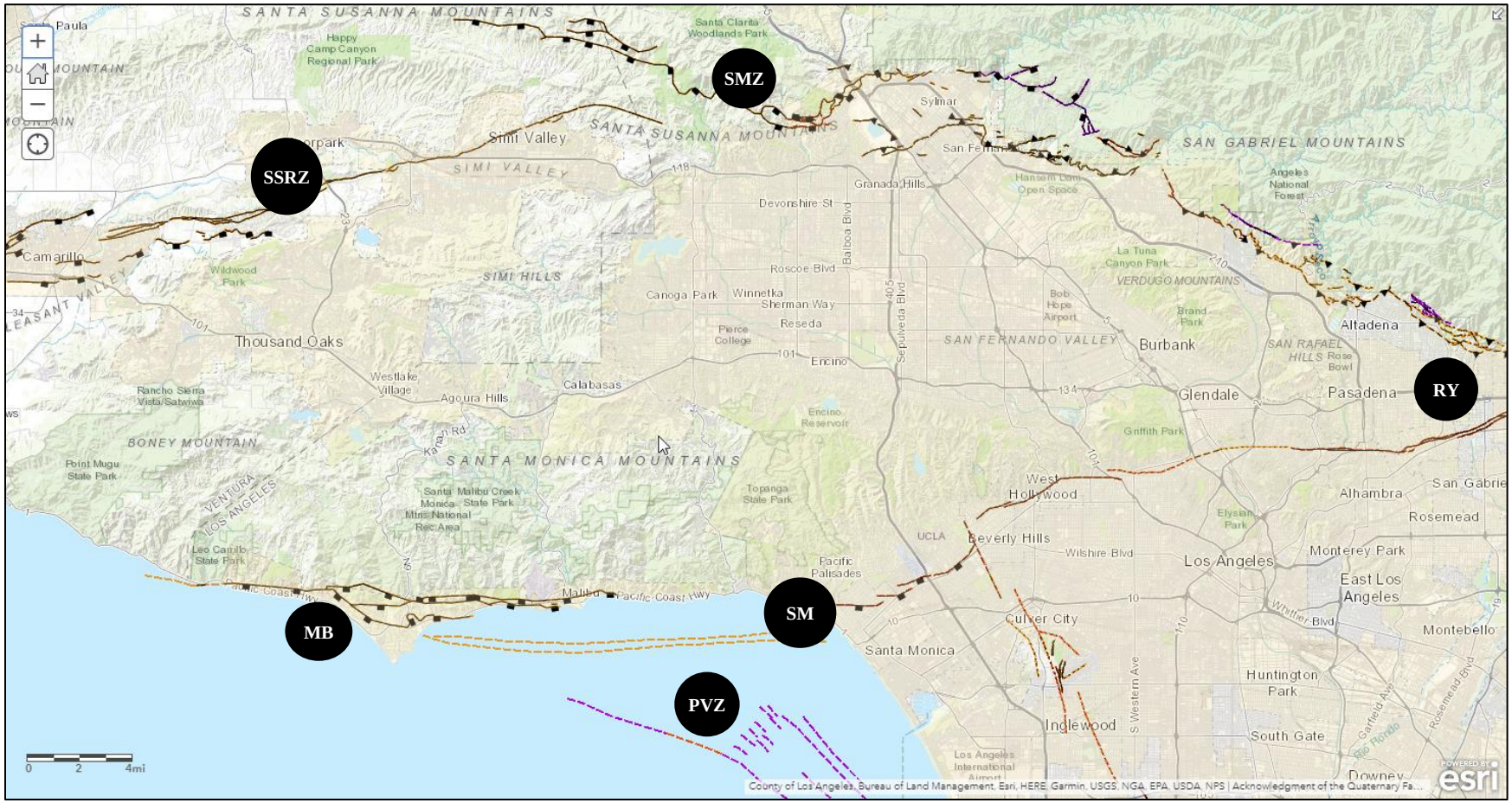
SOURCE: Southern California Earthquake Center (SCEC) and Southern California Seismic Network

This page intentionally left blank

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/

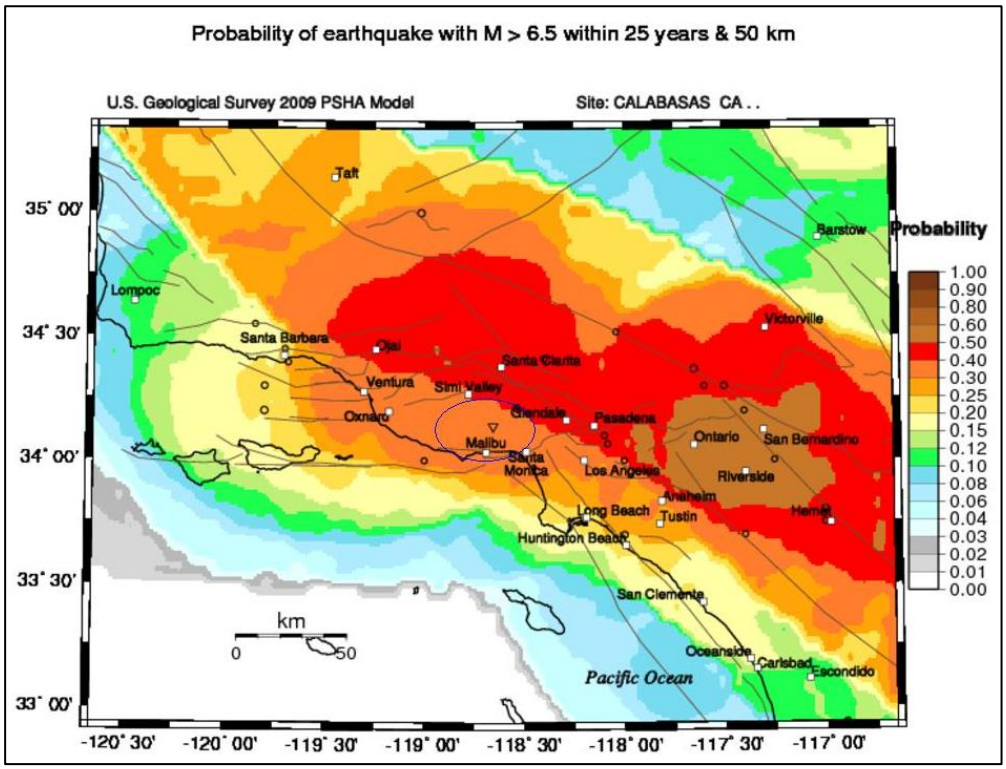
Although the San Andreas Fault is capable of producing an earthquake with a magnitude greater than 8, there are multiple "lesser" faults that are in closer proximity and have the potential to inflict greater damage to the Las Virgenes-Malibu Region. For example, 6.5 M_W earthquake along the Malibu Coast Fault could result in more death and destruction than a "Great" quake on the San Andreas which is 40 miles away.

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:

60% that an earthquake measuring magnitude 6.7
46% that an earthquake measuring magnitude 7
31% that an earthquake measuring magnitude 7.5

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 people

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:

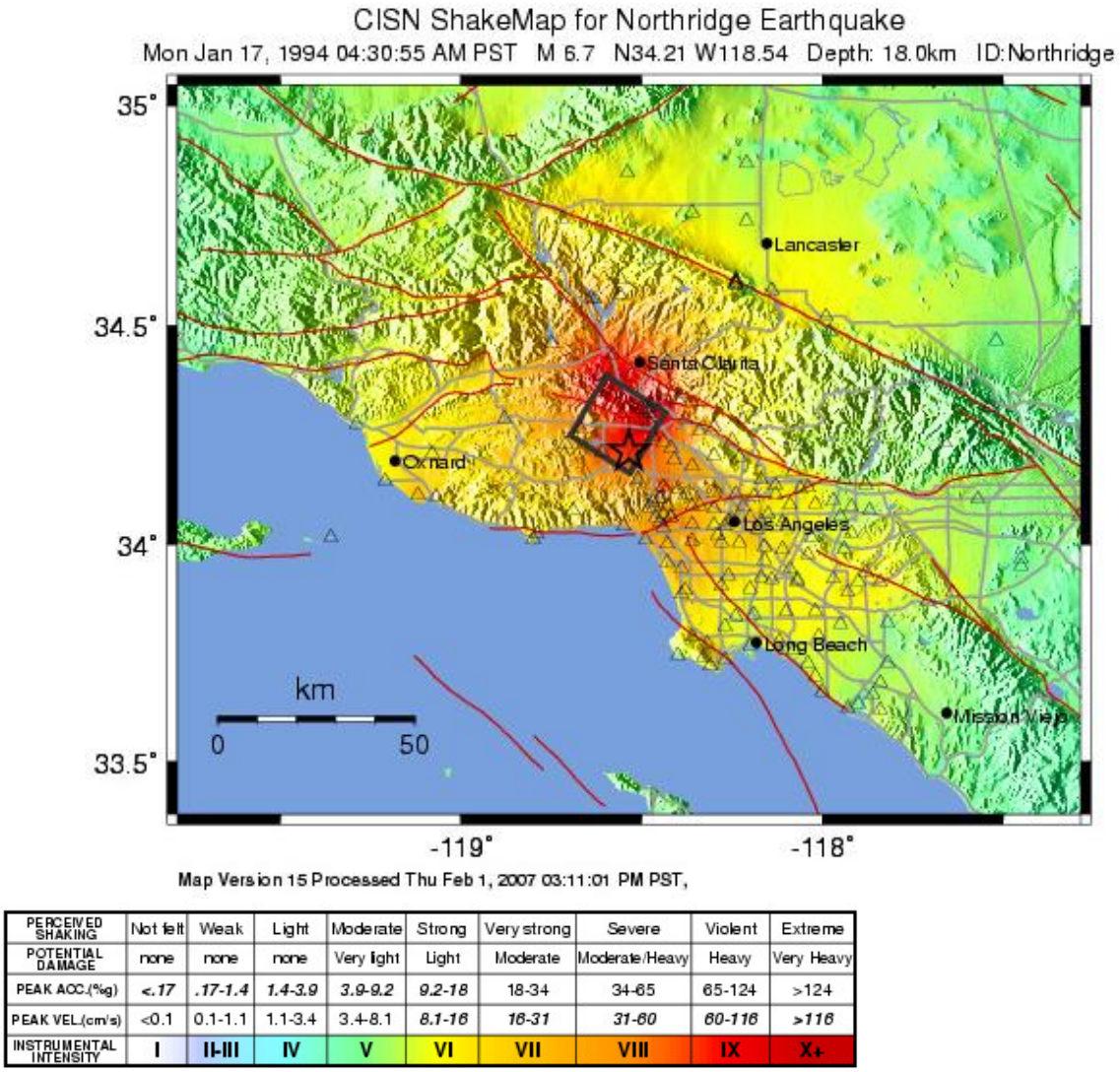
- M 6.7 1994 Northridge Earthquake
- M 6.6 Earthquake on the Santa Monica Fault Scenario
- M 6.9 Earthquake on the Newport-Inglewood Fault Scenario
- M 7.8 San Andreas Fault ShakeOut Scenario

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.

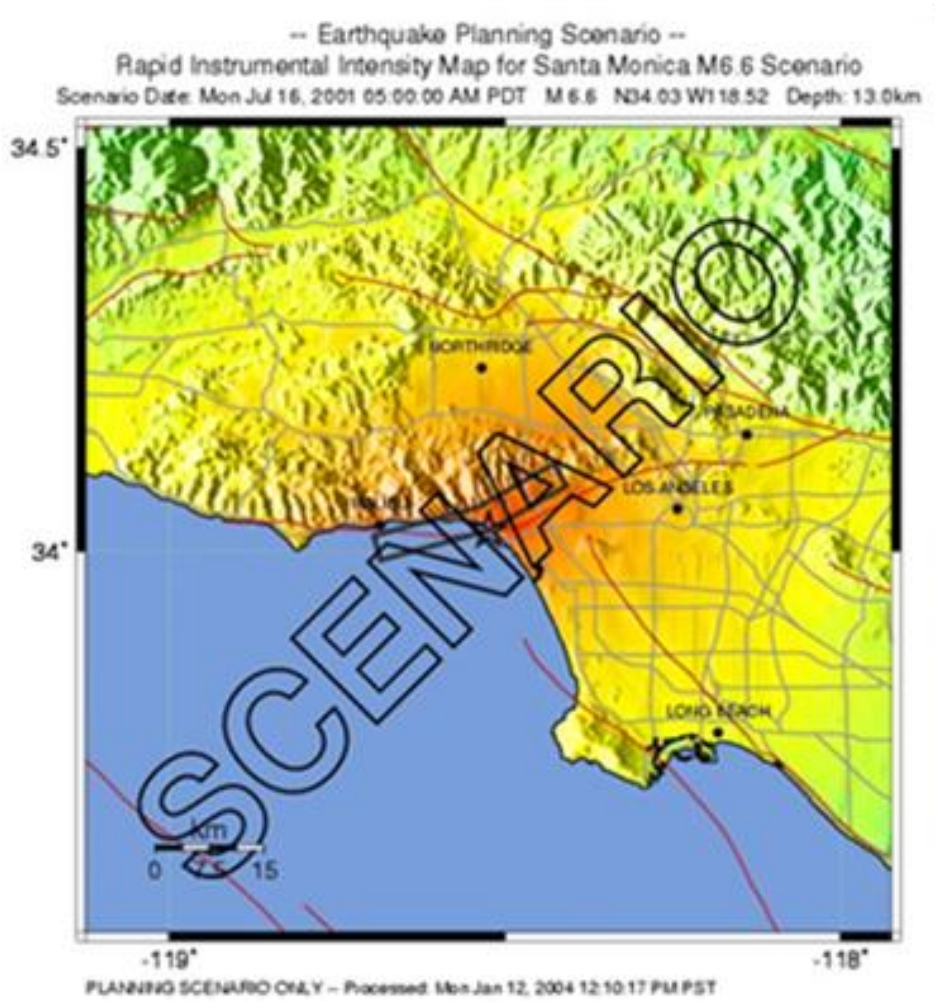


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*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.

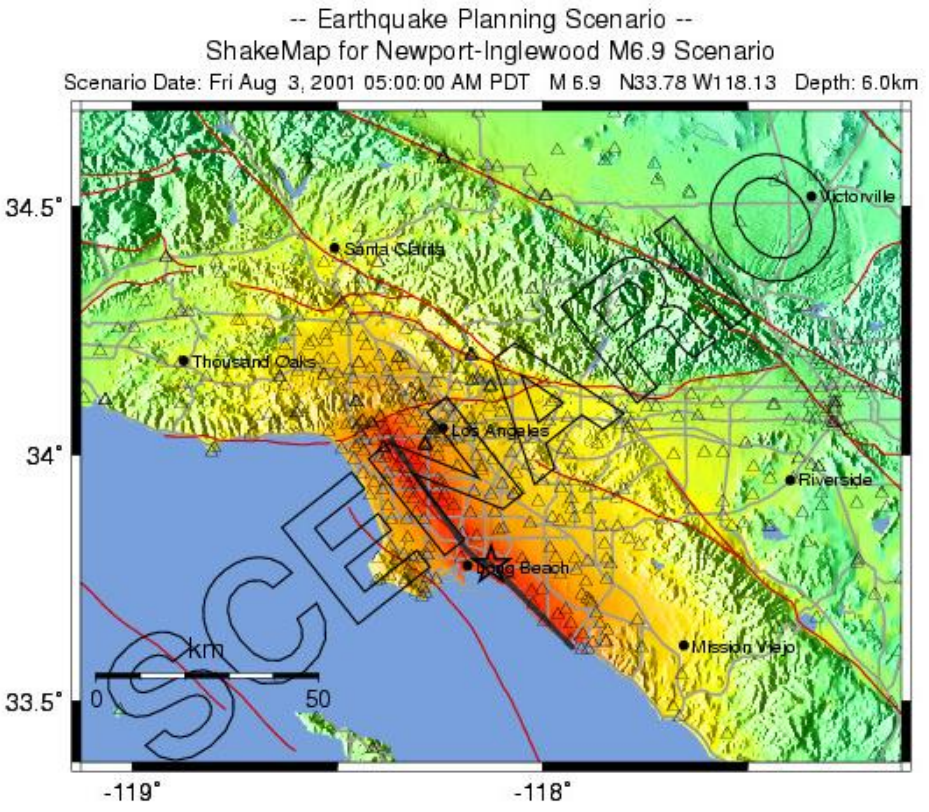


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*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.



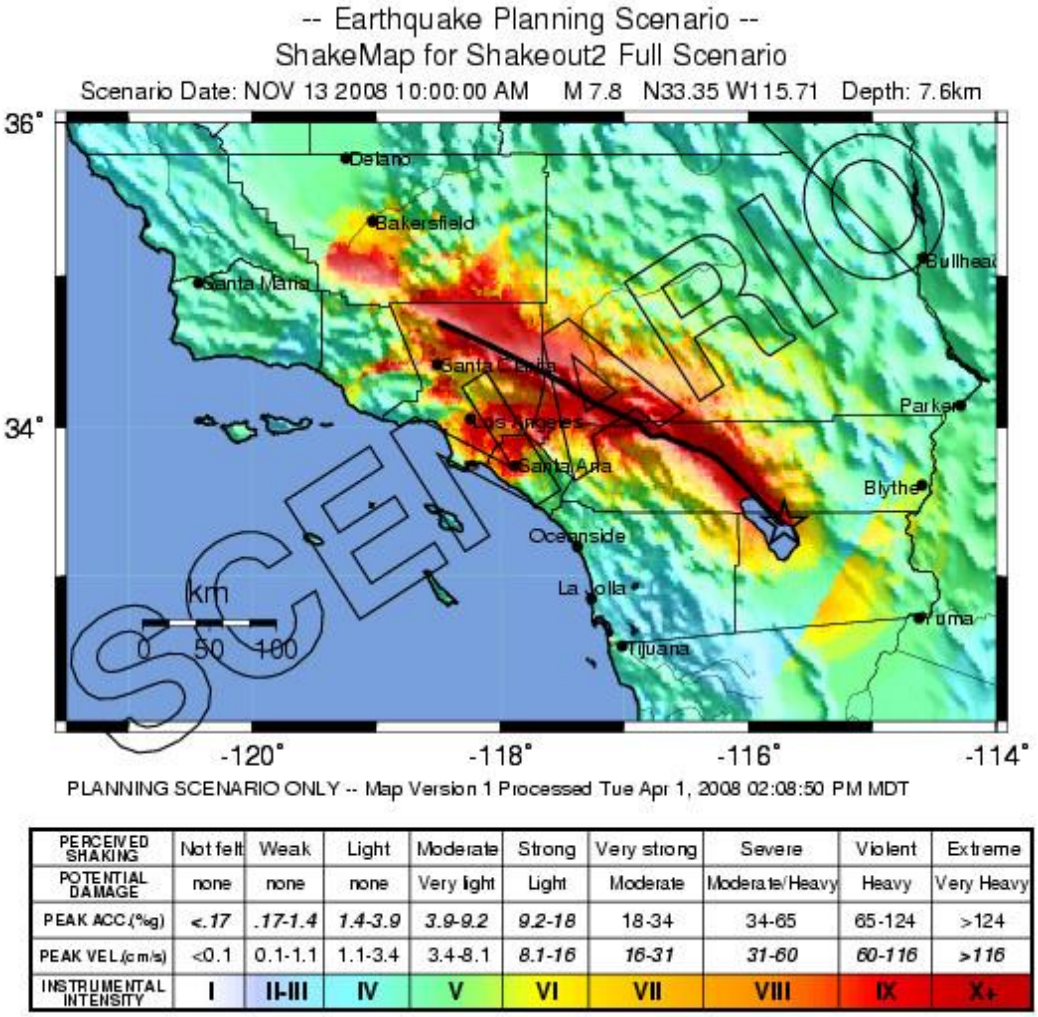
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1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

Map 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 also 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

S

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 (2017 Estimate)	20,692	24,202	1,921	12,877	8,440	6,813
Total City Employment (2017 Estimate except as noted)	11,200	11,900	-	6,201	13,886	4,319
Economy**	$811,395K	$1,614,403K	$500K	$625,676K	$1,894,297K	$494,627K
Total Owner-Occupied Units	5,562	6,097	510	3,944	2,934	1,905
Median Home Value	$699,200	$926,800	More than $2,000,000	$1,802,800	$819,900	More than $2.38B

Table 127: Estimated Population and Economic Loss of an Earthquake

*Per U.S. Census Estimates for 2012
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

Based on a 10% loss projection, more than 6,800 people would be displaced or significantly impacted, and more than 4,300 jobs could be lost (either temporarily or permanently) causing nearly $500M in economic losses. Also, more than 1,900 homes could be damaged or destroyed resulting in over $2.3 billion in losses (see Community Profile section for population, housing, and economic data).

EARTHQUAKE VULNERABILITIES

Liquefaction

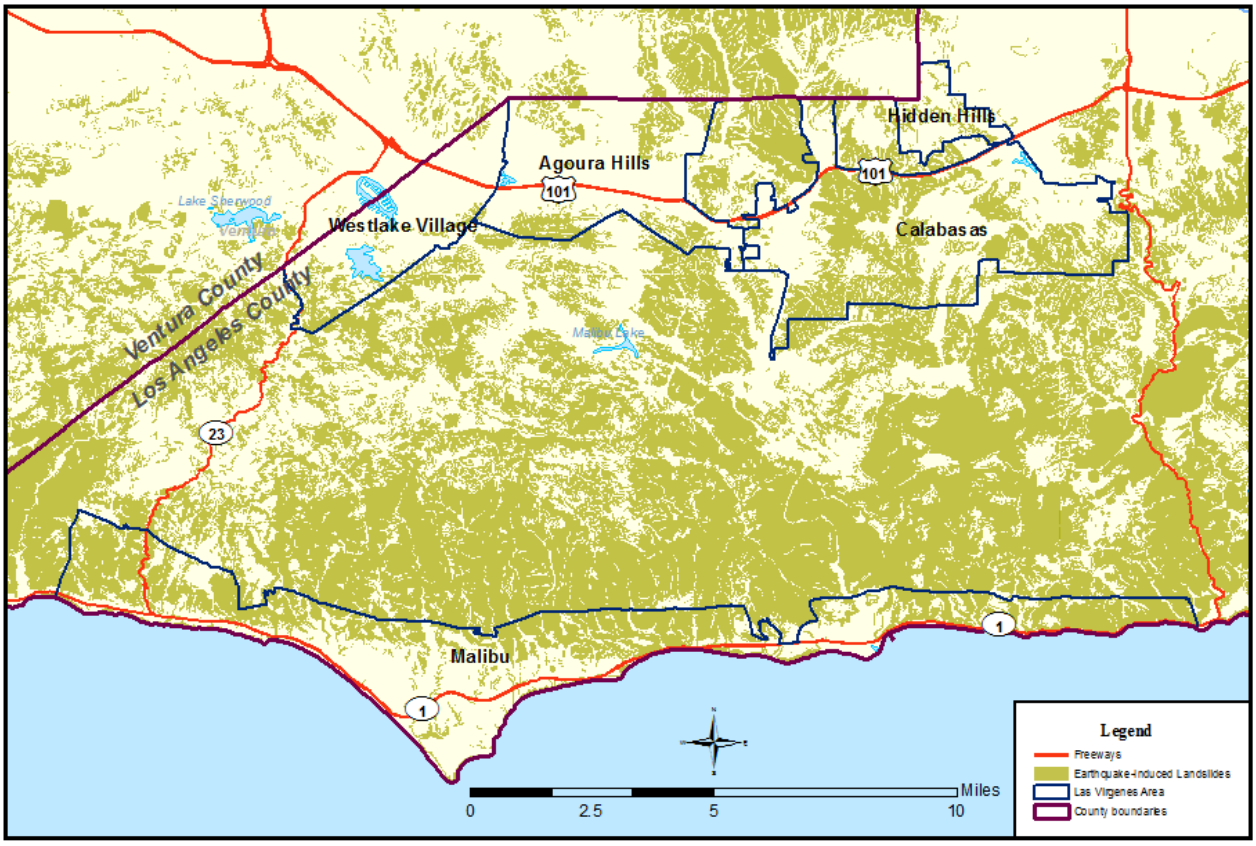
Buildings above liquefiable soils may settle or tip due to a loss of bearing capacity of the soil. Liquefaction occurs when soil grains in loose, saturated silty, sandy, or gravel soils attempt to rearrange themselves in a denser configuration when subjected to strong earthquake ground motions. The resulting 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

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.
Public Resources Code Section 2805-2808	Established the California Earthquake Education Project.

Reference	Description
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 128: Partial List of California Laws on Earthquake Safety

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

EARTHQUAKE MITIGATION STRATEGIES

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 (2010) 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 2010 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 2010 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.

CA Building Code Section	Title
2010 CBC Sec. 1808.7	Footing on or Adjacent to Slopes
2010 CBC Sec. 1808.7.1	Building Clearance from Ascending Slope
2010 CBC Sec. 1808.7.2	Building Clearance from Descending Slope
2010 CRC Sec. R403.1.2	Continuous Footing in Seismic Design Categories D0, D1, D2
2010 CRC Sec. R403.1.3	Seismic Reinforcement
2010 CRC Sec. R403.1.5	Slope
2010 CRC Sec. R404.2	Wood Foundation Wall
2010 CRC Sec. R802.8	Lateral Support
2010 CBC Sec. 1808.7	Footing on or Adjacent to Slopes

Calabasas

The City of Calabasas 2030 General Plan, Public Health & Safety Element includes specific policies to mitigate the threat of earthquakes and other hazards:

Policy	Description
9.04	Maintain open space for adequate protection of lives and properties against natural and man-made hazards.
9.05	Minimize potentially hazardous developments in hillsides, canyons, areas susceptible to flooding, earthquakes, wildfire and other known hazards, and areas with limited access for emergency equipment.

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.

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.

This page intentionally left blank

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 2018.

Top 20 Largest California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	*ACRES*	STRUCTURES	DEATHS
1	**MENDOCINO COMPLEX*** *(Under Investigation)*	July 2018	Colusa County, Lake County, Mendocino County & Glenn County	**459,123**	280	1
2	**THOMAS** *(Under Investigation)*	December 2017	Ventura & Santa Barbara	**281,893**	1,063	2
3	**CEDAR** *(Human Related)*	October 2003	San Diego	**273,246**	2,820	15
4	**RUSH** *(Lightning)*	August 2012	Lassen	**271,911 CA / 43,666 NV**	0	0
5	**RIM** *(Human Related)*	August 2013	Tuolumne	**257,314**	112	0
6	**ZACA** *(Human Related)*	July 2007	Santa Barbara	**240,207**	1	0
7	**CARR** *(Human Related)*	July 2018	Shasta County, Trinity County	**229,651**	1,604	7
8	**MATILIJA** *(Undetermined)*	September 1932	Ventura	**220,000**	0	0
9	**WITCH** *(Powerlines)*	October 2007	San Diego	**197,990**	1,650	2
10	**KLAMATH THEATER COMPLEX** *(Lightning)*	June 2008	Siskiyou	**192,038**	0	2
11	**MARBLE CONE** *(Lightning)*	July 1977	Monterey	**177,866**	0	0
12	**LAGUNA (POWERLINES)**	September 1970	San Diego	**175,425**	382	5
13	**BASIN COMPLEX** *(Lightning)*	June 2008	Monterey	**162,818**	58	0
14	**DAY FIRE** *(Human Related)*	September 2006	Ventura	**162,702**	11	0
15	**STATION** *(Human Related)*	August 2009	Los Angeles	**160,557**	209	2
16	**ROUGH** *(Lightning)*	July 2015	Fresno	**151,623**	4	0
17	**McNALLY** *(Human Related)*	July 2002	Tulare	**150,696**	17	0
18	**STANISLAUS COMPLEX** *(Lightning)*	August 1987	Tuolumne	**145,980**	28	1
19	**BIG BAR COMPLEX** *(Lightning)*	August 1999	Trinity	**140,948**	0	0
20	**HAPPY CAMP COMPLEX** *(Lightning)*	August 2014	Siskiyou	**134,056**	6	0

* Fires uncontained and totals are likely to change.

*There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times.
**This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.

9/5/2018

Table 129: CAL FIRE Top 20 Most Destructive Wildfires

History of Fire Events in the Las Virgenes-Malibu Region

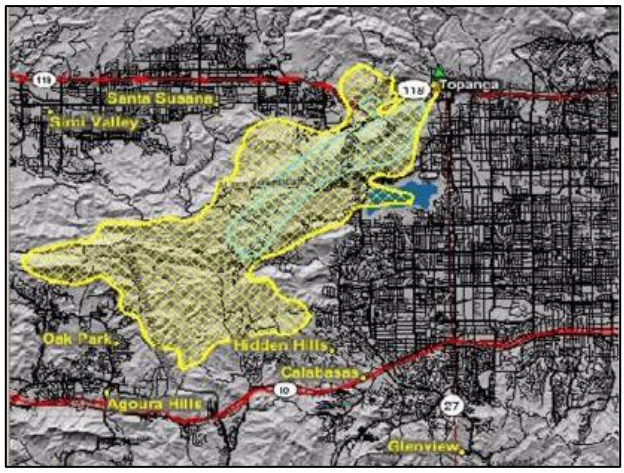
The Las Virgenes-Malibu COG Region has a long history of wildland fires. In fact, over the past 110 years nearly the entire Las Virgenes Malibu Region has been impacted by fire. Major fires since 2003 in the Las Virgenes-Malibu Region include the following events:

Name	Year	Estimated Acres	Structure Loss
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
Pacific Fire	2003	806	0

Table 130: Major Fires Near of In the Las Virgenes-Malibu Region

The map below outlines the perimeter of the 2005 Topanga Fire. The fires were driven by high winds and the subsequent smoke plume carried over Malibu to the Pacific Ocean.

Previously, the 1993 Old Topanga Fire severely impacted the City of Malibu burning 18,000 acres and destroying 359 homes.



Map 51: Topanga Fire Perimeter

Figure 85: Topanga Fire Smoke Plume

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.

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. Local Responsibility Area VHFHSZ maps were initially developed in the mid-1990s and are now being updated based on improved science, mapping techniques, and data. In late 2005 to be effective in 2008, the California Building Commission adopted California Building Code Chapter 7A requiring new buildings in VHFHSZs to use ignition resistant construction methods and materials. These new codes include provisions to improve the ignition resistance of buildings, especially from firebrands. The updated very high fire hazard severity zones will be used by building officials for new building permits in LRA. The updated zones will also be used to identify property whose owners must comply with natural hazards disclosure requirements at time of property sale and 100 foot defensible space clearance. It is likely that the fire hazard severity zones will be used for updates to the safety element of general plans.
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

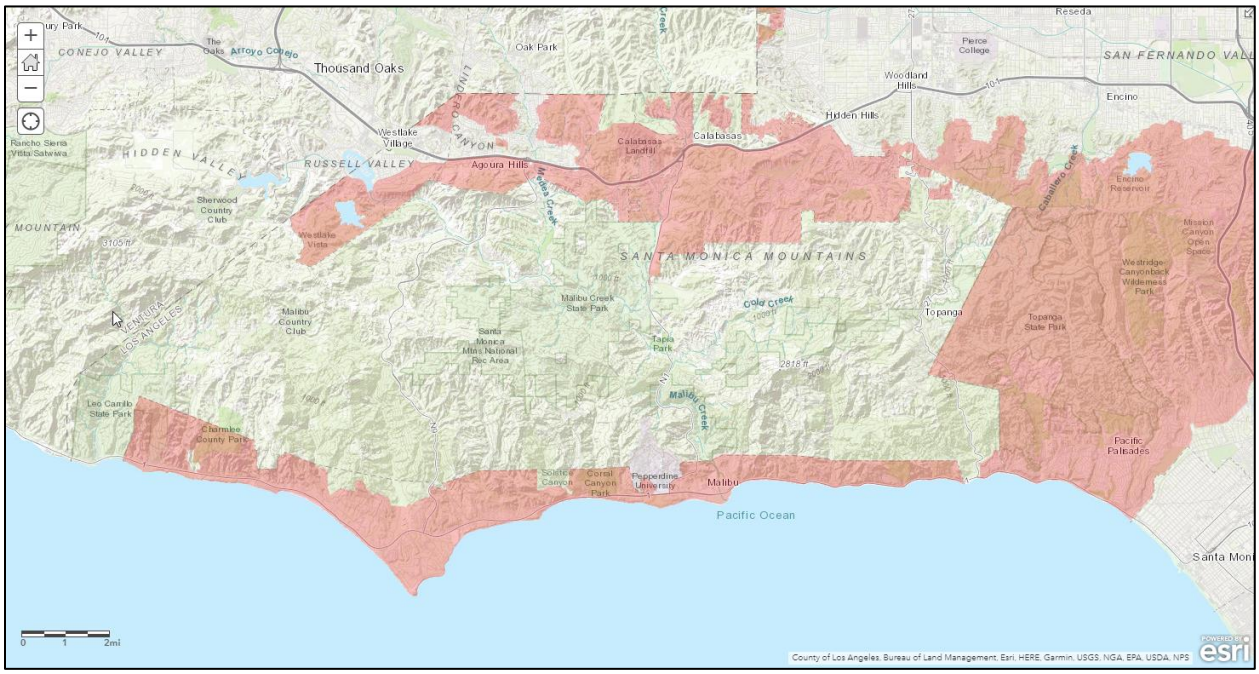
Each factor was given a value of 1-4 with a 4 being the highest danger rating. Any total score over 10 qualified the area as being one of VHFHSZ. Each of the three areas evaluated rated 10 or above with the highest area receiving a 12.

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:

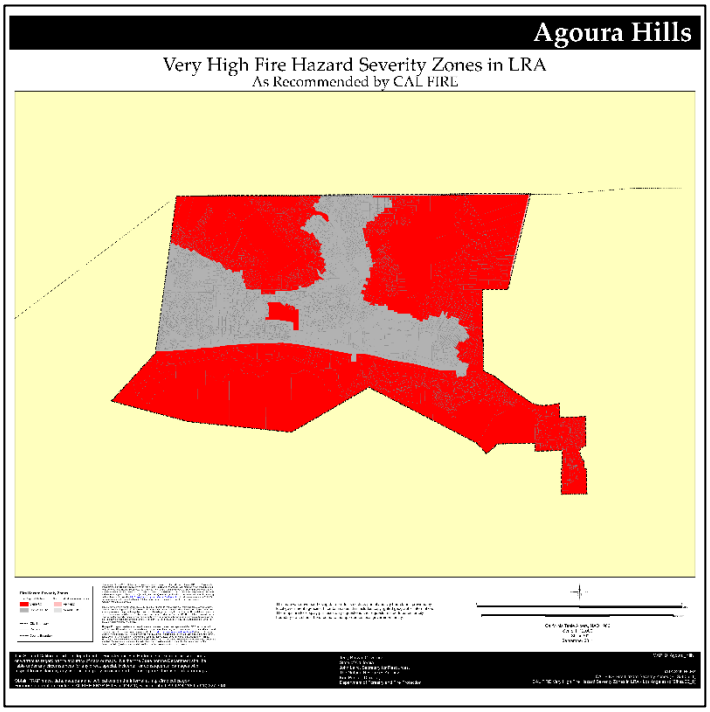
- Ignition sources
- Building materials and design
- Community design
- Structural density
- Slope
- Vegetative fuel
- Fire occurrence
- Weather, as well as occurrences of drought

The map below depicts the Very High Fire Hazard Severity Zones Local Responsibility Areas (LRA) for the LVMCOG Region.

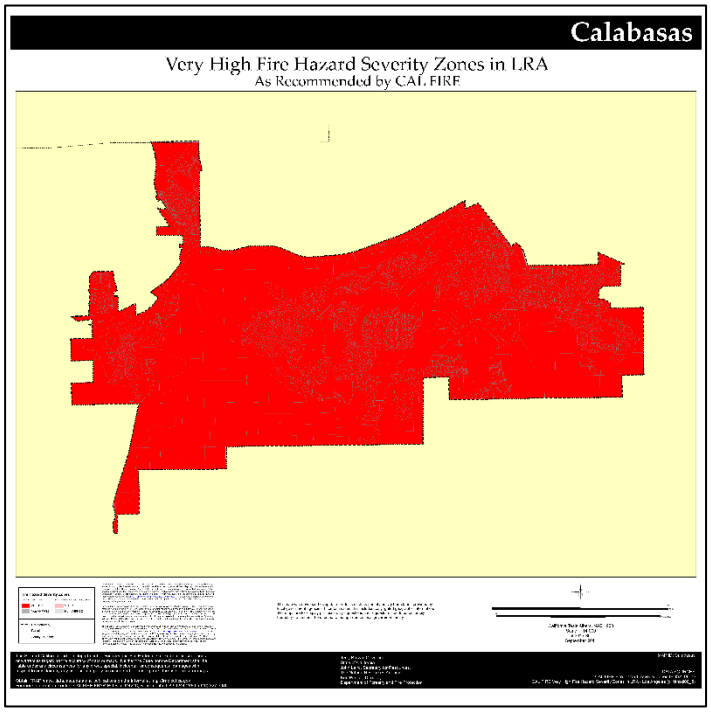


Map 52: VHFHSZ LRA for the LVMCOG Region

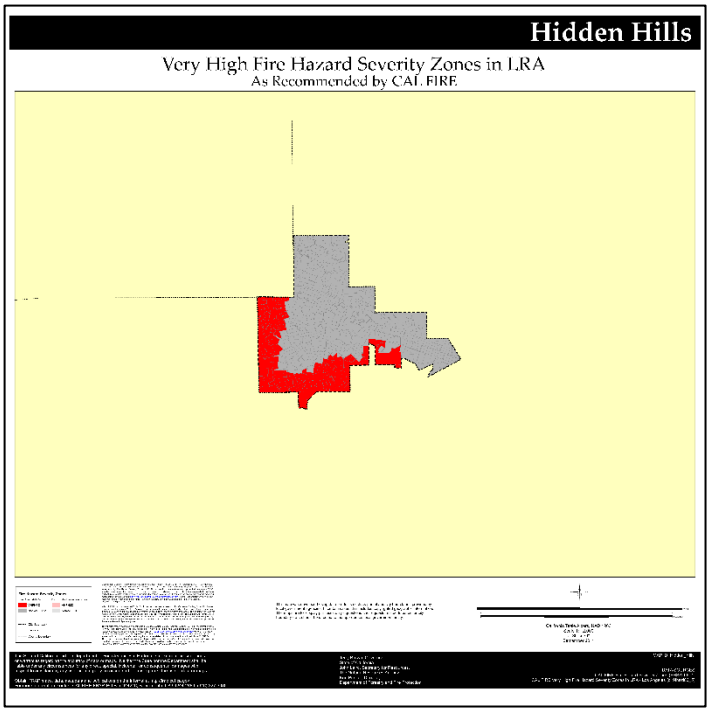
The following maps depict the Very High Fire Hazard Severity Zone LRA for each city within the LVMCOG.



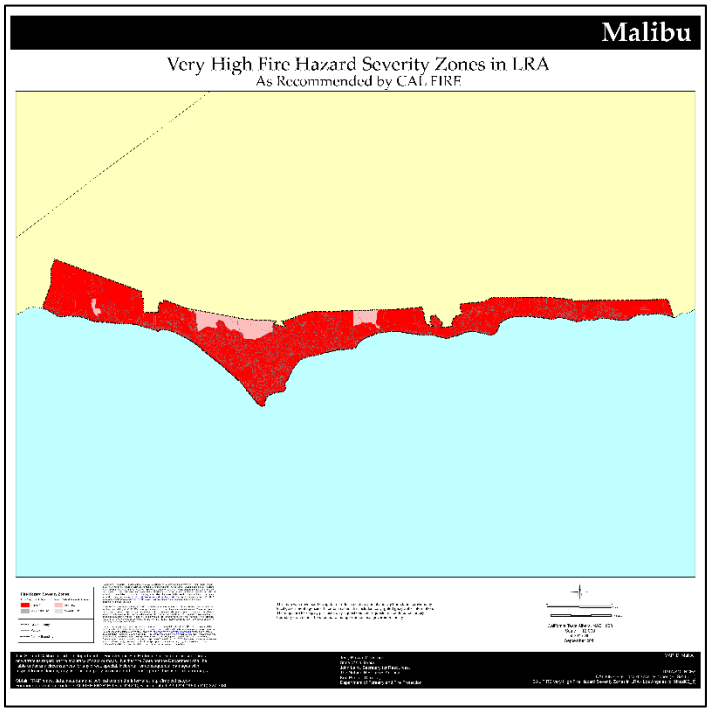
Map 53: City of Agoura Hills VHFHSZ LRA



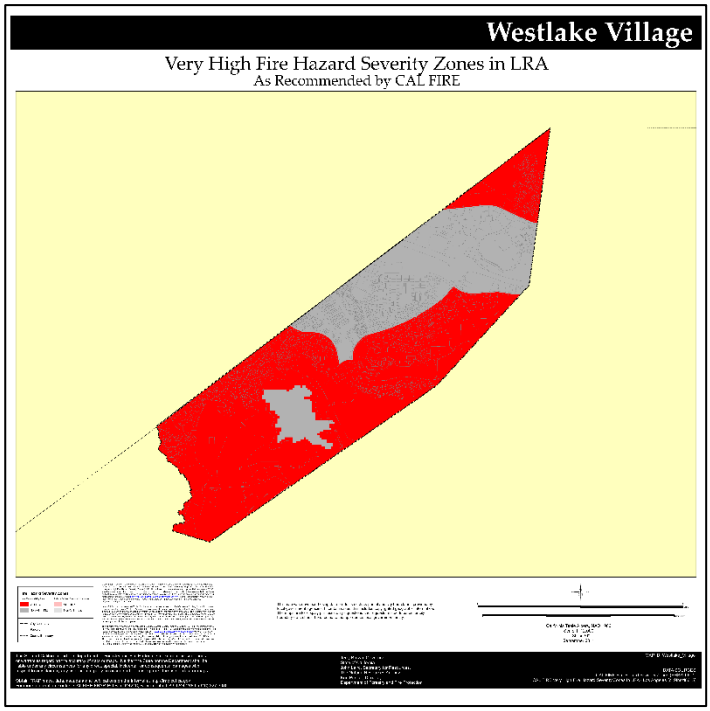
Map 54: City of Calabasas VHFHSZ LRA



Map 55: City of Hidden Hills VHFHSZ LRA



Map 56: City of Malibu VHFHSZ LRA



Map 57: City of Westlake Village VHFHSZ LRA

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 (2017 Estimate)	20,692	24,202	1,921	12,877	8,440	3,407
Total City Employment*	11,200	11,900	-	6,201	13,886*	2,159
Economy** (2017 Estimate except as noted)	$811,395K	$1,614,403K	$500K	$625,676K	$1,894,297K	$272,289K
Total Housing Units	5,562	6,097	510	3,944	2,934	952
Median Home Value	$699,200	$926,800	More than $2,000,000	$1,802,800	$819,900	More than $1.1B

Table 131: Estimated Population and Economic Loss of a Wildfire

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

Based on a 5% loss projection, more than 3,400 residents and more than 2,100 jobs would be displaced or significantly impacted resulting in more than $272M in economic losses, and more than 950 homes could be damaged or destroyed resulting in over $1.1 billion in losses (see Community Profile section for population, housing, and economic data).

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." The cities within the LVMCOG are investigating the implications of such actions and the potential impacts to their communities.

Figure 86: SCE Public Safety Power Shutoff Process

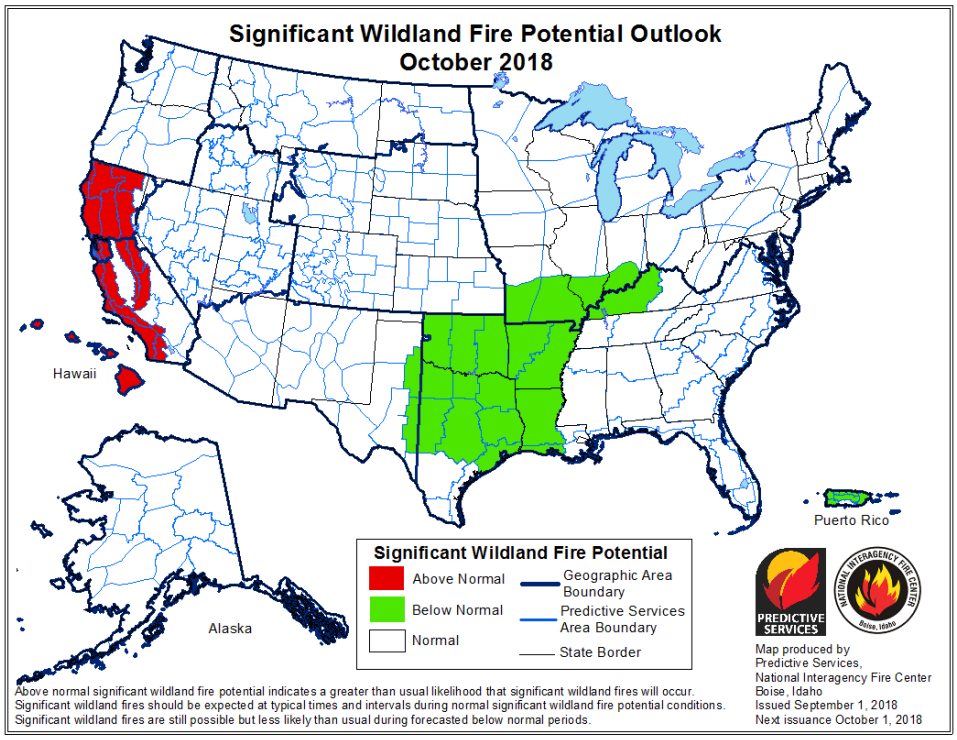
The Threat of Urban Conflagration

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 "Above Normal" as of October 2018.



Map 58: Significant Wildland Fire Potential Outlook – October 2018

WILDFIRE MITIGATION STRATEGIES

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 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.

Los Angeles County Fire Department

First Responders

The Las Virgenes-Malibu Region is located in the Central Region, 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 72,000 residents. The cities include Agoura Hills, Calabasas, Hidden Hills, Malibu, Westlake Village. Division VII and Battalion 5 headquarters are located at 3970 Carbon Canyon Rd., Malibu 90265.

Operating 9 divisions and 22 battalions, LACoFD answers approximately 300,000 emergency calls annually. The Department currently has 169 fire stations, 68 paramedic squads, 9 wildland fire suppression camps, 10 bulldozers, 9 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 4.1 million people who reside in the 1.2 million housing units located throughout the Department's 2,305 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
City of Agoura Hills	Contract
City of Hidden Hills	Contract
City of Malibu	Contract
City of Westlake Village	Contract
City of Calabasas	Contract
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 132: 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.

Special Operations Bureau

The Special Operations Bureau provides highly technical operational functions to County residents including Emergency Medical Services, Urban Search and Rescue, Hazardous Materials, Air Operations, Fire Camps for wildland firefighting, Heavy Equipment and central Dispatch.

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.

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.

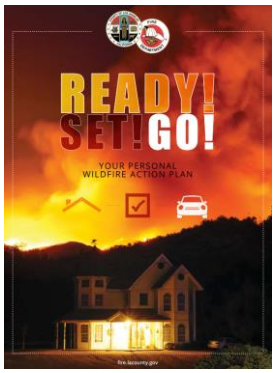
Building Codes

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.

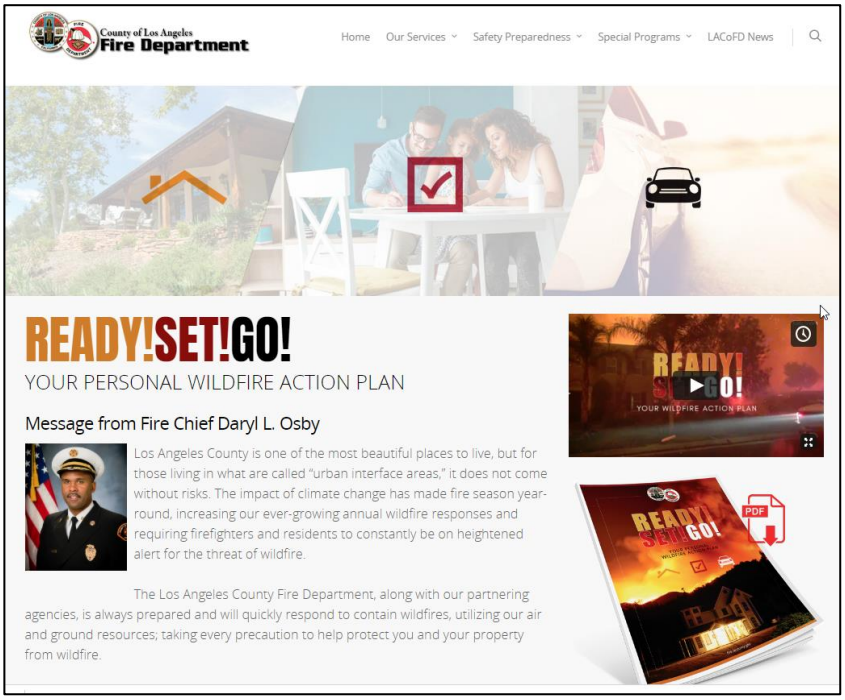


Figure 87: LACoFD Ready Set Go Web Page

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:

- 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.

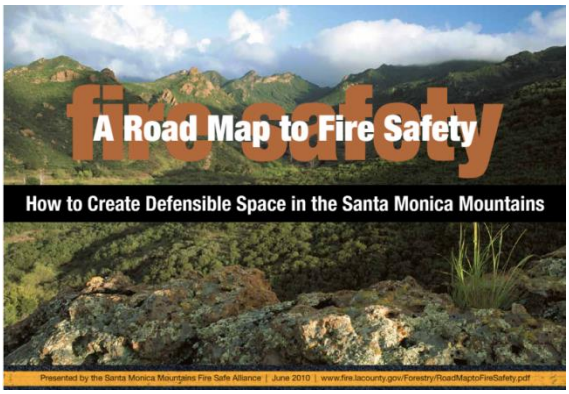


Figure 88: A Road Map to Fire Safety Booklet

Community Education

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

- CERT (Community Emergency Response Team) training
- The City of Calabasas offers Calabasas Emergency Response Program (CERP).
- The City of Malibu offers an Emergency Preparedness Program
- The City of Westlake offers a Disaster Response Team and a Volunteers in Policing program

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.
- Arson Watch - Under the direction and supervision of the Los Angeles County Sheriff's Department, Arson Watch volunteers from Malibu, Topanga, Agoura Hills and Calabasas patrol the Santa Monica Mountains during periods of extreme fire weather conditions.
- In 2019, the City of Malibu created a new Fire Safety Liaison staff position to work with neighborhoods on fire safety, preparedness and response plans, and to coordinate the development of volunteer fire brigades.

Emergency Mass Notification Systems

The City of Malibu has several disaster notification systems including a "Notify Me" Alert Center that is part of their website package; a telephonic mass notification system that can send text, e-mail or phone calls to landlines and cell phones that have been registered in the system, and they are able to send Wireless Emergency Alerts (WEA), which sends text messages to cell phones within a identified geographic area alerting people to imminent threats to safety.

The cities of Agoura Hills, Calabasas, Hidden Hills, and Westlake Village participate in the Blackboard Connect *Connect-CTY* service 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 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.

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 identifying the entire city boundary within the Very High Fire Hazard Severity Zone. 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
2010 CBC Sec. 701A.2.1	Fire Severity Zone Established
2010 CBC Sec. 701A.3	Exception #5 – Roof Repair
2010 CBC Sec. 705A.2	Roof Covering
2010 CBC Sec. 711A	Additions and Alterations
2010 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. Persons and property in Agoura Hills protected from urban and wildland fires and Change Adaptation Objective B.

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)
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 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	Fuel Modification	Ensure that new development complies with fuel modification requirements of the Los Angeles County Fire Department while protecting natural resources and habitat to the extent feasible and encourage design that minimizes the need for fuel modification on public parklands, to the extent feasible. (Imp S-8, CS-30)
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 S-3.2 Wildfire Mitigation

Calabasas

The City of Calabasas 2030 General Plan, Public Health & Safety Element includes specific policies to mitigate the threat of wildfires and other hazards:

9.04 Maintain open space for adequate protection of lives and properties against natural and man-made hazards.

9.05 Minimize potentially hazardous developments in hillsides, canyons, areas susceptible to flooding, earthquakes, wildfire and other known hazards, and areas with limited access for emergency equipment.

City of Calabasas Policies involving wildfire mitigation include:

Policy	Description
Policy VII-12	Emphasize prevention of physical and economic loss associated with wildland fire through early identification of potentially hazardous conditions prior to project approval.
Policy VII-13	Promote fire prevention as the City's preferred management strategy; facilitate programs that are aimed at the prevention of fires.
Policy VII-14	Discourage development and encourage sensitive siting of structures within hazardous fire areas as higher priorities than attempting to implement fuel modification techniques that would adversely affect significant biological resources.
Policy VII-15	Require design and siting of new development within areas subject to wildfires in a manner that minimizes the threat of loss from wildland fire.
Policy VII-16	Ensure that new development is designed so as to facilitate access by firefighting equipment and to maintain adequate evacuation routes.
Policy VII-17	Do not permit development within areas that do not have adequate water pressure or fire flows until sufficient pressure and fire flows can be reliably provided.

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.

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. <u>Policies</u> 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.

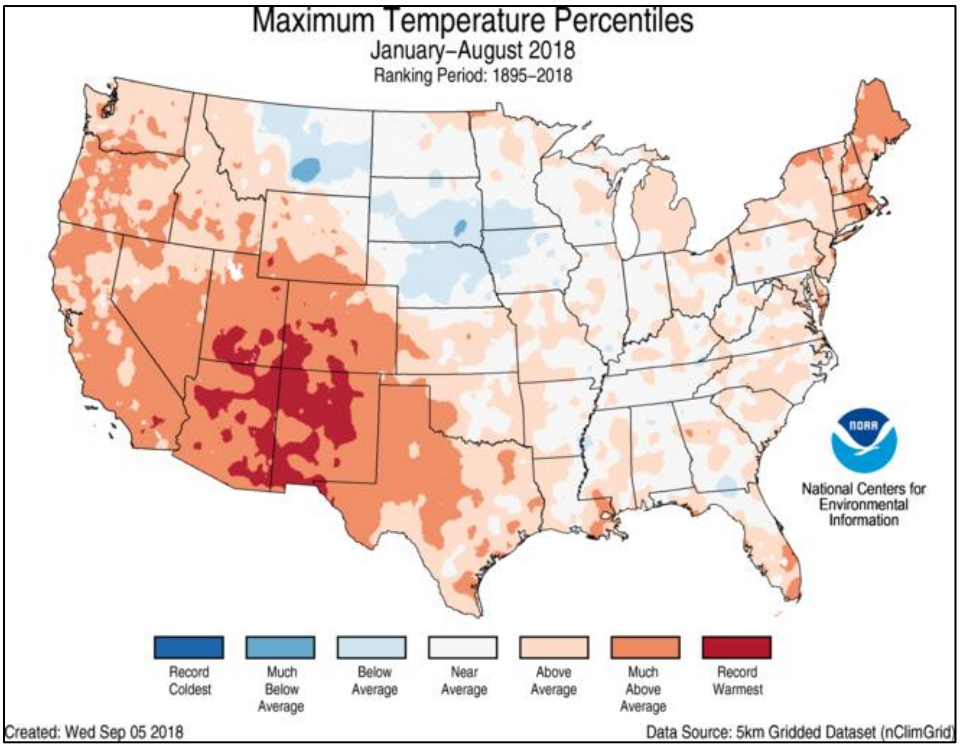
SECTION 8. CLIMATE CHANGE

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 5.6° to 8.8° Fahrenheit. The resulting rise in temperature can result in power outages (from increased demands combined with limited supplies) as well as agriculture and livestock losses.



Map 59: Maximum Temperature Percentiles (1895-2018)

Water and Drought

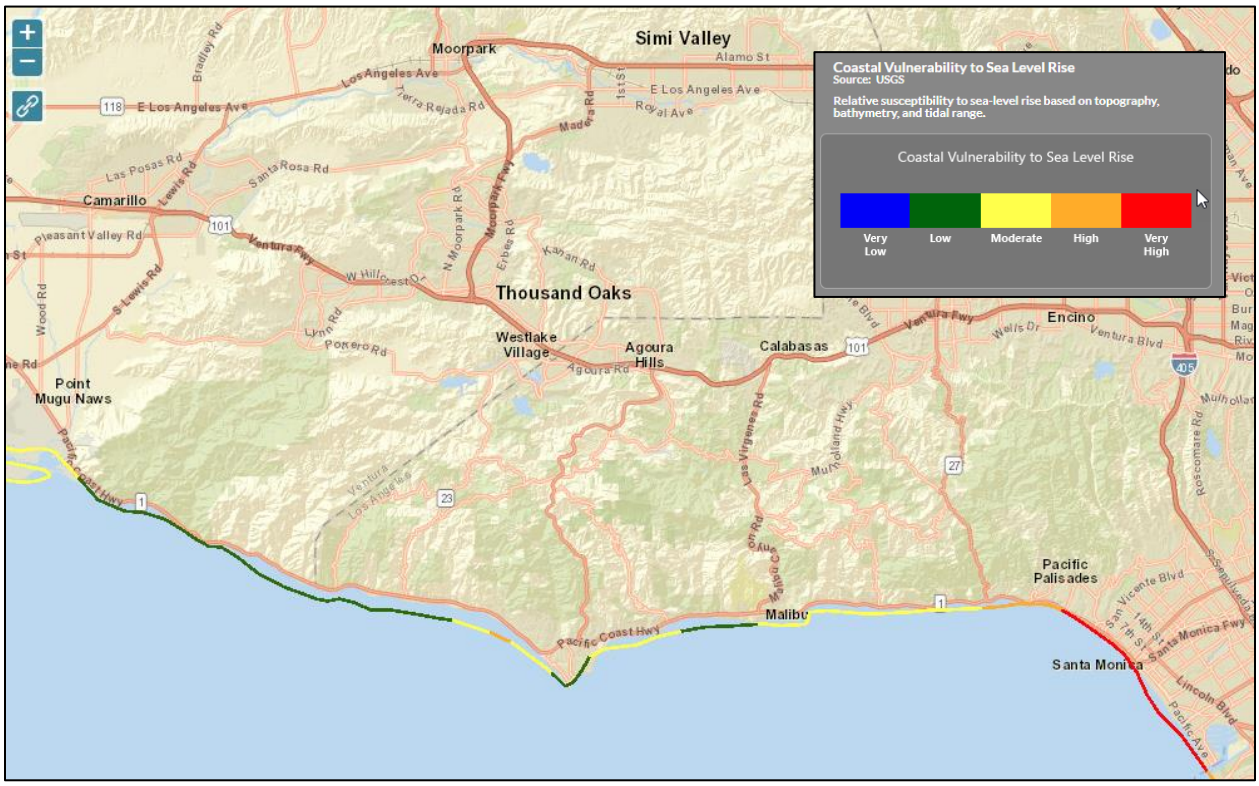
By 2050, the water supply from the California snowpack is projected to decline by two-thirds. This will lead to water shortages of up to 16 percent in certain regions causing losses in agriculture as well as community water consumption restrictions.

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 (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.



Map 60: City of Malibu Coastal Vulnerability to Sea Level Rise

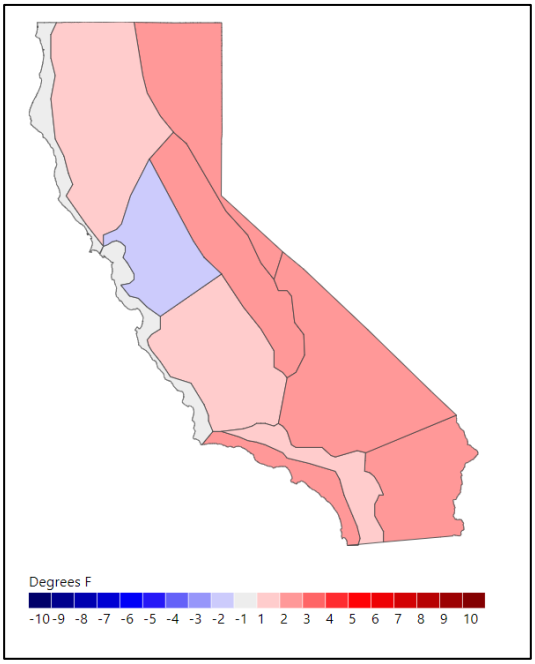
Source: National Environmental Modeling and Analysis Center (NEMAC)

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.

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 2012. Furthermore, as of August 2018, the average temperature in the South Coast Region rose 2 degrees from the 1981-2010 average (CNAP California Climate Tracker). The table below provides a summary of the annual deviation from the average temperature from 1990 to 2017.



Map 61: CNAP Mean Temperature Departures from 1981-2010 Average

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

Year	Annual Mean Temperature (Fahrenheit)	Average (1895-2017)	Change
1990	63.77	63.44	0.33
1991	63.09	63.44	-0.35
1992	64.69	63.44	1.25
1993	63.71	63.44	0.27
1994	63.19	63.44	-0.25
1995	64.05	63.44	0.61
1996	64.67	63.44	1.23
1997	64.83	63.44	1.39
1998	62.14	63.44	-1.30
1999	62.48	63.44	-0.96
2000	63.40	63.44	-0.04
2001	62.37	63.44	-1.07
2002	62.54	63.44	-0.90
2003	63.89	63.44	0.45
2004	63.33	63.44	-0.11
2005	63.39	63.44	-0.05
2006	63.80	63.44	0.36
2007	63.37	63.44	-0.07
2008	64.19	63.44	0.75
2009	63.75	63.44	0.31
2010	62.15	63.44	-1.29
2011	62.13	63.44	-1.31
2012	64.14	63.44	0.70
2013	63.99	63.44	0.55
2014	66.42	63.44	2.98
2015	65.83	63.44	2.39
2016	64.91	63.44	1.47
2017	65.20	63.44	1.76

Table 133: Mean Temperature Observations and Departures for the South Coast

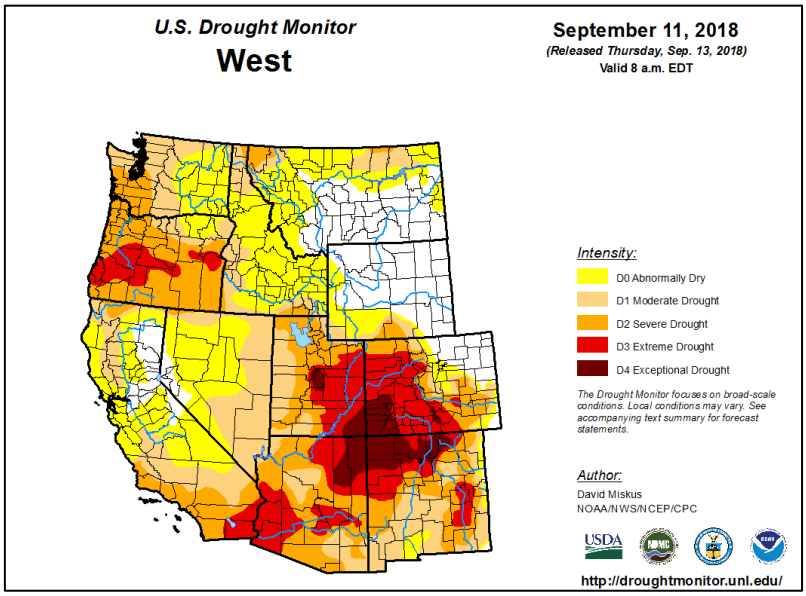
Source: Western Regional Climate Center

Drought

California is currently recovering from the last prolonged period of drought that lasted from 2012 to 2017. Despite heavy rains in 2017, California and the Western U.S. remain in severe drought conditions (as of September 2018).

In addition, historically since rainfall in the South Coast of California and the State in general has varied widely from year to year.

The table below provides a summary of the rainfall variations from 1980 to 2017. Since 2011, average rainfalls have fallen short of the historical average (the annual average from 1895 to 2017 was 17.61).



Map 62: Current Drought Western U.S. Status (2018)

Year	Precipitation (inches)	Percent of Average		Year	Precipitation (inches)	Percent of Average
1980	27.58	156.61		1999	8.14	46.21
1981	13.46	76.43		2000	14.80	84.04
1982	21.72	123.32		2001	21.16	120.15
1983	36.66	208.18		2002	9.00	51.08
1984	9.62	54.62		2003	15.39	87.37
1985	10.35	58.77		2004	19.77	112.25
1986	18.02	102.31		2005	27.77	157.68
1987	13.29	75.48		2006	14.97	85.03
1988	13.40	76.11		2007	7.40	42.03
1989	5.44	30.89		2008	16.77	95.23
1990	8.56	48.59		2009	11.03	62.62
1991	19.26	109.35		2010	28.06	159.31
1992	23.78	135.01		2011	14.21	80.71
1993	28.93	164.25		2012	11.44	64.93
1994	12.75	72.42		2013	5.39	30.60
1995	31.70	180.01		2014	10.86	61.68
1996	20.19	114.64		2015	7.77	44.11
1997	14.40	81.77		2016	13.46	76.44
1998	32.56	184.86		2017	14.91	84.66

Table 134: Precipitation Observation and Percents of Average for the South Coast

Source: Western Regional Climate Center

Sea Level Rise

According to the California Office of Environmental Health Hazard Assessment (OEHHA) May 2018 report, "Indicators of Climate Change in California",[12] 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). 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.

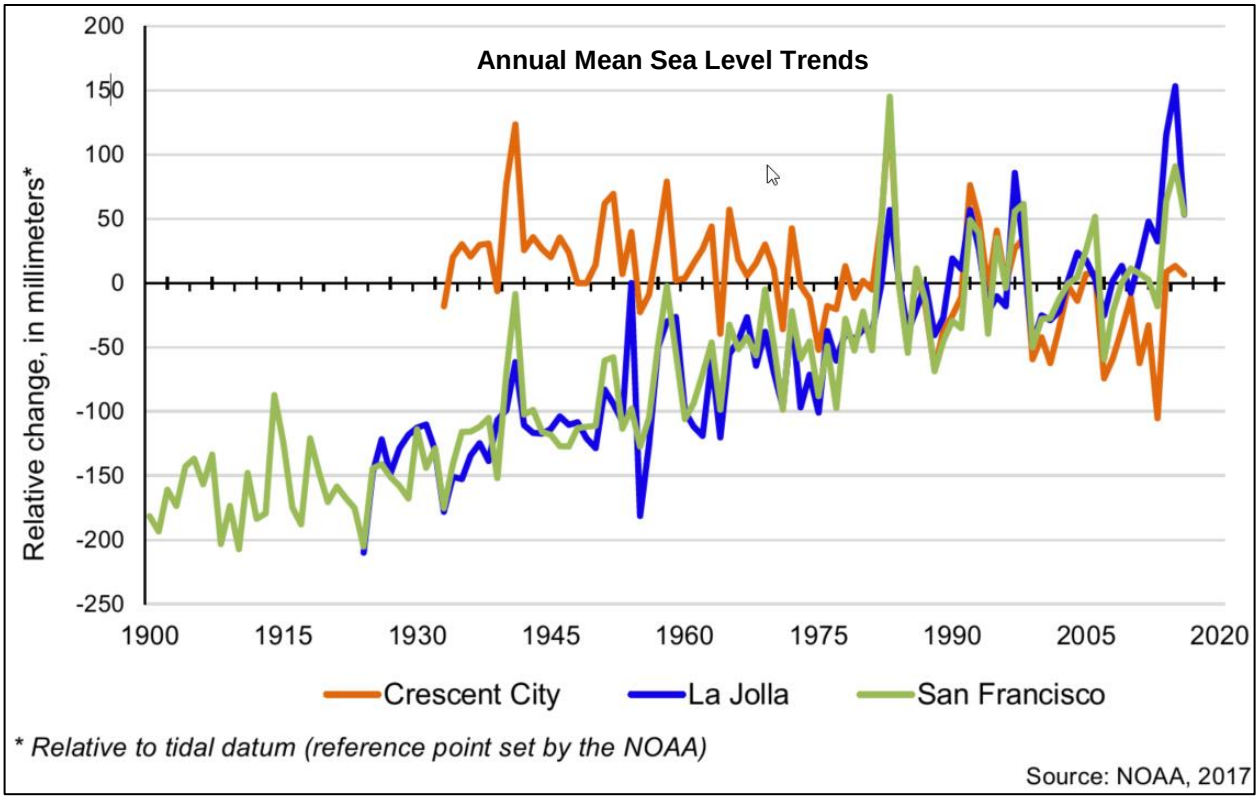
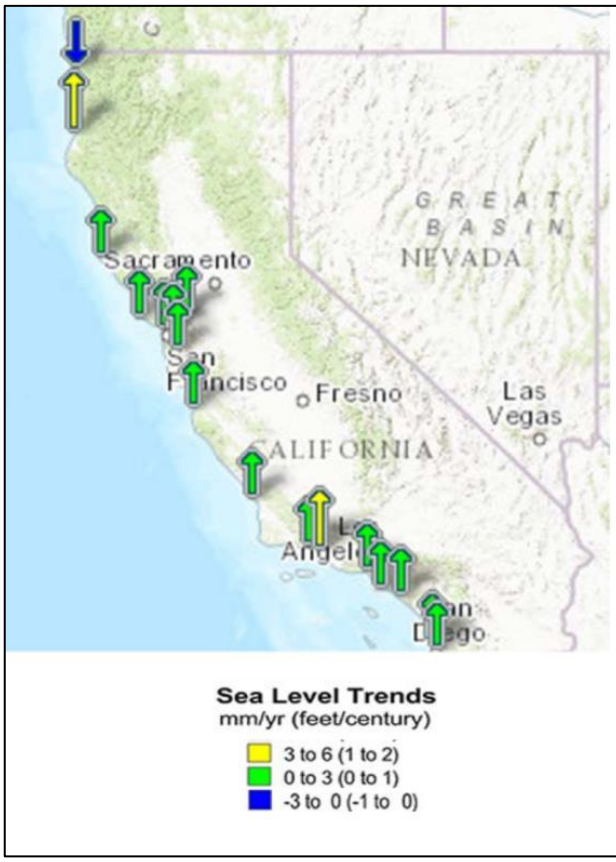


Figure 89: Annual Mean Sea Level Trends

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

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, trends at 16 tide stations operated by NOAA in California shows an overall increase of 3.22 mm/year from 1962 to 1990 (see table below)



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 63: Sea Level Trends

For the City of Malibu, this rising sea level trend has averaged approximately 1 mm (0.04 inches) per year.

Finally, according to the "Indicators of Climate Change in California"[13] 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)

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

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 (2017 Estimate)	20,692	24,202	1,921	12,877	8,440	6,813
65 Years and Older (2017 Estimate)	2,781	3,614	294	3,088	2,122	1,190
Total City Employment (2012 Estimate except as noted)	11,200	11,900	N/A	6,201	13,886*	4,319
Economy**	$811,395K	$1,614,403K	$500K	$625,676K	$1,894,297K	$494,627K

Table 135: Estimated Population and Economic Loss of Climate Change and Drought

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

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	3,944	39
Median Home Value	$1,802,800	More than $71M

Table 136: Estimated Owner-Occupied Home Losses Due to Sea Level Rise

Based on a 10% loss projection, more than 6,800 people could be impacted (either directly or indirectly) including nearly 1,200 people aged 65 years and older (high risk group) with potentially more than 4,300 jobs lost, either temporarily or permanently.

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 39 homes valued at more than $71 million (see individual city Community Profile sections for population, housing, and economic data).

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 (including horses) and domesticated animal losses
  - Damage to local natural habitats
- Sea Level Rise (City of Malibu)
- Wildfire (see **Wildfire** section)

Climate Change Probabilities

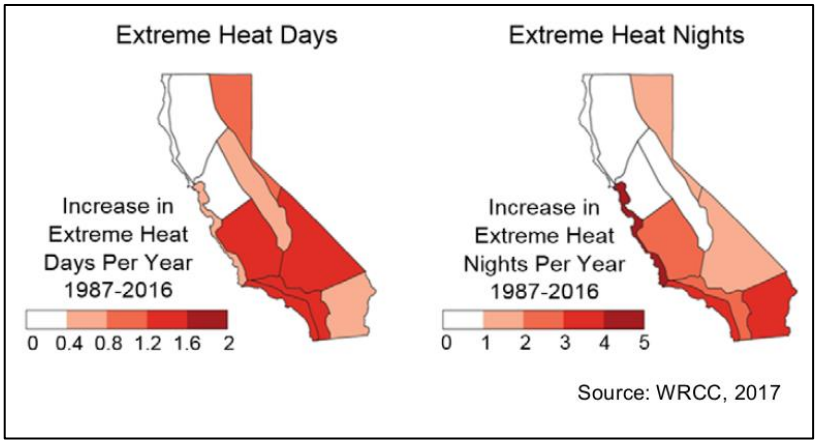
According to the Environmental Protection Agency (EPA), continued emissions of greenhouse gases will lead to further climate changes. Future changes are expected to include a warmer atmosphere, a warmer and more acidic ocean, higher sea levels, and larger changes in precipitation patterns. The extent of future climate change depends on what we do now to reduce greenhouse gas emissions. The more emitted, the larger future changes will be (Environmental Protection Center, 2015).

Temperature Rise

California can expect an increase in temperature in the future. A recent presentation by the California Public Utilities Commission, Policy & Planning Division [14] stated that extreme heat days in some cities in California are likely triple by 2030.

The Indicators of Climate Change in California report summarized trends in extreme heat conditions for the state.[15] The report indicated that the number of daytime heat waves varied year-to-year without a clear trend. However, nighttime heat waves increased in frequency over the past 40 years. Further, regional trends showed that the rate of increase in the number of extreme heat nights was twice that of the rate of increase in extreme heat days for most of Southern California.

Regional Trends in Extreme Heat Days and Nights



Map 64: Regional Trends in Extreme Heat Days and Nights

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

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

The graph on the following page depicts the number of Extreme Heat days by year from 1950 through 2005 with predictions to 2099.

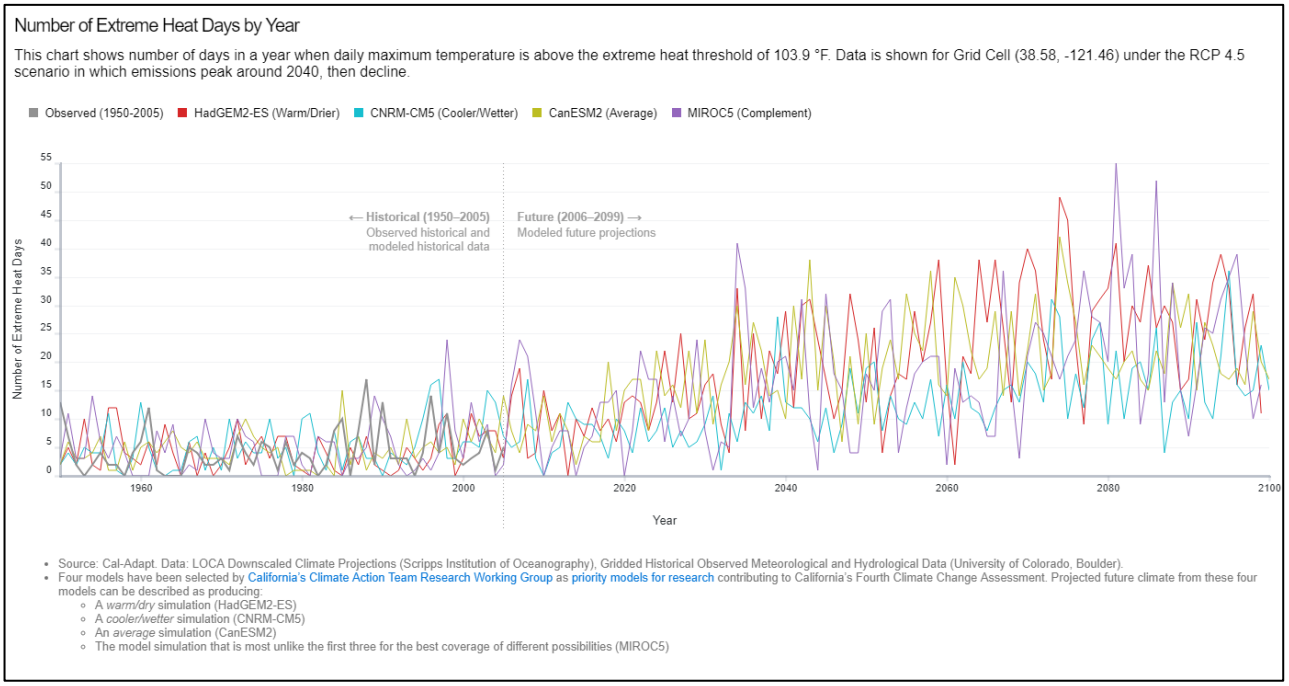


Figure 90: Number of Extreme Heat Days by Year

Source: Cal-adapt.org

Drought

Over the long-term, drought conditions in the Western U.S. are likely to continue for the foreseeable future as exemplified by the 2012 – 2016 drought (see previous Drought History section for additional details). Short-term, the region remains in Severe Drought status.

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.

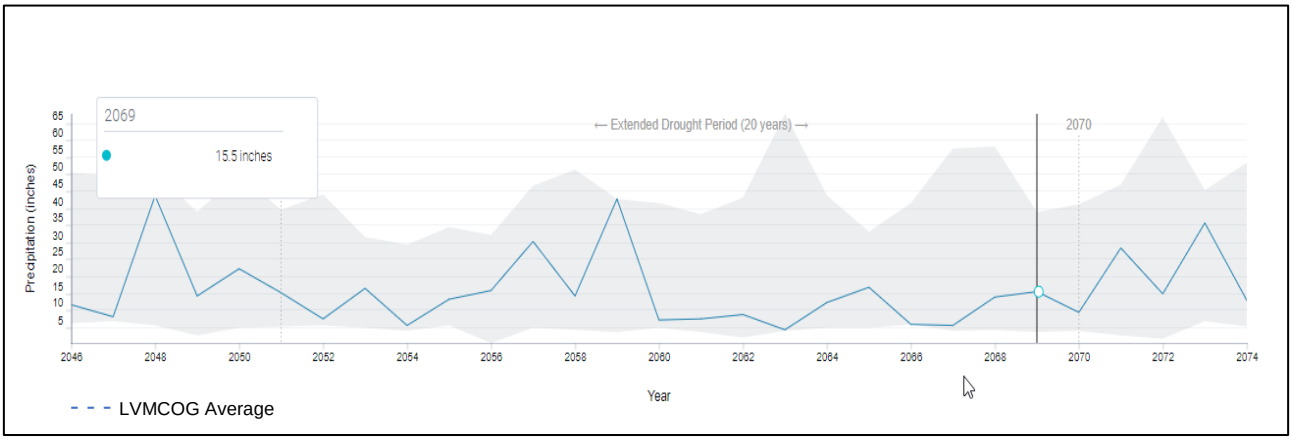


Figure 91: Extended Drought Scenario (2051 - 2070)

Source: Cal-adapt.org

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."

For the City of Malibu, on September 11, 2017 the USGS provided a presentation to the Malibu City Council[16] 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 137: Sea Level Rise Impacts for the City of Malibu (by 2100)

SOURCE: USGS

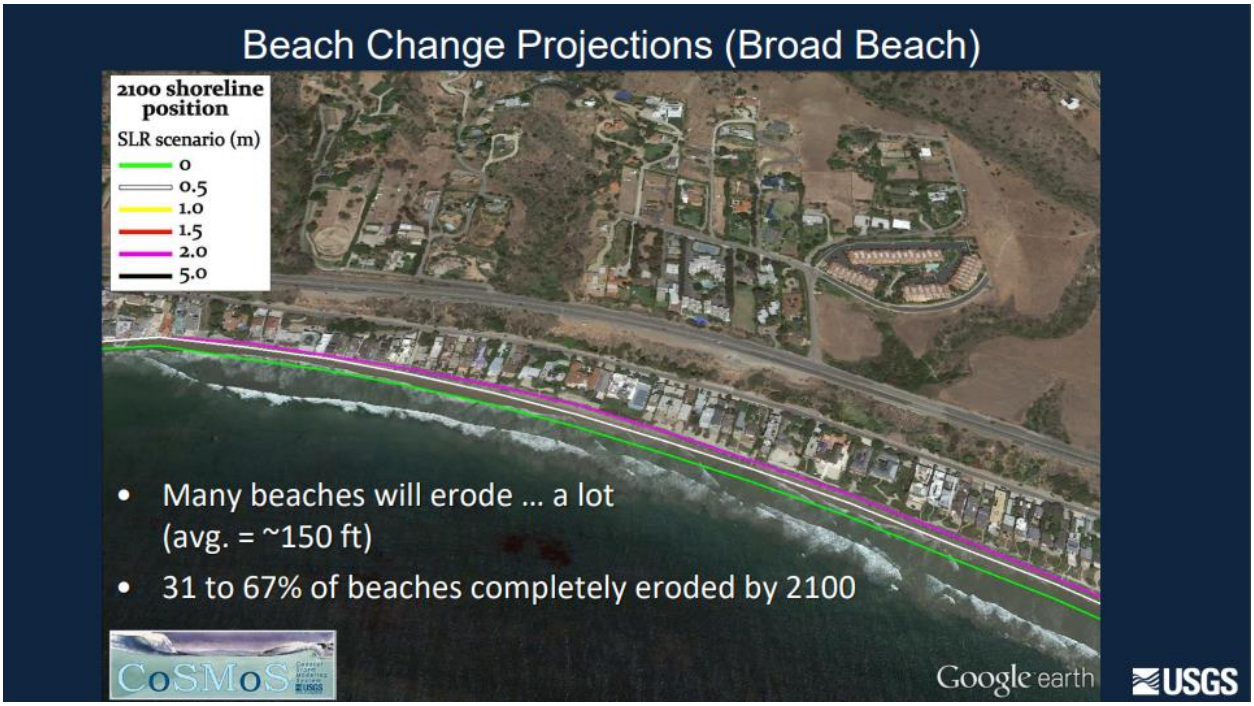


Figure 92: Beach Change Projections

SOURCE: USGS

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

CLIMATE CHANGE MITIGATION STRATEGIES

State and Federal Water Management Operations

On January 17, 2014, Governor Jerry Brown Jr. declared a state-wide drought State of Emergency. Under the requirements issued by the Governor, specific water use restrictions were put into place and goals were established for communities to decrease water use (State of California, California Department of Water Resources, 2015). Key measures in the proclamation include:

- Asking all Californians to reduce water consumption by 20 percent and referring residents and water agencies to the Save Our Water campaign - www.saveourh2o.org - for practical advice on how to do so
- Directing local water suppliers to immediately implement local water shortage contingency plans
- Ordering the State Water Resources Control Board (state water board) to consider petitions for consolidation of places of use for the State Water Project and Central Valley Project, which could streamline water transfers and exchanges between water users
- Directing the California Department of Water Resources and the state board to accelerate funding for projects that could break ground this year and enhance water supplies
- Ordering the state water board to put water rights holders across the state on notice that they may be directed to cease or reduce water diversions based on water shortages
- Asking the state water board to consider modifying requirements for releases of water from reservoirs or diversion limitations so that water may be conserved in reservoirs to protect cold water supplies for salmon, maintain water supplies and improve water quality

As part of the State's drought response, a public website has been established to provide guidance and information on ways to save water http://saveourwater.com/.
According to the State of California Drought Management Website (May 1, 2014) (http://ca.gov/drought/managementactions.html):

> *"the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation) joined with the State Water Resources Control Board (State Water Board) to form a Real-Time Drought Operations Management Team. This multi-agency team has exercised flexibility to conserve and store water since late January and continues exercising flexibility in a manner consistent with State Water Project and federal Central Valley Project operations protocols and provisions for water contract shortages. The California Department of Fish and Wildlife (CDFW), the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) have coordinated closely with the Team and they have collectively worked to ensure that water management decisions do not unreasonably affect threatened and endangered species"* (State of California, 2014).

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, the City participates in the California Statewide Community Development Authority (CSCDA) Open PACE Program. The Property Assessed Clean Energy (PACE) Program finances renewable energy sources, energy and water efficiency improvements, and seismic strengthening improvements for residential and commercial properties.

In addition, the City's 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 93: 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 "green building" efforts.

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)

In 2017, the City of Agoura Hills joined the County of Los Angeles and other agencies to participate in the "Clean Power Alliance" (CPA) a new, locally controlled electricity provider in Southern California. Participation in the CPA will look to supply greener power to homes and businesses.

Finally, the California Governor's Office of Planning and Research (OPR) prepares a list of plans and initiatives adopted by California Jurisdictions to address climate change. As of 2016 (3/16/16), the City of Agoura Hills was credited as having been in the process of implementing climate change provisions into its General Plan Policy and General Plan Implementation Measures.

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*".

"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 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 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.

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%
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.
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.

Project	Description
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.
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:

- PACE Program – Encourages private property owners to invest in energy efficiency retrofits
- 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

Figure 94: City of Calabasas Green City Web Page

Finally, the California Governor's Office of Planning and Research (OPR) prepares a list of plans and initiatives adopted by California Jurisdictions to address climate change. As of 2016 (3/16/16), the City of Calabasas was recognized with having adopted climate change provisions into its Codes or Ordinances.

Hidden Hills

The City of Hidden Hills has drafted 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.

Malibu

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.

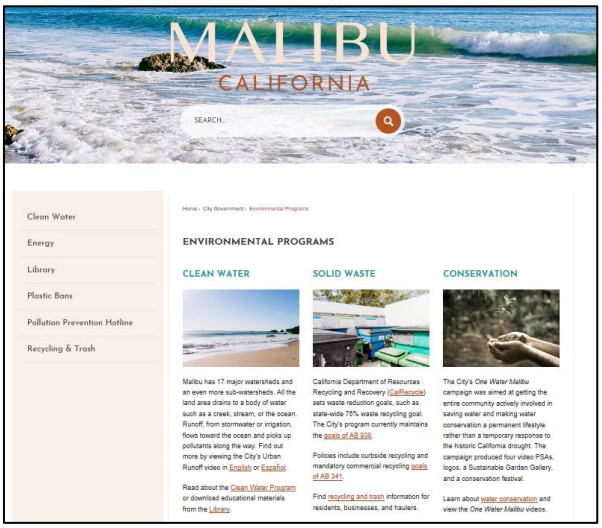


Figure 95: City of Malibu Environmental Programs Web Page

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 96: City of Malibu Environmental Sustainability Facebook Page

Westlake Village

The City of Westlake Village has implemented a "Green City" program that prioritizes 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 (http://www.wlv.org/292/Green-City). The website includes information on conservation, rebates, and other environmental tips as well as environmental programs that the City participates in.

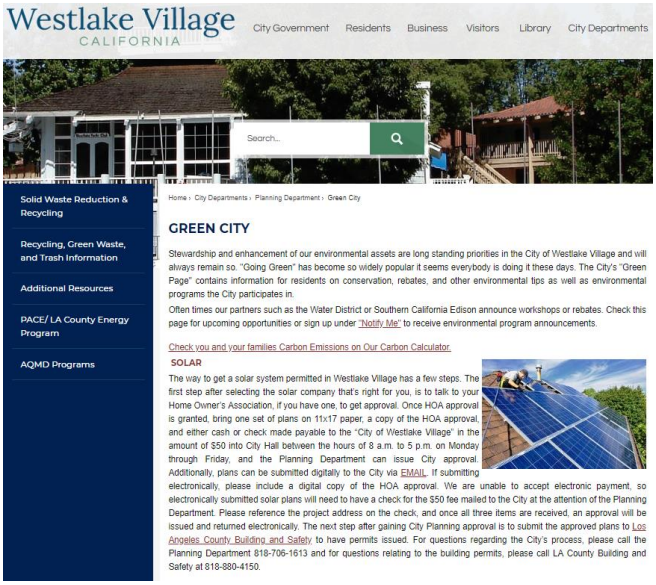


Figure 97: City of Westlake Village Green City Web Page

As part of its Green efforts, the City provides instructions and advice on:

- Solar Permitting and Approvals
- Composting
- Water Conservation

In addition, the City has completed water quality improvement projects such as:

- The Three Springs Priority Catch Basin Retrofit Project which prevents debris and trash from entering the storm drain system.
- The Westlake Lake, Phase I and Phase II Median Retrofit Project that reconstructed the center medians into bio-swales for capture and infiltration of storm and urban run-off.
- City-wide Irrigation Control Retrofit Project which converted the City's conventional timer-controlled irrigation system into weather-based SMART controller system which uses automation to reduce water demands and thereby reduces non-storm water run-off that is largely associated with urban pollution.
- A number of water quality improvements as part of the City Lindero Canyon Road Interchange Improvement Project and Westlake Village Community Park project.

The City 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:

- All City vehicles are fuel efficient hybrids or CNG vehicles.
- 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 is updating all its medians, parkways and park irrigation system to use only weather-based controllers and water efficient sprinkler heads to control over irrigation and run-off.
- 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%.

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.

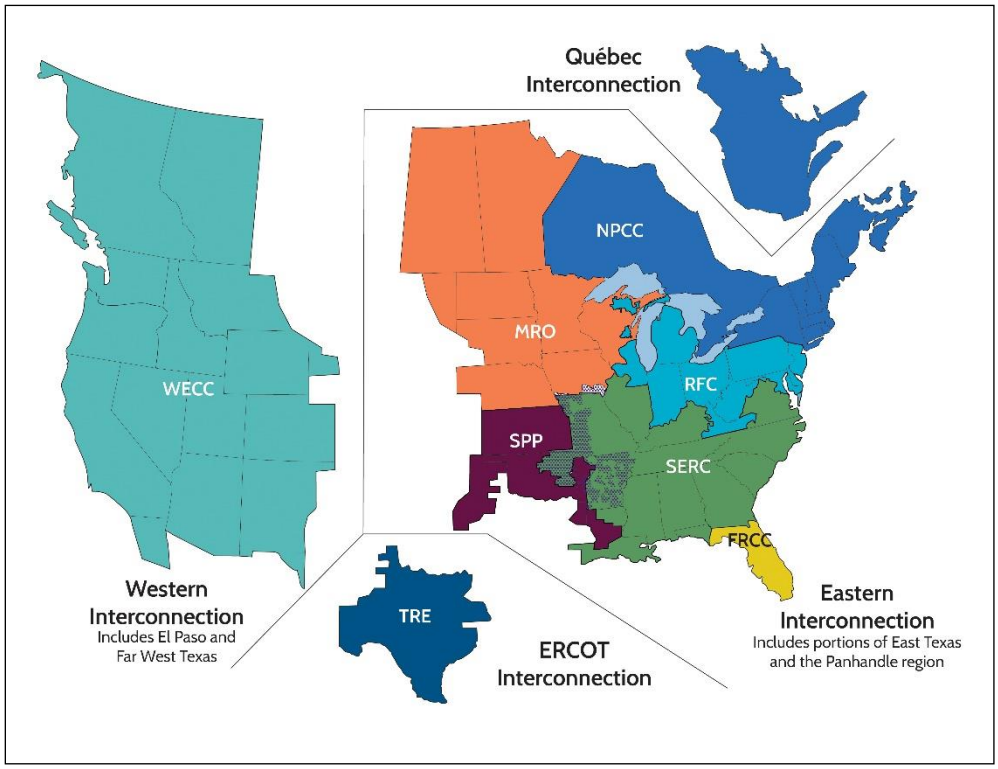


Figure 98: NERC Interconnections

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
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.
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.
2004	Rolling Blackouts	Forced blackouts in local communities from Calabasas to Simi Valley.	Technology: Power company equipment failure.
2005	Los Angeles Blackout	The City of Los Angeles, West Los Angeles, San Fernando Valley, Hollywood	Man-made: human error
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.
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.
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.

Table 138: Large Power Outages in Southern California

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, 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 four types of events:[17]

- Natural disasters caused by nature (e.g., floods, wind, earthquakes)
- 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)

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

Natural Disasters

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

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

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, 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.[18] 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.[19]

[18] 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.
[19] 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.

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.[20]

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.[21]

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 (2017 Estimate)	20,692	24,202	1,921	12,877	8,440	6,813
Total City Employment (2017 Estimate except as noted)	11,200	11,900	-	6,201	13,886	4,319
Economy**	$811,395K	$1,614,403K	$500K	$625,676K	$1,894,297K	$494,627K
Total Owner-Occupied Units	5,562	6,097	510	3,944	2,934	1,905

Table 139: Estimated Population and Economic Loss of a Power Disruption

*Per U.S. Census Estimates for 2012
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

Based on a 10% loss projection, more than 6,800 people would be impacted, and more than 4,300 jobs could be disrupted causing nearly $500M in economic losses. Also, more than 1,900 homes could experience an energy loss (see Community Profile section for population, housing, and economic data).

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

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.

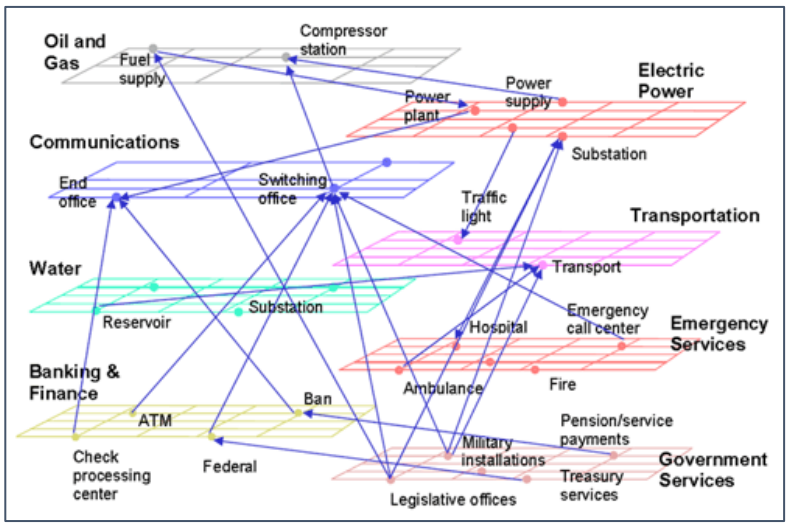


Figure 99: Infrastructure Interdependencies

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.[22] 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.[23] 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

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.

On September 18, 2018, representatives from SCE provided the LVMCOG a presentation on Wildfire Mitigation, Safety, and Grid Resiliency. During the presentation, SCE outlined 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.

[22] Lights out: Impact of the August 2003 power outage on mortality in New York, NY
[23] 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"

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 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.

SECTION 10. LANDSLIDE AND DEBRIS FLOWS

THE NATURE OF THE LANDSLIDE THREAT

A landslide is defined as, the movement of a mass of rock, debris, or earth 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). The term "landslide" encompasses events such as rock falls, topples, slides, spreads, and flows. 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.

The size of a landslide normally depends on the geology and the initial cause of the landslide. Landslides 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 are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names, depending on the type of failure and 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 $1 billion and $2 billion annually (FEMA)[24]. As a seismically active region, California has had a significant number of locations impacted by landslides. 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.

[24] FEMA, Landslide Loss Reduction, A Guide for State and Local Government Planning, 1989

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 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 2010 (additional flood events are documented in the **Flood and Severe Winter Storm** section).

Date(s)	Weather	Adverse Impacts
12/17/2010 - 12/22/2010	A very wet period developed as strong westerly flow across the Pacific tapped a pool of deep subtropical moisture near Hawaii, resulting in days of moderate to heavy rainfall. Four to 12 inches of rain fell in the coastal and valley areas over six days, 12 to 28 inches in the mountains, up to 9 inches in the high desert and less than 4 inches in the lower desert.	Major landslides and flash flooding impacted the communities of Laguna Beach, Apple Valley, along the Whitewater Channel in the Coachella Valley near Palm Springs, Highland, Corona, Loma Linda, La Jolla, and the city of San Diego from 12.21 to this day. Qualcomm Stadium was flooded but was miraculously drained and prepared for the Poinsettia Bowl held there on 12.23.
8/17/2012	A massive thunderstorm dropped 5.36" of rain on Yucaipa Ridge.	Runoff caused several mudslides down the hill in Forest Falls, one was 5 feet deep.
8/30/2012	Thunderstorms erupted in the mountains above Cathedral City. A thunderstorm produced 1.53" in one hour at March AFB in Riverside.	Major flash flooding in Cathedral City included 1 to 2 feet of rapidly moving water, closing several roads. Water forced mud and debris into several businesses in town, causing significant damage. Flash flooding in Moreno Valley went into a few homes. A rescue was needed to save a stranded motorist. Several roads and freeways were closed because of water and/or mud.
12/13/2012	Heavy rain from a winter storm spread rainfall across the San Diego metro area of 1.25 to 2 inches.	The rain triggered an eight-ton, six-foot diameter boulder to roll into a Poway home. There were also numerous flood related issues on the roadways, including a few that required swift water rescues. High tide and flooding runoff combined to flood PCH in Seal Beach and Sunset Beach. Some garages were inundated.

Date(s)	Weather	Adverse Impacts
7/21/2013	Thunderstorms erupted across the mountains and deserts. Radar estimated two to four inches of rainfall in one hour for some of the storms.	The newly vulnerable burn scar of the Mountain fire got brief heavy rain on the 21st that produced a flash flood and a debris flow called an "ash flow." One of these flowed into a pond, displaced the water, and killed the resident fish. Several other desert roads near Sky Valley, Mecca, and Borrego Springs were rendered impassable from the water and debris. In Big Bear City, some of these floodwaters entered a few homes. In remote Anza Borrego Desert State Park, three vehicles were washed downstream.
8/23/2013	Heavy thunderstorms on the San Jacinto Mountains.	Debris and water came down from the Mountain Fire burn into Palm Springs.
9/6/2013 - 9/7/2013	Thunderstorms developed in the mountains and deserts and Inland Empire each day. Pea to dime sized hail and damaging winds also accompanied these storms.	On 9.6, mud and water covered the highway near Warner Springs, stranding multiple vehicles stuck in the mud. Minor road flooding near Pine Valley and just east of Lucerne Valley. On 9.7, normally dry Mill Creek near Forest Falls ran deep and wide, stranding campers. There was flooding in Campo, east of Julian, Ocotillo, and in Cathedral City along the Whitewater Wash.
2/28/2014 - 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.
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.
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.
12/3/2014 – 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.

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.
7/18/2015 – 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.
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.
1/5/2016 – 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.

Table 140: Significant Flood Events in Southern California 2010 - 2016

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 21 reported deaths, multiple injuries, and at least $177 million in property damage.[25]

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

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.

History of Landslides in the Las Virgenes-Malibu Region

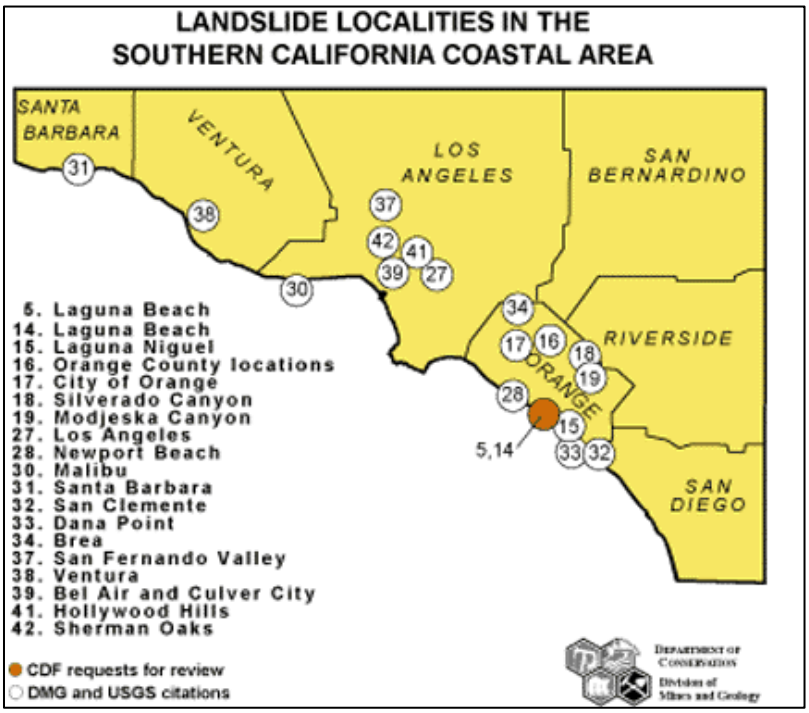
Several cities in the Las Virgenes-Malibu Region have experienced landslide events due to heavy rains or seismic events. Examples for the cities of Agoura Hills and Malibu are provided below.

Agoura Hills Landslides

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.

Malibu Landslides

Landslide events in the City of Malibu have included the Calle del Barco, Kanan, Pacific Coast Highway, Las Flores, Love, and Malibu Road landslides. 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. The *Landslide Localities in Southern California Coastal Area Map* depicts landslides along coastal areas in Southern California (1997-1998) including Malibu (Number 30). The summary on the next page describes a timeline of events in Malibu.



Map 65: Landslide Localities in the S. Calif. Coastal Area

Landslide Localities in Southern California Coastal Area

30. Malibu, Los Angeles County. On 12/06/97 homes in Malibu were damaged by waves and seacliff erosion. On 02/07 Malibu Canyon Road closed due to mudslides and rockfalls (Tan, 02/11). On 02/08 an ocean-eroded cliff buckled, causing one home to collapse and two others threatened. The homes along Broad Beach Road were undermined by high tides (Tan, 02/11). On 02/16 several houses along the beach of Malibu were damaged by the high surf and rainstorms (Tan, 02/19). On 02/23

Pacific Coast Highway, Topanga Canyon Boulevard, and Malibu Canyon Road were blocked by mudslides. A Union Pacific railroad trestle was undermined by the surging flows of the Ventura River and was not reopened to rail traffic for weeks (Tan, 03/05). On 02/24 in Malibu's Las Flores Canyon, officials called for evacuation of about a dozen homes because of unstable ground. Also, more mudslides on Pacific Coast Highway forced officials to close the local courthouse (Tan, 03/05). On 02/25 a 140-foot-long retaining wall partially collapsed, damaging two homes above the slide on Calle del Barco. The 20-year-wall, along a narrow road (Rambla Orienta) just above Pacific Coast Highway, began to give away during the evening of 02/24 (Tan, 03/05).

SOURCE: http://www.consrv.ca.gov/cgs/fwgp/ls_response/Pages/ls_la.aspx

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.[26]

CAUSES AND CHARACTERISTICS OF LANDSLIDES

Landslide Events and Impacts

Landslides 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.

[26] Fugro, Annual Report Malibu Road Landslide Assessment District, June 2017

LANDSLIDE HAZARD IDENTIFICATION

Landslides 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.

Natural Processes

Natural processes can cause landslides or re-activate historical landslide sites. 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 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. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. 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 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 of a landslide. Additionally, changing away from native ground cover plants may increase the risk of landslide. For example, if certain vegetation requires heavy watering, soil conditions can change and trigger landslides.

Landslide Risk Factors

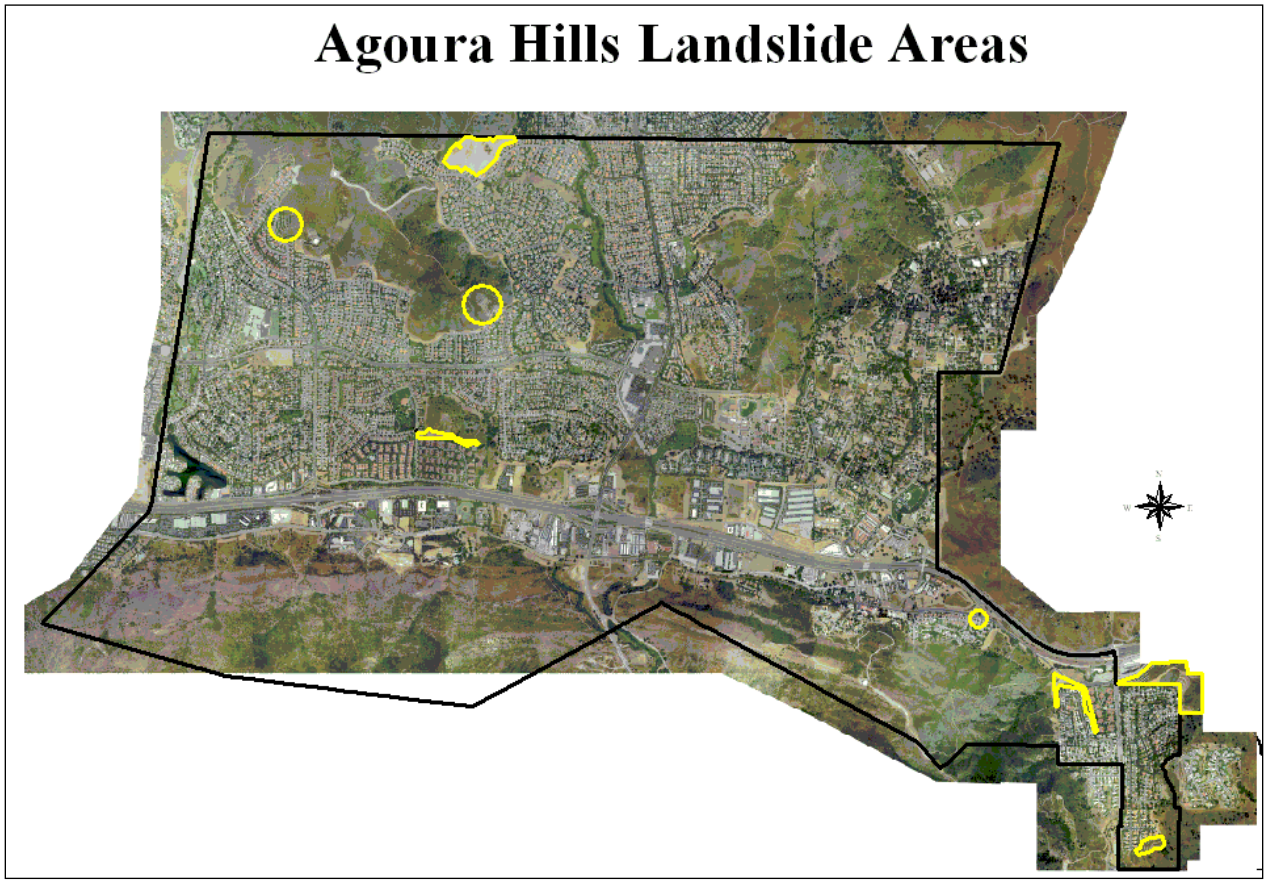
Locations at risk from landslides or debris flows include areas with one or more of the following conditions:

1. On or close to steep hills;
2. Steep road-cuts or excavations;
3. Existing landslides or places of known historic landslides (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 Areas

Agoura Hills

The City of Agoura Hills has identified areas that may be prone to landslides (see Agoura Hills Landslide Areas map on the following page). Yellow boundaries enclose areas that may be prone to landslide events within the City.

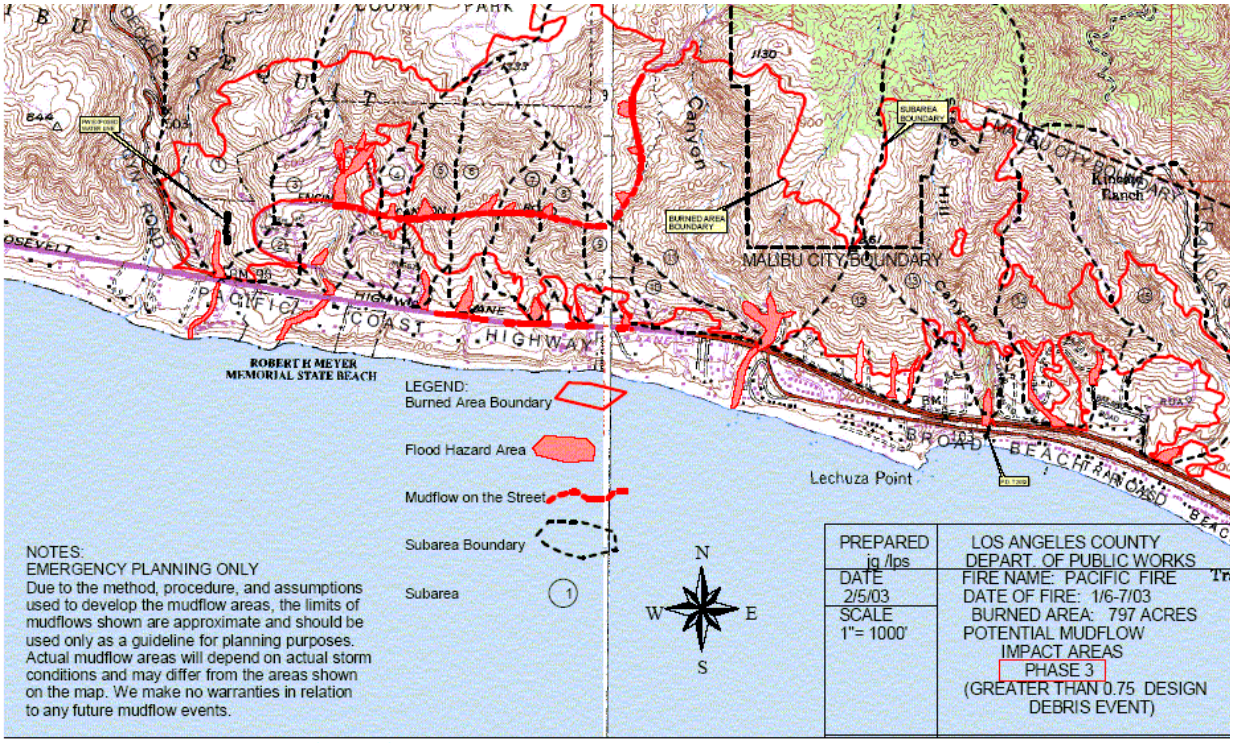


Map 66: Agoura Hills Landslide Areas

Source: City of Agoura Hills Internal Map

Malibu

For the City of Malibu, a mudflow risk assessment was conducted by the Los Angeles County Department of Public Works as a result of the Pacific Fire. The fire destroyed much native vegetation and left the soil and terrain vulnerable to absorbing higher than normal amounts of water from rainfall, creating a risk of landslide. The following map shows Phase III of the Potential Mudflow Impact Areas (which reflects a worst-case scenario) i.e., greater than .75 design debris event.



Map 67: Potential Mudflow Impact, City of Malibu

Westlake Village

In the City of Westlake Village, potential landslide hazards are primarily limited to areas of sedimentary rocks in the northeast tip of the City. Areas with sediments have moderate to high slope instability potential. Areas with volcanic rocks have moderate to low slope instability potential.

Estimated Impact of an Event

If multiple landslides 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	20,692	24,202	1,921	12,877	8,440	68
Total Owner-Occupied Units	5,562	6,097	510	3,944	2,934	19
Median Home Value	$699,200	$926,800	More than $2,000,000	$1,802,800	$819,900	More than $23M

Table 141: Estimated Population and Economic Loss of Multiple Landslides

Based on a 0.1% loss projection, more than 68 people could be displaced or significantly impacted, and more than 19 homes could be damaged or destroyed resulting in over $23 million in losses (see Community Profile section for population, housing, and economic data).

LANDSLIDE VULNERABILITIES

Landslides 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 landslide movements.

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 fall under their immediate attention.

Landslide 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 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 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.

Landslide 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 slope-setback 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.

Section	Title
8103(a) 110.2	Geologic Hazard
8103(u) 1806.5	Foundations on Adjacent Slopes
8103(aaa) 3304.6.11	Debris Prohibited

Calabasas

There have been no significant landslide events in recent history in the City of Calabasas. Consequently, the City currently does not take additional measures beyond standard CBC requirements.

Hidden Hills

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

Section	Title
3316	Erosion Control
1806.11	Foundations on Expansive Soil

Malibu

The City of Malibu Local Coastal Program Land Use Plan (LUP) includes policies to minimize the hazards associated with shoreline and bluff development including slope stability and landslide potential in hillside areas and the City of Malibu Building Code addresses development on steep slopes. The following building codes are implemented as preventative measures for loss of life and property because of a landslide hazard event.

Malibu Municipal Code Section	Title
Title 17 Zoning, Chapter 17.40 Property Development and Design Standards	Slope and Set Back Requirements

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.[27] 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.

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.

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

This page intentionally left blank

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.

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 142: 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	20,692	24,202	1,921	12,877	8,440	681
Total Owner-Occupied Units	5,562	6,097	510	3,944	2,934	190
Median Home Value	$699,200	$926,800	More than $2,000,000	$1,802,800	$819,900	More than $238M (1% of the total owner-occupied units x median home value)

Table 143: Estimated Population and Owner-Occupied Housing Unit Loss of a Windstorm

Based on a 1% loss projection, more than 680 people could be significantly impacted, and more than 190 homes damaged resulting in over $238 million in losses for owner-occupied housing units (see Community Profile section for population, housing, and economic data).

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.

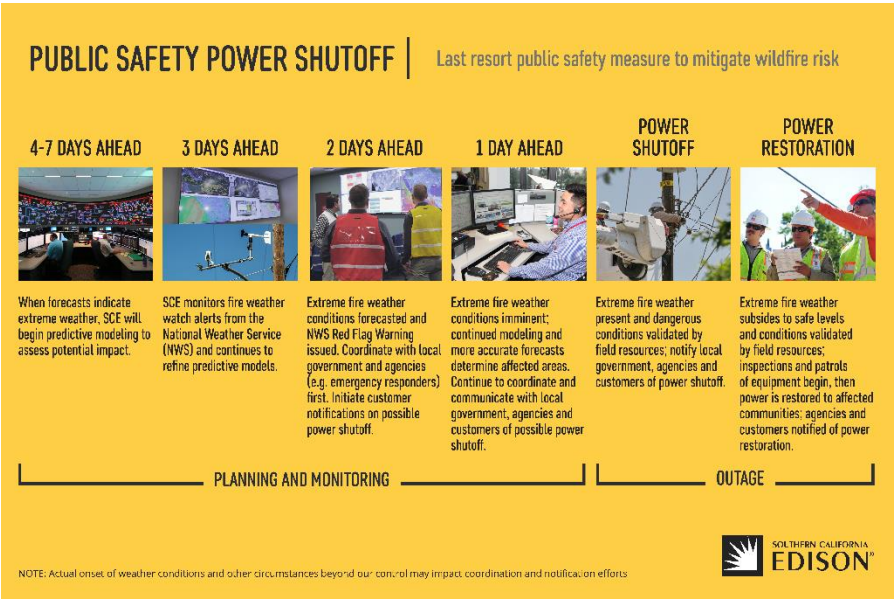


Figure 100: SCE Public Safety Power Shutoff Process

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 101: Santa Ana Wind Satellite Image

Source: NASA / JPL-Caltech, 2002

The Santa Ana Wind Circulation Map 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. The LVMCOG is in the 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 tracks 8,000 trees that it maintains according to standards regarding public safety. Codes on tree pruning were recently reviewed and updated and new codes regarding tree maintenance were implemented.

In 2011 Agoura Hills signed a professional tree maintenance contract with West Coast Arborists Inc. to maintain all City owned trees. Since there is a great deal of individual attention required for adequate tree maintenance to ensure an increase in the health of city trees and enhance public safety this separate contract ensures that detailed maintenance logs and inventories are kept resulting in improved care, which can help reduce the City's liability. Under this new contract, every City owned tree is assessed every three years. Additionally, the City offers free hazardous oak tree pruning and removal permits and reduced fees for preventive oak tree pruning permits for potentially hazardous oak trees.

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. The City is in the process of mapping all of its trees using a GIS program.

This page intentionally left blank

SECTION 12. FLOOD / SEVERE WINTER STORM

THE NATURE OF THE FLOOD 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.

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 2010.

Date(s)	Weather	Adverse Impacts
1.18-22.2010	A very wet and dynamic series of storms dropped two to four inches of rainfall in the deserts, to four to eight inches west of the mountains, to six to 12 inches on the coastal slopes.	Widespread flooding resulted across the region. Some of the worst flash flooding occurred in the high desert on the 1.21 due to the prolonged heavy rainfall. Scores of homes and several schools sustained damage, and many roads were washed out in Hesperia, Apple Valley, Victorville and Adelanto. Numerous swift water rescues were needed, one of which likely saved four teens trapped in a storm water drain. Two deaths in Tijuana were attributed to the flooding.
8.25.2010	Powerful thunderstorms hit Forest Falls and Hemet with heavy rain.	Flash floods resulted.
8.26.2010	Powerful thunderstorms hit Wrightwood and Warner Springs with heavy rain.	Flash floods resulted.
12.17-22.2010	A very wet period developed as strong westerly flow across the Pacific tapped a pool of deep subtropical moisture near Hawaii, resulting in days of moderate to heavy rainfall. Four to 12 inches of rain fell in the coastal and valley areas over six days, 12 to 28 inches in the mountains, up to 9 inches in the high desert and less than 4 inches in the lower desert.	Major landslides and flash flooding impacted the communities of Laguna Beach, Apple Valley, along the Whitewater Channel in the Coachella Valley near Palm Springs, Highland, Corona, Loma Linda, La Jolla, and the city of San Diego from 12.21 to this day. Qualcomm Stadium was flooded but was miraculously drained and prepared for the Poinsettia Bowl held there on 12.23.
7.31.2012	A strong thunderstorm produced heavy rain in the Split Mountain area of the Anza Borrego Desert.	A 15-foot wall of water rushed through Split Mountain Road in Fish Creek. Two hikers, a man and his son, were caught in the canyon, but were able to get to higher ground and were unharmed. Their pickup truck, however, was washed 1.5 miles down the canyon and destroyed.
8.17.2012	A massive thunderstorm dropped 5.36” of rain on Yucaipa Ridge.	Runoff caused several mudslides down the hill in Forest Falls, one was 5 feet deep.

Date(s)	Weather	Adverse Impacts
8.30.2012	Thunderstorms erupted in the mountains above Cathedral City. A thunderstorm produced 1.53" in one hour at March AFB in Riverside.	Major flash flooding in Cathedral City included 1 to 2 feet of rapidly moving water, closing several roads. Water forced mud and debris into several businesses in town, causing significant damage. Flash flooding in Moreno Valley went into a few homes. A rescue was needed to save a stranded motorist. Several roads and freeways were closed because of water and/or mud.
9.11.2012	A stationary thunderstorm brought persistent, heavy rain to Mecca. 3 to 5" of rain fell in just a couple hours (more than a year's worth).	Floodwaters damaged a school, a mobile home park and several orchards.
12.13.2012	Heavy rain from a winter storm spread rainfall across the San Diego metro area of 1.25 to 2 inches.	The rain triggered an eight-ton, six-foot diameter boulder to roll into a Poway home. There were also numerous flood related issues on the roadways, including a few that required swift water rescues. High tide and flooding runoff combined to flood PCH in Seal Beach and Sunset Beach. Some garages were inundated.
7.21.2013	Thunderstorms erupted across the mountains and deserts. Radar estimated two to four inches of rainfall in one hour for some of the storms.	The newly vulnerable burn scar of the Mountain fire got brief heavy rain on the 21st that produced a flash flood and a debris flow called an "ash flow." One of these flowed into a pond, displaced the water, and killed the resident fish. Several other desert roads near Sky Valley, Mecca, and Borrego Springs were rendered impassable from the water and debris. In Big Bear City, some of these floodwaters entered a few homes. In remote Anza Borrego Desert State Park, three vehicles were washed downstream.
8.18.2013	Heavy thunderstorms developed in the high desert. Radar estimated rainfall west of Victorville at seven inches.	Floodwaters damaged and closed several highways west of Phelan and in Apple Valley and filled the El Mirage Dry Lake.
8.23.2013	Heavy thunderstorms on the San Jacinto Mountains.	Debris and water came down from the Mountain Fire burn into Palm Springs.
8.25.2013	Monsoon thunderstorms. Agua Caliente recorded over two inches of rainfall incredibly in 35 minutes.	Floodwaters filled the Whitewater channel, which goes through several golf courses and crosses many roads from Palm Springs to La Quinta. Flash floods also in the Anza Borrego Desert.
8.29.2013	Thunderstorms struck Riverside and the San Bernardino Mountains where over one inch of rain fell in 20 minutes.	Riverside was inundated with flooding of streets up to two feet deep. Riverside City College canceled classes. Flash floods occurred around the Perris area and along Highway 18 in the San Bernardino Mountains
9.6-7.2013	Thunderstorms developed in the mountains and deserts and Inland Empire each day. Pea to dime sized hail and damaging winds also accompanied these storms.	On 9.6, mud and water covered the highway near Warner Springs, stranding multiple vehicles stuck in the mud. Minor road flooding near Pine Valley and just east of Lucerne Valley. On 9.7, normally dry Mill Creek near Forest Falls ran deep and wide, stranding campers. There was flooding in Campo, east of Julian, Ocotillo, and in Cathedral City along the Whitewater Wash.

Date(s)	Weather	Adverse Impacts
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.
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.
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.
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.
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.
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.
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.
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.
12.12-13.2014	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.

Date(s)	Weather	Adverse Impacts
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.
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.
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.
7.29-30.2015	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.
9.7-8.2015	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.
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.
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.

Date(s)	Weather	Adverse Impacts
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.
11.3-4.2015	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.
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.

Table 144: Significant Flood Events in Southern California 2010 - 2016

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 1978 through 2018.

Community Name	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments
Agoura Hills	60	34	0	26	$552,567.03
Calabasas	19	9	0	10	$99,249.09
Hidden Hills,	37	23	0	14	$391,043.63
Malibu	130	68	1	61	$2,531,819.00
Westlake Village	4	1	0	3	$566.83

Table 145: Flood Loss Statistics for California (From January 1, 1978 to December 31, 2011)

SOURCE: https://bsa.nfipstat.fema.gov/reports/1040.htm CWOP – Closed Out Without Payment

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).*

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 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.

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.

Urban Development

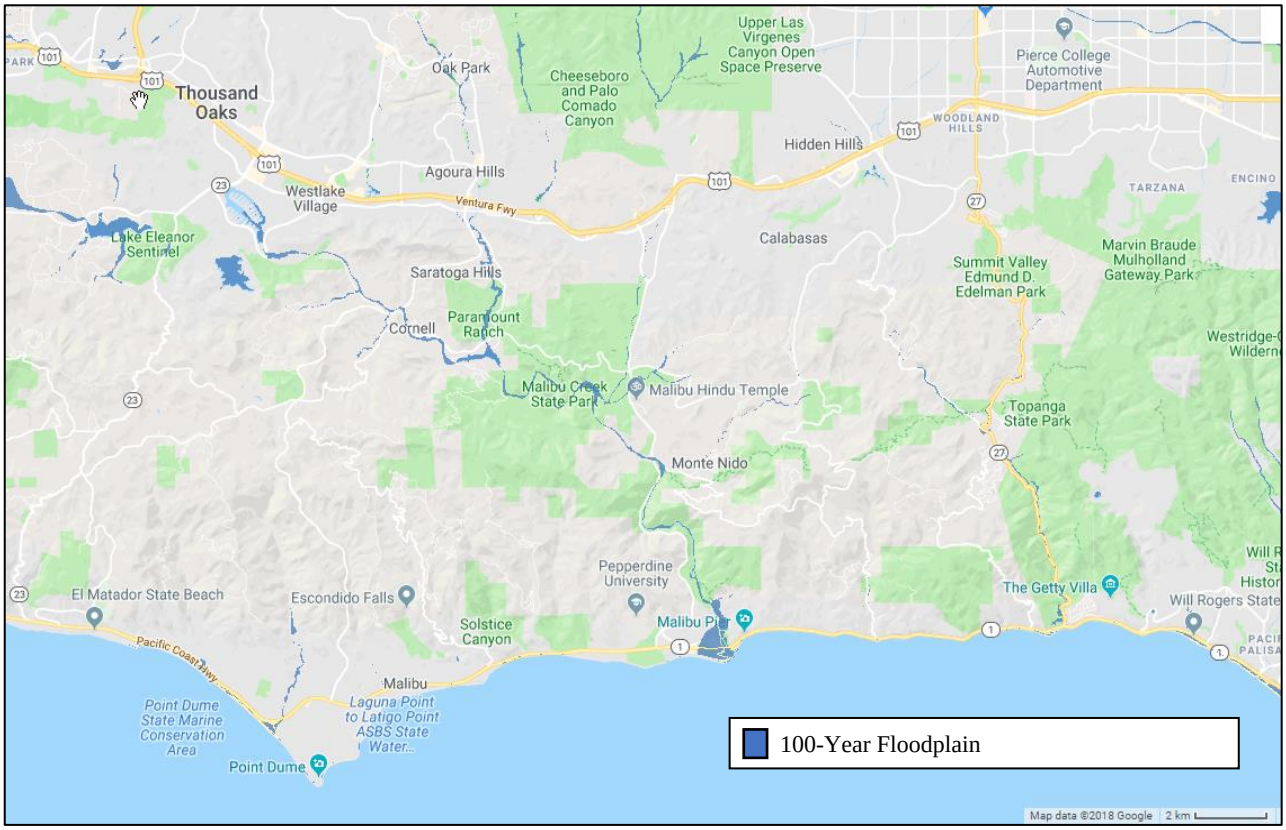
The trend towards development has resulted in less open land and greater flood potential. In-fill building is becoming a much more common practice in many areas. Developers tear down an older home which typically covers up to 40% of the lot size and replace it with a single massive home or multi-unit 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.

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 70: 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.

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	20,692	24,202	1,921	12,877	8,440	681
Total City Employment	11,200	11,900	-	6,201	13,886*	432
Economy**	$811,395,000	$1,614,403,000	$500,000	$625,676,000	$1,894,297,000	$49,462,710
Total Housing Units	5,562	6,097	510	3,944	2,934	190
Median Home Value	$699,200	$926,800	More than $2,000,000	$1,802,800	$819,900	More than $238M

Table 146: Estimated Population and Economic Loss of Floods

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

Based on a 1% loss projection, more than 680 people would be displaced or significantly impacted, more than 430 jobs lost (either temporarily or permanently), more than $49M in economic losses, and more than 190 homes could be damaged or destroyed resulting in over $238 million in home value losses (see Community Profile section for population, housing, and economic data).

FLOOD 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.

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.

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.

FLOOD 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	02/06/16	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	09/26/08	10/1/12	No
060744C	WESTLAKE VILLAGE	LOS ANGELES		09/26/08	04/04/18	10/1/92	No

Table 147: FEMA Community Status Book Report: California

Source: http://www.fema.gov/cis/CA.html

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.

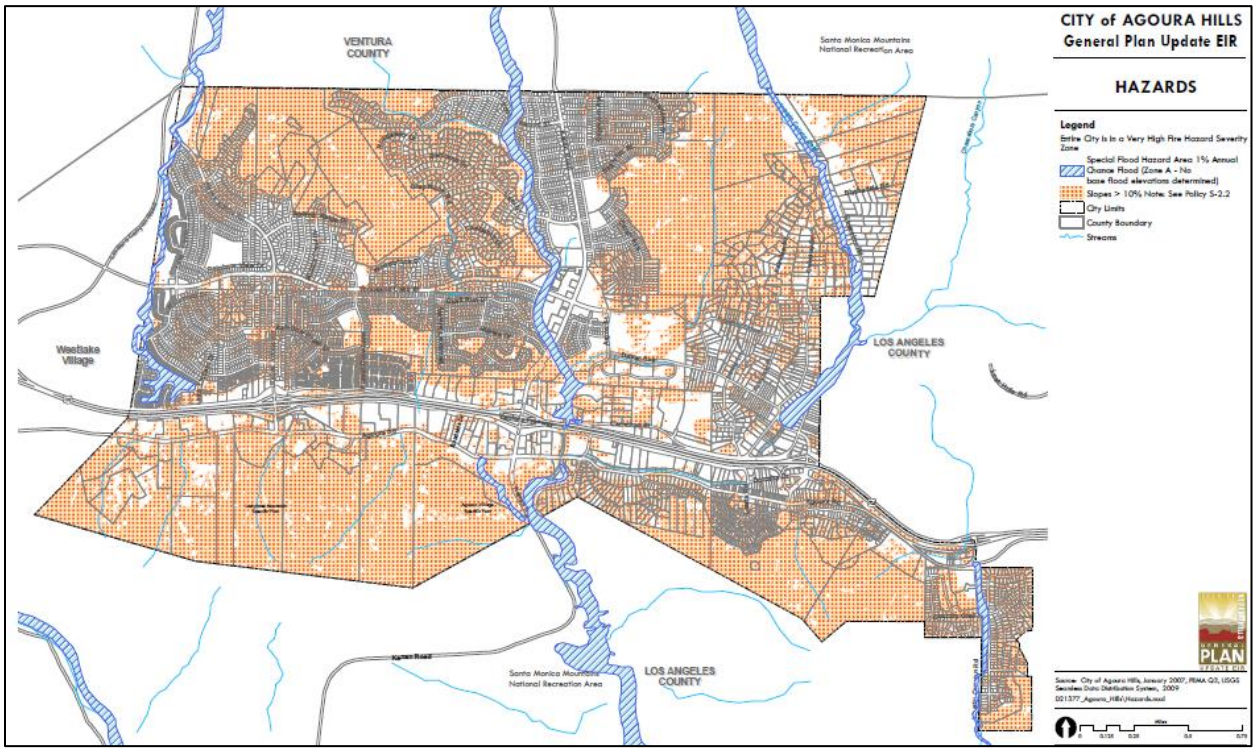
Flood mitigation activities are based on the potential risk as described in the Flood Insurance Rate Maps as well as local historical and planning information. This data was also used in the development of this HMP. Implementation of flood mitigation actions include enforcement of building codes, zoning 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 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.

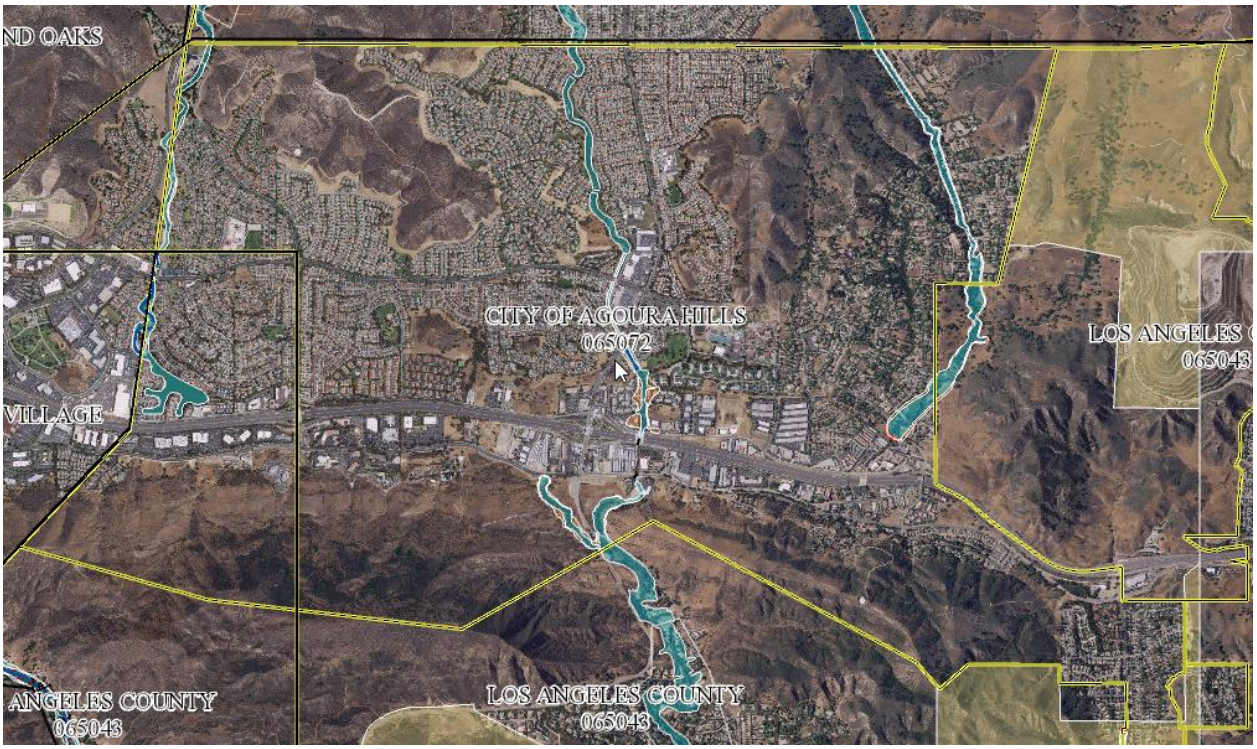


Map 71: City of Agoura Hills Flood Areas

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.
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.

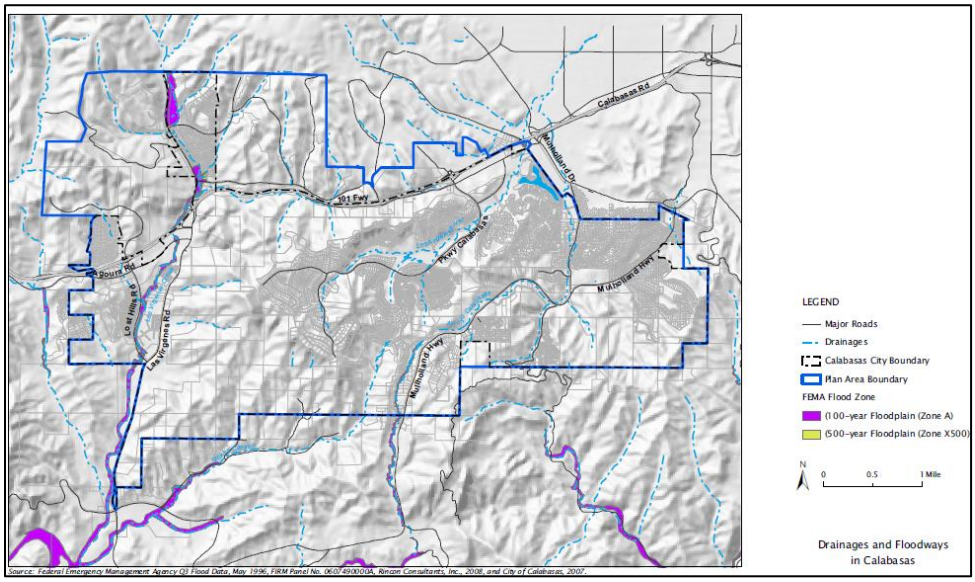
The map below provides a view of the Flood Insurance Rate Map area for the City of Agoura Hills. Flood Insurance Rate Maps (FIRM) are located in **Annex F**.



Map 72: City of Agoura Hills Flood Insurance Rate Map ID

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.

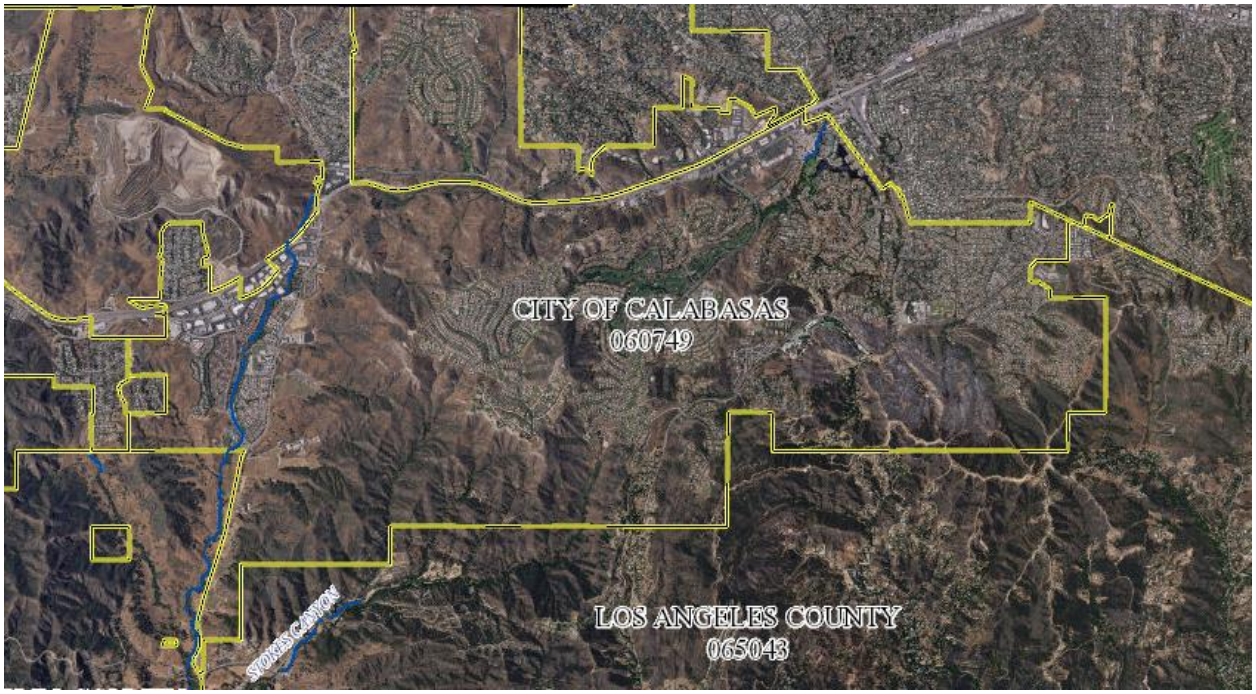


Map 73: Drainages and Floodways in Calabasas

The following policies are outlined in the 2030 City of Calabasas 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
Safety Element VII-1	Incorporate adequate mitigation measures into proposed development projects to achieve an acceptable level of risk from potential flooding hazards.
Safety Element VII-8	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.
Safety Element VII-9	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.
Safety Element VII-10	For discretionary development projects, limit new impervious surfaces to those that will not individually or cumulatively increase harmful runoff into natural stream channels downstream.
Safety Element VII-11	Setbacks from stream beds should be sufficient to avoid possible adverse effects associated with future bank erosion.

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 74: City of Calabasas Flood Insurance Rate Map ID

Hidden Hills

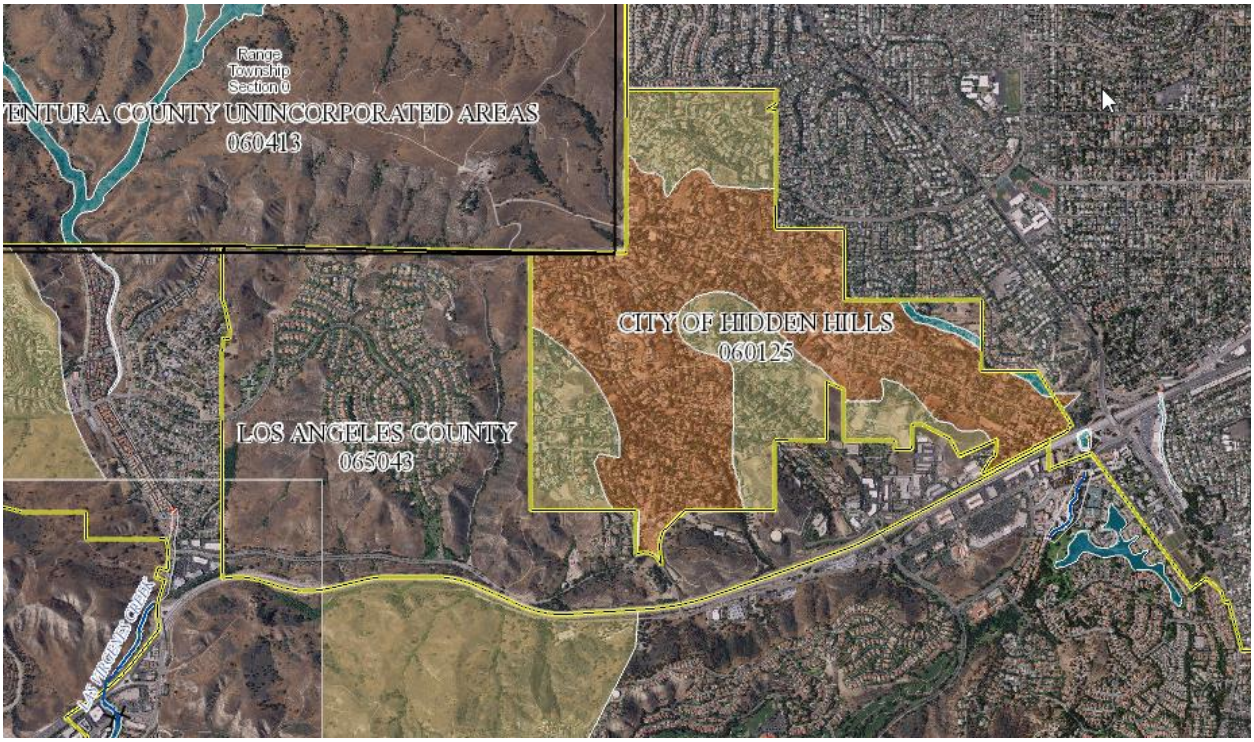
There are no year-round streams or ponds within the city. Surface water runoff only occurs during and after periods of intense rainfall. The City's topography and soil conditions subject Hidden Hills to flood hazards from storm drain overflow, erosion, mudflows, and debris deposits. There are no Special 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 75: 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 27 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.**

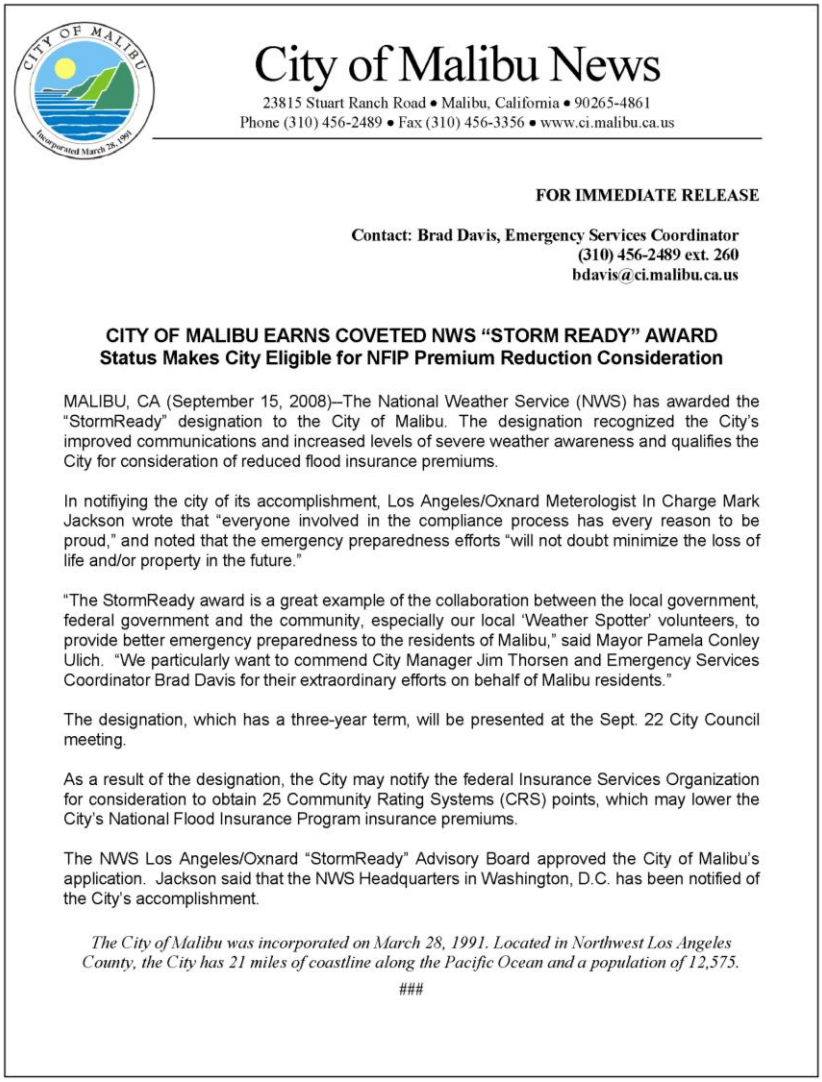
Map 76: City of Malibu Flood Insurance Rate Map ID and Zones

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.

General Plan Section	Description
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.



City of Malibu News

23815 Stuart Ranch Road • Malibu, California • 90265-4861
Phone (310) 456-2489 • Fax (310) 456-3356 • www.ci.malibu.ca.us

FOR IMMEDIATE RELEASE

Contact: Brad Davis, Emergency Services Coordinator
(310) 456-2489 ext. 260
bdavis@ci.malibu.ca.us

CITY OF MALIBU EARNS COVETED NWS "STORM READY" AWARD
Status Makes City Eligible for NFIP Premium Reduction Consideration

MALIBU, CA (September 15, 2008)--The National Weather Service (NWS) has awarded the "StormReady" designation to the City of Malibu. The designation recognized the City's improved communications and increased levels of severe weather awareness and qualifies the City for consideration of reduced flood insurance premiums.

In notifiying the city of its accomplishment, Los Angeles/Oxnard Meterologist In Charge Mark Jackson wrote that "everyone involved in the compliance process has every reason to be proud," and noted that the emergency preparedness efforts "will not doubt minimize the loss of life and/or property in the future."

"The StormReady award is a great example of the collaboration between the local government, federal government and the community, especially our local 'Weather Spotter' volunteers, to provide better emergency preparedness to the residents of Malibu," said Mayor Pamela Conley Ulich. "We particularly want to commend City Manager Jim Thorsen and Emergency Services Coordinator Brad Davis for their extraordinary efforts on behalf of Malibu residents."

The designation, which has a three-year term, will be presented at the Sept. 22 City Council meeting.

As a result of the designation, the City may notify the federal Insurance Services Organization for consideration to obtain 25 Community Rating Systems (CRS) points, which may lower the City's National Flood Insurance Program insurance premiums.

The NWS Los Angeles/Oxnard "StormReady" Advisory Board approved the City of Malibu's application. Jackson said that the NWS Headquarters in Washington, D.C. has been notified of the City's accomplishment.

The City of Malibu was incorporated on March 28, 1991. Located in Northwest Los Angeles County, the City has 21 miles of coastline along the Pacific Ocean and a population of 12,575.

###

Figure 102: NWS Storm Ready Award Announcement

Westlake Village

Flood hazard areas within the City of Westlake Village are limited to 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.

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.

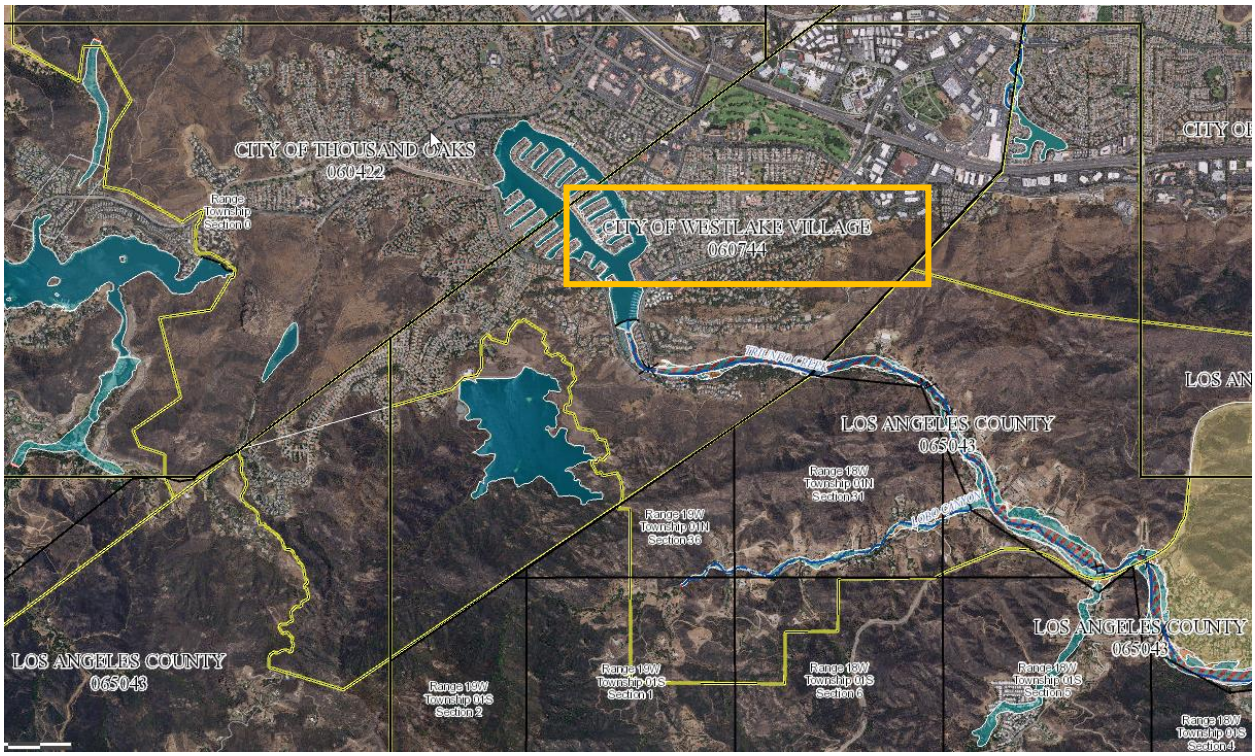
The following goals, policies, and programs are outlined in the City of Westlake Village General Plan Hazards Section. The goals and policies described guide the City in its continued compliance with NFIP guidelines and in reducing present and future flood hazards.

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.

General Plan Section	Description
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 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 77: City of Westlake Village Flood Insurance Rate Map ID

This page intentionally left blank

SECTION 13. 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 148: 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. Abu Sayyaf Group (ASG)	35. al-Shabaab
2. Aum Shinrikyo (AUM)	36. Revolutionary Struggle (RS)
3. Basque Fatherland and Liberty (ETA)	37. Kata'ib Hizballah (KH)
4. Gama'a al-Islamiyya (Islamic Group - IG)	38. al-Qa'ida in the Arabian Peninsula (AQAP)
5. HAMAS	39. Harakat ul-Jihad-i-Islami (HUJI)
6. Harakat ul-Mujahidin (HUM)	40. Tehrik-e Taliban Pakistan (TTP)
7. Hizballah	41. Jundallah
8. Kahane Chai (Kach)	42. Army of Islam (AOI)
9. Kurdistan Workers Party (PKK, aka Kongra-Gel)	43. Indian Mujahedeen (IM)
10. Liberation Tigers of Tamil Eelam (LTTE)	44. Jemaah Anshorut Tauhid (JAT)
11. National Liberation Army (ELN)	45. Abdallah Azzam Brigades (AAB)
12. Palestine Liberation Front (PLF)	46. Haqqani Network (HQN)
13. Palestine Islamic Jihad (PIJ)	47. Ansar al-Dine (AAD)
14. Popular Front for the Liberation of Palestine (PFLP)	48. Boko Haram
15. PFLP-General Command (PFLP-GC)	49. Ansaru
16. Revolutionary Armed Forces of Colombia (FARC)	50. al-Mulathamun Battalion (AMB)
17. Revolutionary People's Liberation Party/Front (DHKP/C)	51. Ansar al-Shari'a in Benghazi
18. Shining Path (SL)	52. Ansar al-Shari'a in Darnah
19. al-Qa'ida (AQ)	53. Ansar al-Shari'a in Tunisia
20. Islamic Movement of Uzbekistan (IMU)	54. ISIL Sinai Province (formerly Ansar Bayt al-Maqdis)
21. Real Irish Republican Army (RIRA)	55. al-Nusrah Front
22. Jaish-e-Mohammed (JEM)	56. Mujahidin Shura Council in the Environs of Jerusalem
23. Lashkar-e Tayyiba (LeT)	57. Jaysh Rijal al-Tariq al Naqshabandi (JRTN)
24. Al-Aqsa Martyrs Brigade (AAMB)	58. ISIL-Khorasan (ISIL-K)
25. Asbat al-Ansar (AAA)	59. Islamic State of Iraq and the Levant's Branch in Libya
26. al-Qaida in the Islamic Maghreb (AQIM)	60. Al-Qa'ida in the Indian Subcontinent
27. Communist Party of the Philippines/New People's Army	61. Hizbul Mujahideen (HM)
28. Jemaah Islamiya (JI)	62. ISIS-Bangladesh
29. Lashkar i Jhangvi (LJ)	63. ISIS-Philippines
30. Ansar al-Islam (AAI)	64. ISIS-West Africa
31. Continuity Irish Republican Army (CIRA)	65. ISIS-Greater Sahara
32. Islamic State of Iraq and the Levant (al-Qa'ida in Iraq)	66. al-Ashtar Brigades (AAB)
33. Islamic Jihad Union (IJU)	67. Jama'at Nusrat al-Islam wal-Muslimin (JNIM)
34. Harakat ul-Jihad-i-Islami/Bangladesh (HUJI-B)	

Table 149: 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
Democratic People's Republic of Korea (North Korea)	November 20, 2017
Iran	January 19, 1984
Sudan	August 12, 1993
Syria	December 29, 1979

Table 150: 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 Terrorism Examples

Year	Event	Description
April 19, 1995	Oklahoma City Bombing	Truck bomb resulting in 168 people killed
July 27, 1996	Centennial Olympic Park Bombing	1996 Summer Olympic bombing in Atlanta, GA resulting in 2 deaths and 111 injuries
September 18, 2001 (start)	U.S. Anthrax Attacks	A series of letters containing anthrax spores lasting several weeks resulting in 5 deaths and 17 infections
May 31, 2009	Assassination of Dr. George Tiller	Murder of a nationally known physician that performed late-term abortions
June 10, 2009	U.S. Holocaust Memorial Museum Shootings	Shooting attack of a believed neo-Nazi resulting in 1 death
November 5, 2009	Fort Hood Shootings	Shooting attack of a believed Islamic extremist resulting in 13 deaths and 30 wounded
August 5, 2012	Wisconsin Sikh Temple Shootings	Shooting attack at the Oak Creek Sikh Temple in Wisconsin resulting in 6 deaths and 4 wounded
February 18, 2010	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
April 15, 2013	Boston Marathon Bombing	Bombing at the Boston Marathon resulting in 3 deaths and several hundred injuries.
June 17, 2015	Charleston Church Shooting	Shooting attack at the Emanuel African Methodist Episcopal Church resulting in 9 killed and 3 injured
December 2, 2015	San Bernardino Inland Regional Center Shootings	Shooting attack resulting in 14 people killed and 24 injured at the San Bernardino County Department of Public Health training event and holiday party
June 12, 2016	Orlando Pulse Nightclub Shootings	Shooting attack resulting in 49 people killed and 58 injuries at the Pulse Nightclub in Orlando
October 1, 2017	Las Vegas Route 91 Harvest Music Festival Shootings	Shooting attack at the Harvest Music Festival by a lone sniper from the Mandalay Bay Hotel resulting in 58 killed and 851 injured

Table 151: 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 counter-terrorism 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

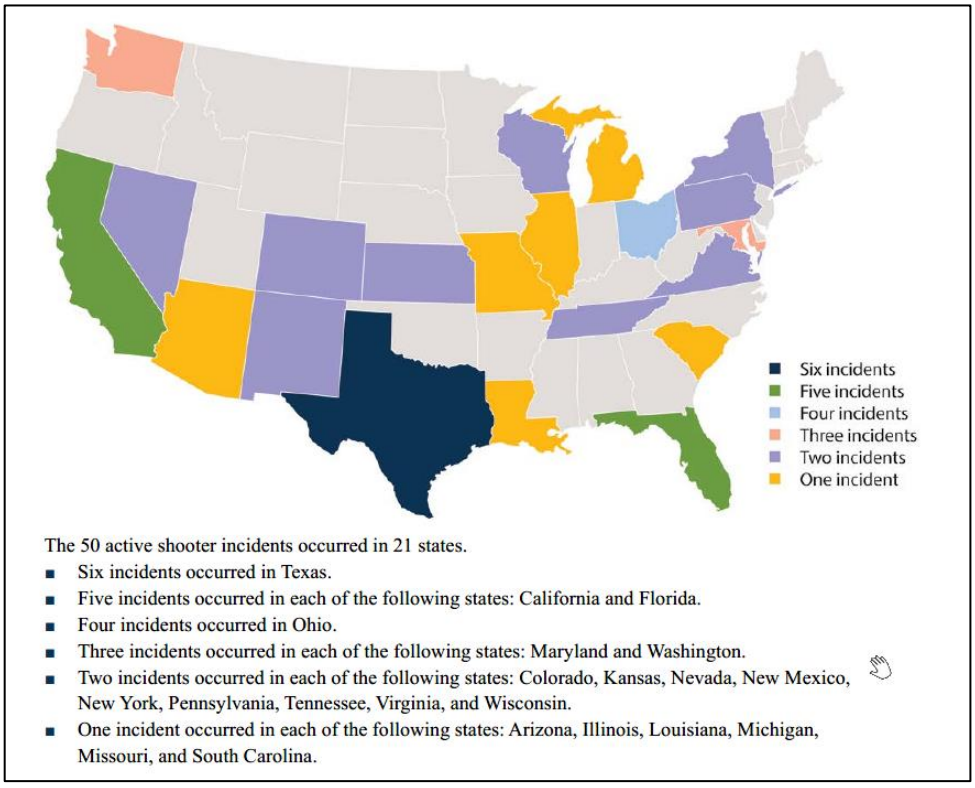
Defining Mass Violence

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

According to the FBI[28], from 2016 to 2017 there were 50 active shooter incidents in the U.S. that resulted in 943 casualties (221 people killed, and 722 people wounded, excluding the shooters).

- The highest number of casualties (58 killed and 489 wounded) occurred during the Route 91 Harvest Festival in Las Vegas, Nevada, in 2017.
- The second highest number of casualties (49 killed and 53 wounded) occurred at Pulse, a nightclub in Orlando, Florida, in 2016.
- The third highest number of casualties (26 killed and 20 wounded) occurred at the First Baptist Church in Sutherland Springs, Texas, in 2017.



Map 78: Active Shooter Incidents in the U.S. from 2016 to 2017

[28] U.S., Department of Justice, Federal Bureau of Investigation, Active Shooter Incidents in the United States in 2016 and 2017, April 2018.

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 (2017 Estimate)	20,692	24,202	1,921	12,877	8,440	68
Total City Employment (2012 Estimate unless otherwise noted)	11,200	11,900	N/A	6,201	13,886*	43
Economy**	$811,395,000	$1,614,403,000	$500,000	$625,676,000	$1,894,297,000	$4,946,271

Table 152: Estimated Population and Economic Loss of Terrorist Events

*Per California Employment Development Department, InfoGroup, and SCAG Estimates for 2015
**U.S. Census Quick Facts for 2012 (Hidden Hills Retail Sales only based on SCAG City Profile Report for 2012)

Based on a 0.1% loss projection, more than 68 people could be impacted (either directly or indirectly), 43 jobs lost (either temporarily or permanently), and more than $4.9M 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).

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 and utility facilities • Water supply locations • Research laboratories • Clinics and hospitals • Places where large groups of people congregate	• Universities and College Campuses • Schools • Businesses (any size or type) • Government 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 153: 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.

Condition	Description
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 154: 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
- Insuring decontamination procedures (radiological and chemical) are in place
- Insuring 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.[29] 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.[30] 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.

[29] http://ourweekly.com/los-angeles/sheriff%E2%80%99s-department-spend-89-million-anti-terror-equipment-training-and-intelligence

[30] 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 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 and a handbook for residents regarding different disasters. Further, the City web site provides Public Safety Resource links to essential information for a variety of situations including Terrorism.

Emegency warning and other information will aslo be provided to the public in the event of a terrorist or mass casualty incident This will be accomplished through several methods in addition to the City website, including: the City's cable TV channel, Channel 10 – Time Warner Cable, Channel 3 – Spectrum, Channel 99 – AT&T U-Verse, and on the City's Emergency Hotline, 818-597-7301. The City will also utilize other tools such as "c-mail", its Twitter account (@CityAgouraHills), and the Connect-CTY Mass Notification System.

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 an Emergency Preparedness Guild with information regarding Terrorism. In addition, the City has an active C.E.R.T. program with volunteers trained to assist in disasters.