19. Wildfire

This chapter describes the characteristics of wildfire, including secondary effects, as well as wildfire hazards within the City of Livermore, regulatory framework, and implications for the General Plan Update. Although the topography of the city is relatively flat to gently sloping, the hills to the north and south of the city, farmlands, and generally dry vegetation pose a risk of wildfire within Livermore. This chapter uses the term "Livermore" to cover the City of Livermore together with the immediately surrounding area within the Urban Growth Boundary (UGB) and Sphere of Influence (SOI). See the Introduction for more information on these boundaries.

19.1 REGULATORY FRAMEWORK

This section presents the regulatory framework, including state, regional, and local regulations related to wildfire in Livermore.

19.1.1 STATE REGULATIONS

19.1.1.1 FIRE RESPONSIBILITY AREAS

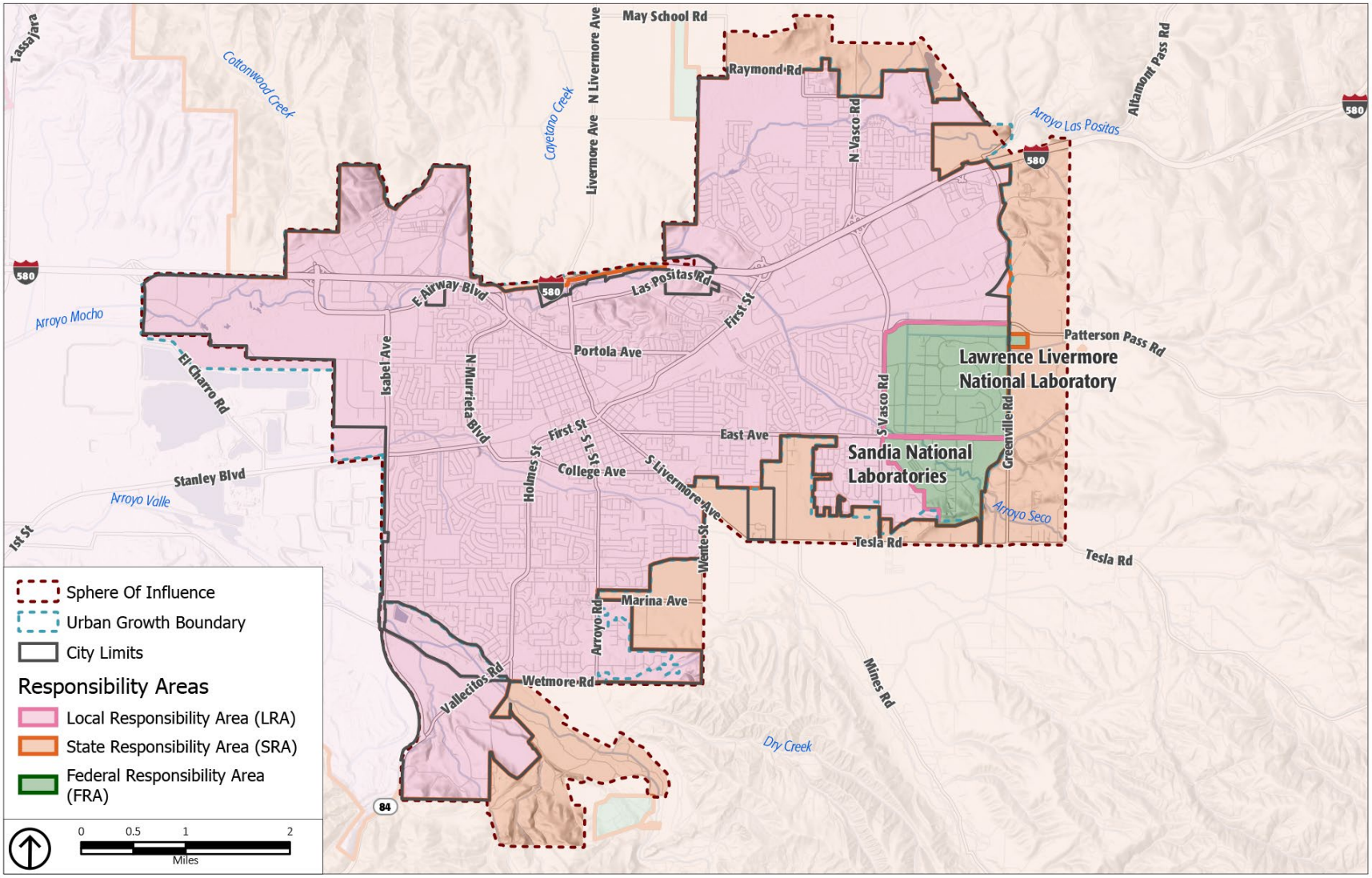
Dozens of agencies have fire protection responsibility for wildfires in California, and primary legal (and financial) responsibility for wildfire protection is divided by local, state, and federal organizations. In 1981, the California state legislature adopted California Public Resource Code Section 4291.5 and Health and Safety Code Section 13108.5 establishing the following responsibility areas:

- Local Responsibility Areas (LRAs) are areas protected by local agencies, including city and county fire departments, local fire protection districts, and the California Department of Forestry and Fire Protection (CAL FIRE) when under contract to local governments. The City of Livermore falls within an LRA.
- State Responsibility Areas (SRAs) are areas where CAL FIRE has responsibility for wildfire protection. SRAs are generally unincorporated areas that are not federally owned, are undeveloped, and are covered by wildland vegetation or rangeland.
- Federal Responsibility Areas (FRAs) are areas that are managed by a federal agency, including the U.S. Forest Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management, and the U.S. Department of Defense.

Figure 19-1 shows the LRA, SRA, and FRA within Livermore.

WILDFIRE

Figure 19-1 Wildfire Responsibility and Fire Hazard Severity Zones



Source: CalFIRE, 2020; City of Livermore, 2021; Esri, 2021.

19.1.1.2 FIRE HAZARD SEVERITY ZONES

While most of California is subject to some degree of fire hazard, there are specific features that make some areas more hazardous. CAL FIRE is required by law to map areas of significant fire hazards. CAL FIRE's Fire and Resource Assessment Program models and maps fire hazard severity zones (FHSZ) using a science-based and field-tested computer model that designates moderate, high, or very high FHSZs. FHSZ designations mandate how people construct buildings and protect property to reduce risk associated with wildland fires. The FHSZ model is built from existing CAL FIRE data and hazard information based on factors such as the following:[1]

- Fuel. Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Trees killed or defoliated by forest pests and diseases are more susceptible to wildfire.
- Weather. Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. Of particular importance for wildfire activity are wind and thunderstorms. Strong, dry winds produce extreme fire conditions. Such winds generally reach peak velocities during the night and early morning hours. Thunderstorm season typically begins in June with wet storms; as the season progresses into July and August, storms become dry and little to no precipitation reaches the ground.
- Terrain. Topography includes slope and elevation. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; elevation; and slope.

CAL FIRE's model also accounts for frequency of fire weather, ignition patterns, expected rate of spread, and flying ember production, which is the principal driver of wildfire hazards in densely developed areas. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures. CAL FIRE's maps were last updated in 2007 to 2010 and are currently being updated to incorporate improved fire science, data, and mapping techniques.

While Livermore and City Limits do not contain any areas currently within a Very High Fire Hazard Severity Zone, the Livermore does contain areas within Moderate or High Fire Hazard Severity Zones. According to the 2018 Tri-Valley Local Hazard Mitigation Plan, the City of Livermore contains 7,140 residents and 2,234 structures within moderate wildfire hazard areas and 6,642 residents and 2,038 structures within the high wildfire hazard areas.

[1] Tetra Tech, 2018. *Tri-Valley Local Hazard Mitigation Plan*, http://www.cityofpleasantonca.gov/civicax/filebank/blobdload.aspx?BlobID=35090, accessed on September 23, 2021.

19.1.1.3 CALIFORNIA BUILDING STANDARDS CODE

The California Building Standards Code (California Code of Regulations, Title 24) is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes.
- Building standards that have been adopted and adapted from national model codes to address California's ever-changing conditions.
- Building standards, authorized by the California legislature, that constitute amendments not covered by national model codes, that have been created and adopted to address particular California concerns.

All occupied buildings in California are subject to national model codes adopted into the California Building Standards Code, and occupied buildings are further subject to amendments adopted by State agencies and ordinances implemented by local jurisdictions' governing bodies.

Part 9 of Title 24 contains the California Fire Code. The California Fire Code contains fire-safety-related building standards, such as construction standards, vehicular and emergency access, fire hydrants and fire flow, and sprinkler requirements. The California Fire Code is revised and published every three years by the California Building Standards Commission. It is effective statewide, but a local jurisdiction may adopt more restrictive standards based on local conditions. The City of Livermore has adopted the most recent version into Chapter 15.06 of the City of Livermore Municipal Code.

Within Part 9, Chapter 49 provides requirements for construction within the Wildland-Urban Interface (WUI). Part 2, Chapter 7A of Title 24 contains regulations pertaining to materials and construction methods for exterior wildfire exposure.

19.1.1.4 2019 STRATEGIC FIRE PLAN FOR CALIFORNIA

CAL FIRE developed the 2019 *Strategic Fire Plan for California*, which contains goals, objectives, and policies to prepare for and mitigate the effects of fire on California's natural and built environments. The 2019 *Strategic Fire Plan for California* focuses on fire prevention and suppression activities to protect lives, property, and ecosystems, in addition to providing natural resource management to maintain state forests as a resilient carbon sink to meet California's climate change goals. A key component of the 2019 *Strategic Fire Plan for California* is the collaboration between communities to ensure fire suppression and natural resource management is successful.[2]

[2] California State Board of Forestry and Fire Protection, 2018, *2018 Strategic Fire Plan for California*, https://osfm.fire.ca.gov/media/5590/2018-strategic-fire-plan-approved-08_22_18.pdf, accessed on September 23, 2021.

19.1.2 REGIONAL REGULATIONS

19.1.2.1 ALAMEDA COUNTY COMMUNITY WILDFIRE PROTECTION PLAN

A Community Wildfire Protection Plan (CWPP) is a collaboratively developed plan that identifies wildland fire hazards, prioritizes way to reduce those hazards, and recommends measures for homeowners and communities to reduce ignitability of structures. The goal of a CWPP is to reduce hazards through increased information and education about wildfires, hazardous fuels reduction, actions to reduce structure ignitability, and other recommendations to assist emergency preparedness and fire suppression efforts.

Alameda County's 2015 CWPP provides a comprehensive analysis of wildfire hazards and risks within the WUI areas of Alameda County. The CWPP follows the standards for CWPPs established by the Federal Healthy Forest Restoration Act by:

1. Identifying and prioritizing fuel reduction opportunities across the county.
2. Addressing structural ignitability.
3. Collaborating with stakeholders.

The CWPP contains recommendations intended to aid residents and business owners in preventing and reducing the threat of wildfire in Alameda County, including the City of Livermore. The CWPP's recommendations are organized into four broad categories of mitigation:

- Information, Education and Collaborative Planning Priorities
- Enhanced Suppression Capability and Emergency Preparedness Priorities
- Fuel Reduction Treatments around Homes and on Public Lands and Related Priorities
- Improving Survivability of Structures Priorities

19.1.2.2 TRI-VALLEY LOCAL HAZARD MITIGATION PLAN

In 2018, the Cities of Livermore, Pleasanton, and Dublin, Livermore-Pleasanton Fire Department, Dublin San Ramon Services District, and the Lawrence Livermore National Laboratory, updated and adopted the Tri-Valley Local Hazard Mitigation Plan (LHMP). The LHMP provides a uniform hazard mitigation strategy for the Tri-Valley area, addressing a range of hazards, including wildland fire.

The Tri-Valley LHMP includes the following key elements:

- A summary of the hazards faced by the region and community.
- An assessment of the region and community's vulnerability to the hazards.
- Specific hazard mitigation actions that can be taken to reduce the risk from the hazards.

The LHMP identifies resources, information, and strategies for reducing risk from natural hazards in the Tri-Valley area and is intended to help guide and coordinate mitigation activities. It was developed to help local planners and government officials better understand local environmental risks, enable all planning partners to continue to use federal grant funding to reduce risk through mitigation, meet the planning requirements of the Federal Emergency Management Agency's (FEMA's) Community Rating System (CRS), and to help coordinate and prioritize existing plans and programs.

The LHMP recommends mitigation best practices that can be implemented on the personal-, corporate-, or government-scale to address wildfire risk and include manipulating the hazard, reducing exposure to wildfire hazards, reducing vulnerability to the hazard, and increasing the community's ability to respond to or be prepared for wildfire hazards. Core strategies include manipulating fire hazards by clearing potential fuels on property; reducing exposure to fire hazards by creating and maintaining defensible space around structures and locating development outside of fire hazards areas; reducing vulnerability to fire hazards by using fire-resistant building materials and plantings; and increasing the ability to respond or to be prepared for fire hazards by enhancing hazard mapping, conducting more public outreach and education efforts pertaining to wildfire hazards, identifying fire response and alternative evacuation routes, seeking alternative water supplies, establishing and maintaining mutual aid agreements between fine and service agencies, developing a post-disaster recovery plan that addresses wildfire hazards, and developing a debris management plan.

19.1.3 LOCAL REGULATIONS

19.1.3.1 LIVERMORE 2003-2025 GENERAL PLAN

Adopted in 2004, the Livermore 2003-2025 General Plan Public Safety Element provides information about public safety hazards in Livermore and establishes mechanisms to reduce death, injuries, and damage to property. Table 19-1 identifies the Public Safety Element goals, objectives, policies, and actions pertaining to wildfire hazards.

TABLE 19-1 LIVERMORE 2003-2025 GOALS, OBJECTIVES, POLICIES, AND ACTIONS RELATED TO PUBLIC SAFETY

Goal PS-3	Protect lives and property from wildland fire hazard.
Objective PS-3.1. Plan new development with wildland fire hazards in mind.	
Policy PS-3.1-P1	Areas in which the elimination of fire hazard would require the following measures shall not be developed: (a) major modification of existing landforms. (b) significant removal of, or potential damage to, established trees and other vegetation. (c) exposure of slopes which cannot be suitable re-vegetated
Policy PS-3.1-P2	In order to ensure fire safety, development shall be restricted in areas with steep terrain.
Action PS-3.1-A1	Review all proposed development in wildland-urban interface areas for conformity with the Wildland-Urban Interface Code (WUIC), as periodically amended, utilizing specialists in WUIC review and implementation. All development in wildland-urban interface areas shall utilize the best development and site design practices identified by the Fire Department, as required in the WUIC, as periodically amended.

19.1.3.2 LIVERMORE MUNICIPAL CODE

The City of Livermore's Fire Code is contained within Chapter 15.06 of the Livermore Municipal Code (LMC). Documents adopted by reference into Chapter 15.06 include the 2018 Edition of the International Fire Code (IFC), as amended, and set forth in the California Code of Regulations (CCR), Title 24, Part 9. Additionally, Chapters 13.04.040 and 13.04.050 of the LMC address fire hydrant purpose, use restrictions, and installation requirements and costs. LMC Chapter 13.04.070 addresses the fire chief's authority during fires.

19.2 EXISTING CONDITIONS

19.2.1 TYPES OF WILDFIRES

There are three basic types of wildland[3] fires:

- Crown fires burn trees to their tops and are the most intense and dangerous wildland fires.
- Surface fires burn surface litter and duff and are known for being the easiest fires to extinguish and to cause the least damage. Brush and small trees enable surface fires to reach treetops, and so are referred to as *ladder fuels*.
- Underground fires occur underground in deep accumulations of dead vegetation. These fires move very slowly and can be difficult to extinguish due to limited access.[4]

Wildfires burn in many types of vegetation—forest, woodland, scrub (including chaparral, sage scrub, and desert scrub), and grassland. Many species of native California plants are adapted to fire. Between 2010 and 2017, wildfires in California burned about 265,000 acres of forest land, 207,000 acres of scrub vegetation, 99,000 acres of grassland, 18,000 acres of desert vegetation, and 14,000 acres of other vegetation types, which has increased substantially since 2017.[5] Wildfires have been observed to be more frequent and growing in intensity the past several years, particularly in California where prolonged drought and hot, dry temperatures have been common.

[3] A "wildland fire" is a general term describing any non-structure fire that occurs in vegetation and natural fuels. A "wildfire" is an unplanned fire caused by lightning or other natural or human-made causes. (National Park Service. 2020. "Wildfires, Prescribed Fires, and Fuels," accessed September 21, 2021).

[4] Natural Resources Canada. 2018. Fire Behavior, https://www.nrcan.gc.ca/forests/fire-insects-disturbances/fire/13145, accessed on September 23, 2021.

[5] State Board of Forestry and Fire Protection and California Department of Forestry and Fire Prevention (CAL FIRE). 2018. *2018 Strategic Fire Plan for California,* https://osfm.fire.ca.gov/media/5590/2018-strategic-fire-plan-approved-08_22_18.pdf, accessed on September 23, 2021.

19.2.2 WILDFIRE CAUSES

Although the term *wildfire* suggests natural origins, a 2017 study that evaluated 1.5 million wildfires in the United States (US) between 1992 and 2012 found that humans were responsible for igniting 84 percent of wildfires, accounting for 44 percent of acreage burned.[6] The three most common types of human-caused wildfires are debris burning (logging slash, farm fields, trash, etc.); arson; and equipment use.[7] Power lines can also ignite wildfires through downed lines, vegetation contact, conductors that collide, and equipment failures.[8] The California Department of Forestry and Fire Protection (CAL FIRE) determined that 5 wildfires of 300 acres or more in California in 2019 were caused by electric power line failure.[9] Lightning is the most common cause of nature-induced wildfire and was responsible for igniting the 2020 Santa Clara Unit (SCU) Lightning Complex Fire.[10,11]

There are three primary methods of wildfire spread:

- Embers. Embers are the most prolific cause of home ignition, at a rate of two out of every three homes destroyed. Embers are glowing or burning pieces of vegetation or building debris that are lofted during a wildfire and can move up to a mile ahead of a firestorm. These small embers or sparks may fall on the vegetation near a home (on dry leaves, needles, or twigs on the roof) and subsequently ignite the home. Ember storms place a potential risk on structures without fire-resistant landscaping and construction that are within miles of a fire.
- Direct Flame Contact. Direct flame impingement refers to the transfer of heat by direct flame exposure. Direct contact will heat building materials of a structure, and if the time and intensity of exposure is severe enough, windows will break, and materials will ignite.
- Radiant Heat. A structure can catch fire from the heat that is transferred to it from nearby burning objects, even in the absence of direct flames or embers. By creating defensible space around homes, the risk from radiant heat is significantly reduced. In most cases, radiant heat from a wildfire will not ignite materials on homes at distances greater than 30 feet.[12]

[6] Balch, Jennifer; Bradley, Bethany; Abatzoglou, John, et. al. 2017, March 14. Human-Started Wildfires Expand the Fire Niche Across the United States. Proceedings of the National Academy of Sciences (PNAS): Volume 114 No. 11, https://www.pnas.org/content/pnas/114/11/2946.full.pdf, accessed on September 23, 2021.

[7] Pacific Biodiversity Institute. 2007. Roads and Wildfires, http://www.pacificbio.org/publications/wildfire_studies/Roads_And_Wildfires_2007.pdf, accessed on September 23, 2021.

[8] Texas Wildfire Mitigation Project. 2018. How Do Power Lines Cause Wildfires? https://wildfiremitigation.tees.tamus.edu/faqs/how-power-lines-cause-wildfires, accessed on September 23, 2021.

[9] State Board of Forestry and Fire Protection and California Department of Forestry and Fire Prevention (CAL FIRE). 2019. *2019 Wildfire Activity Statistics*, https://www.fire.ca.gov/media/iy1gpp2s/2019_redbook_final.pdf, accessed on September 23, 2021.

[10] Balch, Jennifer; Bradley, Bethany; Abatzoglou, John, et. al. 2017, March 14. Human-Started Wildfires Expand the Fire Niche Across the United States. Proceedings of the National Academy of Sciences (PNAS): Volume 114 No. 11. https://www.pnas.org/content/pnas/114/11/2946.full.pdf, accessed on September 23, 2021.

[11] The SCU Lightning Complex Fire refers to the several distinct fires that burned in the Diablo Range spanning Santa Clara, Alameda, Contra Costa, and parts of San Joaquin and Stanislaus Counties.

[12] Randall, Cotton. *Fire in the Wildland-Urban Interface: Understanding Fire Behavior. University of Florida IFAS Extension*, https://www.srs.fs.usda.gov/factsheet/pdf/fire-understanding.pdf, accessed on September 29, 2021.

Wildfire season in the Western US recently has lengthened from an average of between five and seven months to year-round. The number of large wildfires in California (i.e., greater than 1,000 acres) has increased from approximately 25 to 55 per year since the 1960s.[13] At the same time, the average annual temperature in the Western US has risen by nearly two degrees Fahrenheit since the 1970s, and the winter snowpack has declined.[14] The encroachment of urban development into wildland areas has been another contributing factor.

In its fire management plan, the East Bay Municipal Utility District (EBMUD) identified causative agents for fires in their watershed between 1980 and 1997. While the origins of some fires could not be determined, known causes were primarily human and included arson, camp and picnic activities, powerlines, fireworks, fuel-reduction activities, and smoking, with only 2 out of the 174 fires analyzed caused by lighting. Additionally, equipment associated with the wind farms in the eastern hills of the county may serve as a source of wildfire ignition.[15]

19.2.3 SECONDARY EFFECTS OF WILDFIRE

Wildfires can, in some cases, generate secondary effects that cause more widespread and prolonged damage than the fire itself. Secondary effects typically associated with wildfire include debris flows and air pollution.

19.2.3.1 DEBRIS FLOW

Post-wildfire landslide hazards include fast-moving, highly destructive debris flows that can happen soon after wildfires in response to high intensity rainfall events and flows that are generated over a longer time because of root decay and loss of soil strength. Fires increase the potential for debris flows by increasing the imperviousness of soil so that it repels water, and by destroying vegetation that would slow and absorb rainfall, and whose roots would help stabilize soil.[16] The burning of vegetation and soil on slopes more than doubles the rate that water will run off into watercourses.[17]

Postfire debris flows are particularly hazardous because they can occur with little warning, exert great impulsive loads on objects in their paths, strip vegetation, block drainage ways, damage structures, and endanger human life. Debris flows are considered a type of landslide, which is defined as a mass-

[13] State Board of Forestry and Fire Protection and California Department of Forestry and Fire Prevention (CAL FIRE). 2018. *2018 Strategic Fire Plan for California*, page 7.

[14] State Board of Forestry and Fire Protection and California Department of Forestry and Fire Prevention (CAL FIRE). 2018. *2018 Strategic Fire Plan for California*.

[15] Diablo Fire Safe Council. 2015. *Community Wildfire Protection Plan Update Alameda County*. http://www.diablofiresafe.org/pdf/2015_Draft_AlCo_CWPP_Update.pdf, accessed on September 23, 2021.

[16] US Geological Survey. 2018. New post-wildfire resource guide now available to help communities cope with flood and debris flow danger, https://www.usgs.gov/center-news/post-wildfire-playbook?qt-news_science_products=1#qt-news_science_products, accessed on September 23, 2021.

[17] California Geological Survey. 2018. *Post-Fire Debris Flow Facts*, https://www.conservation.ca.gov/index/Pages/Fact-sheets/Post-Fire-Debris-Flow-Facts.aspx, accessed on September 23, 2021.

movement process that generates a down-slope movement of mud, soil, rock, and/or vegetation.[18] Debris flows occur when surface soils become completely saturated by intense rainstorms and break away from the hillside. Areas with steep slopes are typically within debris flow areas. Debris flows differ from mudflows in that debris flows are composed of larger particles. Postfire debris flows are most common one to two years after a fire; they are usually triggered by heavy rainfall. It takes much less rainfall to trigger debris flows from burned basins than from unburned areas.

19.2.3.2 AIR POLLUTION

Wildfire smoke can threaten the health of communities up to thousands of miles beyond the areas in which they burn. Wildfire smoke is comprised of air pollutants including particulate matter, known to be a public health risk.[19] The effects of exposure to these air pollutants range from eye and respiratory tract irritation to reduced lung function, pulmonary inflammation, bronchitis, exacerbation of asthma, other lung diseases, and cardiovascular disease, and premature death.[20] Wildfire smoke is a particularly harmful health hazard for children, the elderly, and those with respiratory and cardiovascular diseases. First responders are exposed to dangers from the initial incident and aftereffects from smoke inhalation and heat stroke. Within the past several years, Alameda County and the City of Livermore have witnessed significant increases in daily average levels of particulate matters coinciding with major wildfires occurring in the region.[21]

19.2.4 WILDFIRE HAZARDS IN LIVERMORE

19.2.4.1 LAND COVER AND VEGETATION

As discussed in Chapter 5, Biological Resources, land cover in and around Livermore consists largely of urban developed areas. However, the City of Livermore and its environs also includes a diverse range of vegetation and habitat types, including grassland (including scrub), woodland, and forest.

Grassland occupies most of the undeveloped areas north, west, and south of downtown Livermore. Grassland within Livermore consists of alkali meadow and scalds, California annual grassland, and valley sink scrub grassland communities. Fire is a natural part of the grassland ecosystem and helps maintain its health and vigor. Fire heats the soil and reduces the amount of leaf litter that accumulates each year, allowing sunlight to penetrate deeper into the soil. Soil warming increases microbial activity, which releases nutrients from decaying plant material that new grasses and flowers need to grow.[22]

[18] US Geological Survey. What is a debris flow? https://www.usgs.gov/faqs/what-a-debris-flow?qt-news_science_products=0#qt-news_science_products, accessed on September 23, 2021.

[19] Environmental Protection Agency. *Why Wildfire Smoke is a Health Concern*, https://www.epa.gov/wildfire-smoke-course/why-wildfire-smoke-health-concern, accessed September 23, 2021.

[20] Environmental Protection Agency. *Health Effects Attribute to Wildfire Smoke*, https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke, accessed September 23, 2021.

[21] California Air Resources Board. Air Quality Data Query Tool, https://www.arb.ca.gov/aqmis2/aqdselect.php, accessed September 23, 2021.

[22] The Nature Conservancy, 2018. *Restoring Fire to Native Grasslands*, https://www.nature.org/en-us/about-us/where-we-work/united-states/stories-in-mn-nd-sd/restoring-fire-to-native-grasslands/, accessed on September 23, 2021.

As a fire-prone ecosystem, scrub communities in the northern portion of Livermore contain many fire-adapted species and are adaptable to changes in fire regimes.[23]

Woodland and forested habitats are largely restricted to the north and east-facing slopes or higher elevations to the south and west of Livermore. Coast live oak and evergreen forest habitats are located in and around the City of Livermore, depending on the microclimate of the site. Coast live oak woodland is typically found higher on slopes and on ridgetops where there is a drier microclimate and well-drained soils.

Fires caused by lightning have played a role in shaping oak woodlands, and this ecosystem is extremely well adapted to summer fires.[24] Fire plays a role in the development of oak woodland stand structure, oak regeneration processes, and the development of habitat for wildlife and nutrient cycling. Mature oaks can survive regular low-intensity ground fires and most woodland oak species have the capacity for young seedlings and saplings to resprout after being top-killed by fire.

Livermore contains significant area where natural ecosystems, such as woodlands, scrub, and human development closely intermingle, commonly referred to as the WUI. A WUI is an area in which wildlands and communities are sufficiently close to each other to present a credible risk of fire spreading from one to the other.[25] Development within the WUI not only increases the probability of wildfire ignition but also increases the probability that a wildfire will result in significant damage to property and loss of life. Figure 19-2 shows the WUI in the City of Livermore.

In the urban lands of Alameda County, 77,727 (43.2 percent of the 180,056 acres in urban land use) are located in the WUI threat areas. Of those acres of land 21,963 acres (12.2 percent), are subject to high, very high, or extreme wildfire threat.[26] Within the City of Livermore, numerous critical facilities and other valuable assets are located at least in part within the WUI. These include natural gas pipelines, electrical transmission lines, electric power plants and substations, major roadways, local and highway bridges, cell towers, healthcare facilities, schools, and daycare centers.

19.2.4.2 SLOPES

Slope is a measure of land steepness, and wildfire intensity and rate of spread increase as slope increases due to the tendency of heat to rise via convection.[27] Alameda County's steep topography, with canyons and swales, influences fire behavior and in many instances intensifies fire effects. Westward facing slopes

[23] Conlisk, Erin; Swab, Rebecca; Martinez-Berdeja, Alejandra; Daugherty, Matthew. *Post-Fire Recovery in Coastal Sage Scrub: Seed Rain and Community Trajectory*. 2016, September 20. PLOS ONE, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0162777, accessed September 23, 2021.

[24] University of California Agriculture and Natural Resources Cooperative Extension. 1994. *The Role of Fire in California's Oak Woodlands*, https://oaks.cnr.berkeley.edu/the-role-of-fire-in-californias-oak-woodlands-2/, accessed September 23, 2021.

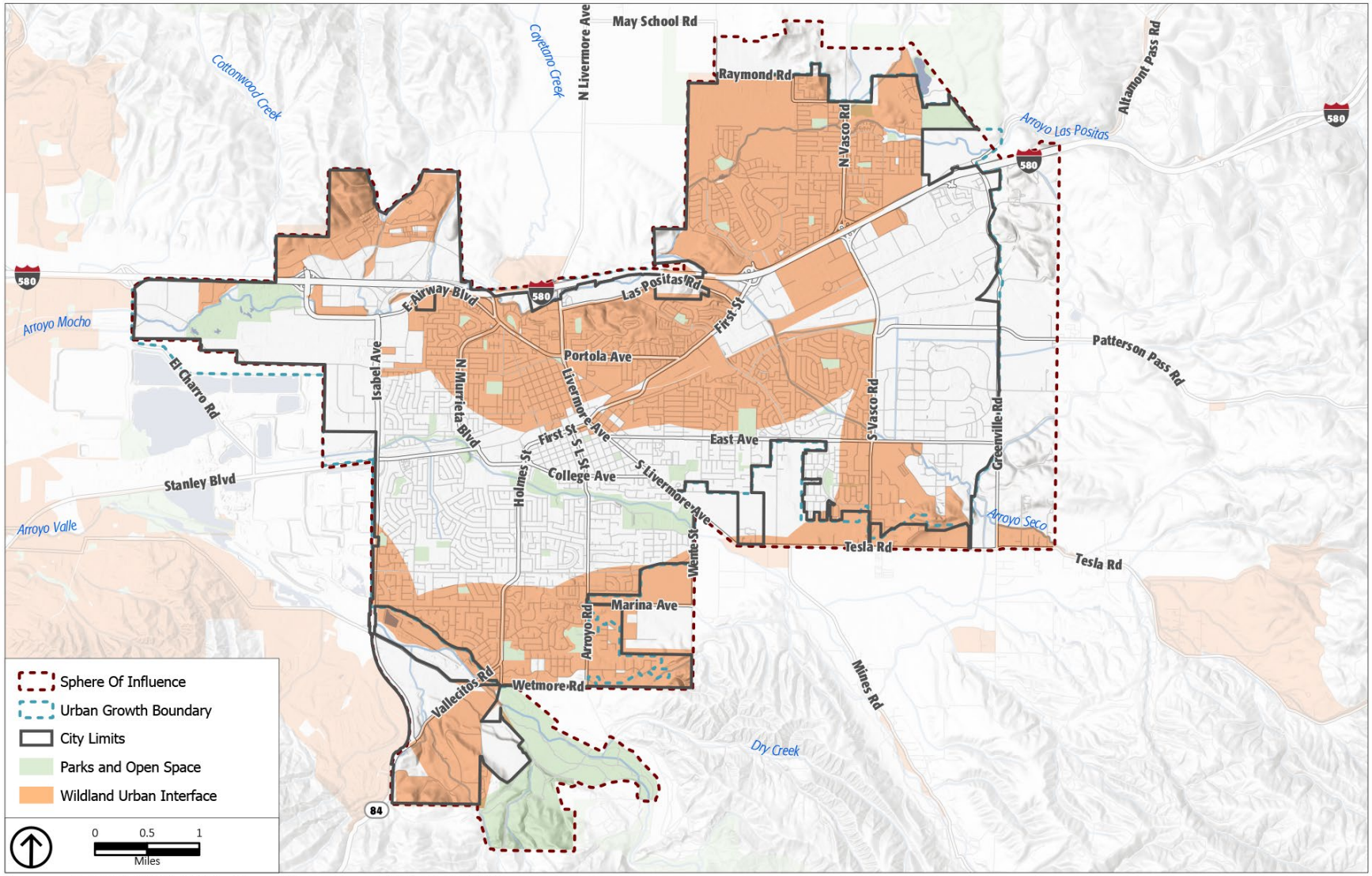
[25] Diablo Fire Safe Council. 2015. *Community Wildfire Protection Plan Update Alameda County*. http://www.diablofiresafe.org/pdf/2015_Draft_AlCo_CWPP_Update.pdf, accessed on September 23, 2021.

[26] Diablo Fire Safe Council. 2015. *Community Wildfire Protection Plan Update Alameda County*. http://www.diablofiresafe.org/pdf/2015_Draft_AlCo_CWPP_Update.pdf, accessed on September 23, 2021.

[27] Auburn University. *Topography's Effect on Fire Behavior*, http://www.auburn.edu/academic/forestry_wildlife/fire/topos_effect.htm, accessed on September 23, 2021.

are more arid (due to long exposure to the afternoon sun) and thus more combustible. The difficulty of building roads in the steep areas makes ingress or egress difficult and delays fire fighter response time. Steep slopes also contribute to fire hazard by intensifying the effects of wind and making fire suppression difficult. Areas with especially steep slopes are scattered throughout Livermore and exist in the highest concentrations along its northern and southern borders as shown on Figure 19-3.

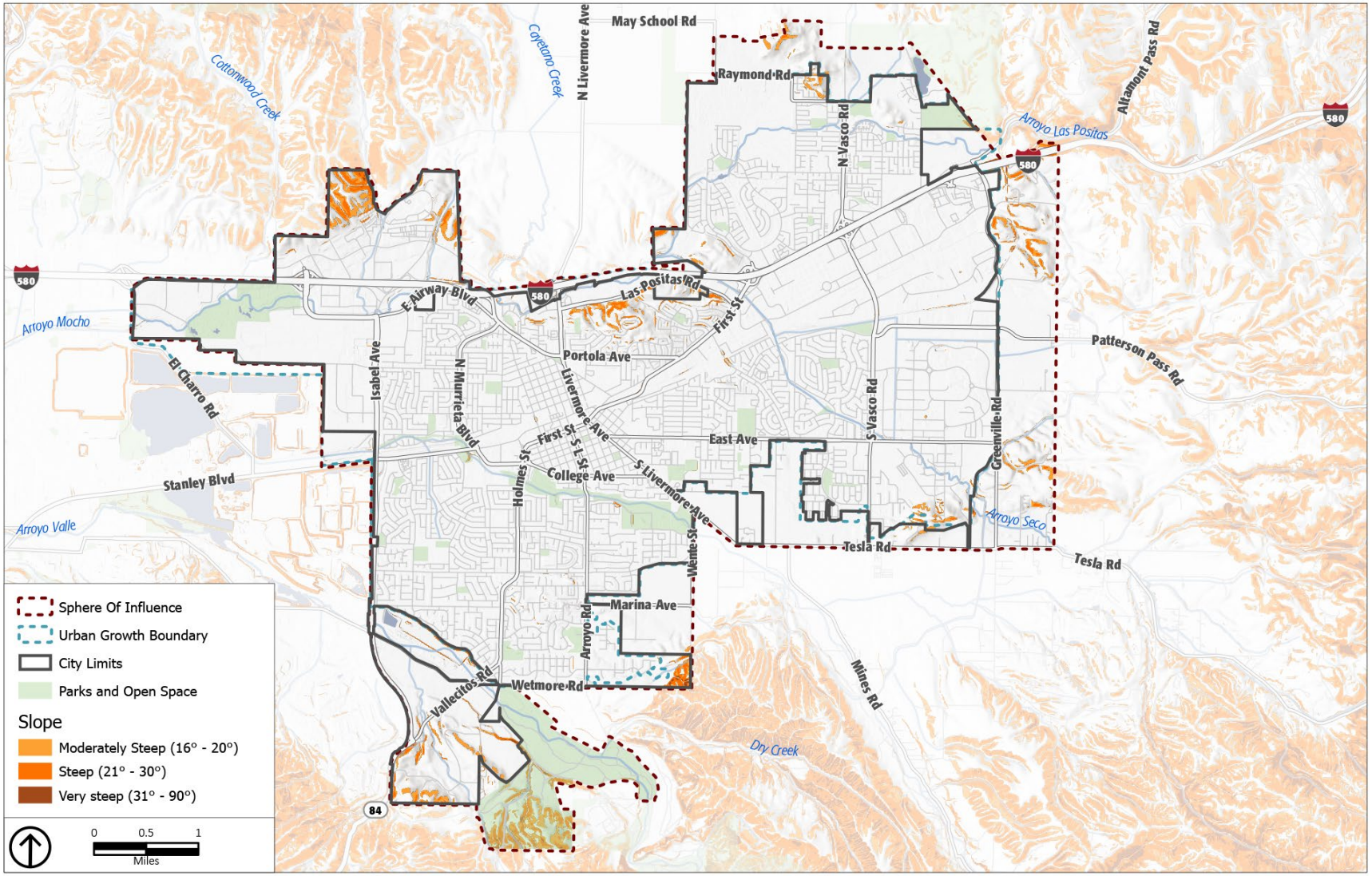
Figure 19-2 Wildland-Urban Interface Area



Source: CalFIRE FRAP, 2021; City of Livermore, 2021; Esri, 2021.

WILDFIRE

Figure 19-3 Steep Slopes and Topography



Source: City of Livermore, 2021; Esri, 2021.

19.2.4.3 PREVAILING WINDS AND PUBLIC SAFETY POWER SHUTOFFS

Despite efforts to improve neighborhood safety and firefighting capabilities, uncontrollable fire storms may occur under the extreme, but periodic conditions of "Red Flag" weather days. The National Weather Service issues "Red Flag" warnings when weather elements such as low relative humidity, strong winds, and abundance of dry fuel could lead to rapid increases in wildfire activity. In Livermore and its neighboring communities, "Red Flag" weather may coincide with the occurrence of strong, hot, dry offshore winds. These winds are known locally as "Diablo Winds" since they come from the north, northeast in the direction of Mount Diablo. Diablo Winds carry extremely dry air at high velocity and quickly desiccate vegetation and other flammable materials. Diablo Winds can occur at any time of year but are especially dangerous in the driest months of summer and fall, which coincide with wildfire season. During these times, fighting a fire becomes far more difficult.

In an effort proactively address the fire hazards created by high winds and severe weather, beginning in 2018, Pacific Gas and Electric Company (PG&E) instituted the Public Safety Power Shutoff (PSPS) program. During a PSPS, PG&E deactivates power circuits in areas affected by severe weather conditions such as low humidity and high winds.

Since 2018, the City of Livermore and adjacent communities have been affected by several PSPS events.[28]

- October 25-28, 2020. On October 25, 2020, PG&E initiated a PSPS to mitigate catastrophic wildfire risk presented by significant wind events combined with low-humidity levels and critically dry fuels. The PSPS event ultimately de-energized 345,470 customers in 35 counties and 14 tribal areas in Northern California. This was PG&E's largest PSPS event in 2020.
- October 14-17, 2020. On October 14, 2020, PG&E initiated a PSPS to mitigate catastrophic wildfire risk presented by significant wind events combined with low-humidity levels and critically dry fuels, ultimately de-energizing 40,574 customers in 19 counties in Northern California.
- October 26-Nov 1, 2019. Starting on October 26, 2019, and subsequently October 29, 2019, PG&E implemented two PSPS events to mitigate catastrophic wildfire risk presented by significant offshore wind events combined with low-humidity levels and critically dry fuels. The first offshore wind event started on October 26 with weather conditions lasting through October 28. The second offshore wind event started on October 29 with weather conditions lasting through October 31. Within these offshore wind events, PG&E planned de-energization times specific to different geographic areas based on their unique weather timing to minimize outage durations. In total, approximately 967,700 unique customers were impacted over the course of both events, with some customers impacted by both events.
- October 9-12, 2019. On Sunday, October 6, 2019, PG&E responded to a forecasted offshore wind weather event by proactively turning off power in multiple phases, in an effort to reduce the risk of wildfire ignition. This PSPS event became the largest to date, impacting 735,440 customers in 35 counties across the Sacramento Valley, Sierra Foothills, North Bay, South Bay, East Bay, Central Coast, and parts of Southern California.

[28] Pacific Gas & Electric. PSPS reports, https://www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-reports.page, accessed on September 23, 2021.

While PSPS events reduce the risk of wildfire ignition statewide, they can create a number of hazards and hardships for Livermore residents. These include economic losses associated with loss of power, health hazards for residents who rely on electricity for medical services and cooling, and mental health concerns resulting from planning for loss of power, the uncertainty of loss of power and duration of the outage, and potential losses resulting from loss of power, including loss of refrigerated and frozen food, inability to work, and loss of access to medical and other services.

19.2.4.4 WILDFIRE HISTORY SURROUNDING LIVERMORE

Analysis of past wildfires near Livermore from 1923 to 1991 shows that wildfire ignitions during critical Diablo Wind conditions have occurred approximately every 10 to 20 years.[29] According to the 2016 Alameda County Local Hazard Mitigation Plan, wildfires are common in the county, with large wildfires recorded in 1961, 1962, 1964, 1965, 1970, 1981, 1985, 1988, and 1991. Figure 19-4 shows historic wildfire perimeters within and near the City of Livermore from 1887 to present; however, this map is not inclusive of all fires described in this section.

Particularly devastating fires occurred in the Bay Area in 1991 and 2020. The 1991 Oakland Hills Fire resulted in $1.7 billion in losses and received a FEMA disaster declaration. The fire spread across 1,520 acres, destroyed 3,354 homes and 456 apartments, injured 150 people, and took the lives of 25 people.[30] The 2020 SCU Complex Fire burned 396,624 across five Bay Area counties and was responsible for the damage or destruction of 248 structures and 6 injuries. A Fire Management Assistance Declaration for the SCU Lightning Complex fire was declared on August 21, 2020.

Minor to moderate wildfires, worsened by drought conditions in recent years, have occurred near Livermore. The following wildfires of over 10 acres were recorded near the city in recent years:[31]

- August 16, 2020 – The SCU Lightning Complex Fire affected multiple regions throughout Alameda County, as well as the neighboring counties of Santa Clara, Contra Costa, San Joaquin, Merced, and Stanislaus. The complex fire burned a total of 396,624 acres between August and October[32] and became the third-largest wildfire recorded in California's modern history as of 2020. While the fires never breached Livermore City Limits, Alameda County issued a voluntary evacuation warning for unincorporated parts of the County south and east of Livermore.
- July 8, 2018—The Grant Fire burned 640 acres of unincorporated county grassland near Interstate (I-) 580 near the Grant Line Road exit. All four lanes of I-580 east of Livermore were temporarily closed.

[29] Diablo Fire Safe Council. 2015. *Community Wildfire Protection Plan Update Alameda County*. http://www.diablofiresafe.org/pdf/2015_Draft_AlCo_CWPP_Update.pdf, accessed on September 23, 2021.

[30] Tetra Tech, 2018. *Tri-Valley Local Hazard Mitigation Plan*, http://www.cityofpleasantonca.gov/civicax/filebank/blobdload.aspx?BlobID=35090, accessed on September 23, 2021.

[31] Tetra Tech, 2018. *Tri-Valley Local Hazard Mitigation Plan*, http://www.cityofpleasantonca.gov/civicax/filebank/blobdload.aspx?BlobID=35090, accessed on September 23, 2021.

[32] California Department of Forestry and Fire Protection (CAL FIRE). SCU Lightning Complex, https://www.fire.ca.gov/incidents/2020/8/18/scu-lightning-complex/, accessed on September 23, 2021.

- August 22, 2015—Burned 2,700 acres off Tesla Road near Correll Hollow between Livermore and Tracy. This fire took four days to contain with 18 fire personnel and five fire engines.
- June 25, 2015—Burned 53 acres off Tesla Road, southeast of Livermore.
- October 4, 2013—Burned 150 acres along Highland Road near Livermore.
- July 6, 2013—The Fallon Fire burned 38 acres off Fallon Road and Camino Tassajara near Dublin. The fire was contained within one day by Alameda County Fire Department.
- June 8, 2013—The Vasco Fire burned 240 acres off Vasco Road and North Vasco Road, north of Livermore. The fire was contained within one day.

19.3 IMPLICATIONS FOR THE GENERAL PLAN

The General Plan Update can provide the City with the framework to increase resiliency to fire hazards and expand on existing efforts through the following:

- Addressing provision of funding and resources for the Department, fire response times, and participation in collaborative regional fire management initiatives and programs such as the Diablo Fire Safe Council.
- Managing housing growth within the WUI in order to minimize wildfire risk.
- Providing education and public outreach to residents and businesses regarding wildfire mitigation, evacuation procedures, and how to respond to low air quality events.
- Remaining apprised of and responsive to climate change's effects on local wildfire conditions.
- Exploring diverse wildfire management techniques.
- Preventing fuel accumulation around any City-owned infrastructure.
- Maintaining adequate peak-load water supply for fire suppression.
- Including policies and actions that address the vulnerabilities identified in the climate change vulnerability assessment.
- Identifying funding opportunities to support new or expanded defensible space projects.
- Considering new actions to stabilize burned slopes located above developed areas, important infrastructure, or key transportation corridors as soon as possible after a wildfire event.
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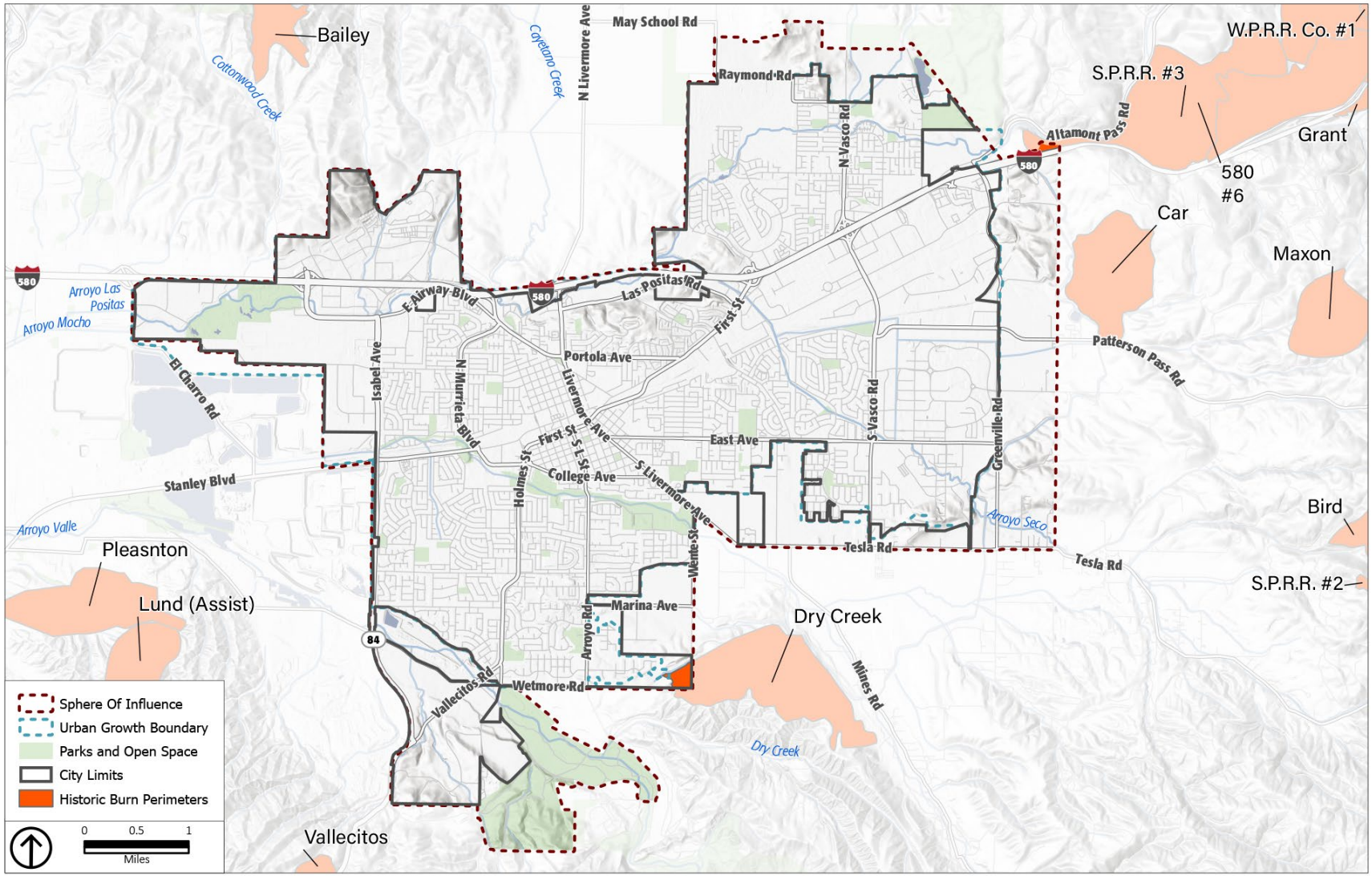
WILDFIRE

Figure 19-4 Historic Wildfire Perimeters



Source: CalFIRE FRAP, 2021; City of Livermore, 2021; Esri, 2021.