



Safety Element

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Chapter 6

Safety Element

1. Introduction

Purpose, Scope, and Content

The Safety Element conveys the County of Riverside's (County's) goals, policies, and actions to minimize the hazards to safety in and around unincorporated Riverside County. It identifies the natural and human-caused hazards that affect existing and future development and provides guidelines for protecting residents, employees, visitors, and other community members from injury and death. It describes present and expected future conditions and sets policies and standards for improved public safety. The Safety Element also seeks to minimize physical harm to the buildings and infrastructure in and around unincorporated Riverside County and to reduce damage to local economic systems, community services, and ecosystems.

Some degree of risk is inevitable—the potential for many disasters cannot be completely eliminated and the ability to predict such disasters is limited. The goal of the Safety Element is to reduce the risk of injury, death, property loss, and other hardships to acceptable levels.

One of the fundamental values of the Vision for Riverside County highlights the importance of safety to the people of unincorporated Riverside County:

"We acknowledge security of person and property as one of the most basic community needs and commit to designing our communities so that vulnerability to natural and human made hazards, as well as criminal activities, is anticipated and kept to a minimum."

This "value" underlies the policy direction of the Safety Element and is further defined by the following Vision statement:

"Considerable protection from natural hazards such as earthquakes, fire, flooding, slope failure, and other hazardous conditions is now built into the pattern of development authorized by the General Plan."

Based on the direction provided by the Vision, and in compliance with state law, the primary objective of the Safety Element is to "reduce death, injuries, property damage, and economic and social impact from hazards."

The Safety Element serves the following functions:

- Identifies a framework by which safety considerations are introduced into the land use planning process;
- Facilitates the identification and mitigation of hazards for new development, and thus strengthens existing codes, project review, and permitting processes;

- Presents policies directed at identifying and reducing hazards in existing communities and infrastructure networks; and
- Strengthens earthquake, flood, inundation, and wildland fire preparedness planning and post-disaster reconstruction policies.

Regulatory Framework

Under state law, all counties and incorporated communities in California must prepare a General Plan, which must address several topics, one of which is public health and safety. The Safety Element addresses this topic in accordance with state requirements, which are laid out in California law, particularly Section 65302(g) of the California Government Code. State law requires that the Safety Element address the following:

- Protect the community from risks associated with a variety of hazards, including seismic activity, landslides, flooding, and wildfire, as required by the California Government Code Section 65302(g)(1).
- Map and assess the risk associated with flood hazards, develop policies to minimize the flood risk to new development and essential public facilities, and establish effective working relationships among agencies with flood protection responsibilities, as required by California Government Code Section 65302(g)(2).
- Map and assess the risk associated with wildfire hazards, develop policies to reduce the wildfire risk to new land uses and essential facilities, ensure there is adequate road and water infrastructure to respond to wildfire emergencies, and establish cooperative relationships between wildfire protection agencies, as required by California Government Code Section 65302(g)(3).
- Assess the risks associated with climate change on local assets, populations, and resources. Note existing and planned development in at-risk areas and identify agencies responsible for providing public health and safety and environmental protection. Develop goals, policies, and objectives to reduce the risks associated with climate change impacts, including locating new public facilities outside of at-risk areas, providing adequate infrastructure in at-risk areas, and supporting natural infrastructure for climate adaptation, as required by California Government Code Section 65302(g)(4).
- Identify residential developments in any hazard area identified that do not have at least two emergency evacuation routes, as required by California Government Code Section 65302(g)(5).

Senate Bill 1000 (SB 1000), the Planning for Healthy Communities Act, was signed into law on September 24, 2016, mandating that cities and counties adopt an environmental justice element or integrate environmental justice goals, objectives, and policies into other elements of their General Plans. SB 1000 amends California SB 379: Land use; general plan; safety element; climate adaptation from October 2015, which required all cities and counties to include climate adaptation and resiliency strategies in the safety elements of their general plans upon the next revision beginning January 1, 2017.

SB 1000 requires a local government to prepare an environmental justice element or integrate environmental justice-related policies into other elements when two or more other General Plan elements are updated and when a jurisdiction has one or more disadvantaged community (known as Environmental Justice (EJ) Communities in the County's General Plan) within its General Plan planning area. Alternatively, a jurisdiction may voluntarily adopt an environmental justice element or integrate environmental justice policies into its General Plan. SB 1000 has basic requirements that General Plans identify EJ Communities, include policies to reduce environmental impacts to

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community members within EJ Communities, include residents in decision-making processes, and prioritize improvements and projects in EJ communities. Environmental justice can be implemented in various ways, such as through policies and actions that improve sustainability and resilience, protect community health, and prioritize safety, as in the policies included in this Safety Element. The County addresses EJ in the Land Use Element and Healthy Community Elements; please refer to these elements for related policies.

Relationship to Other Documents

The Riverside County Safety Element does not exist in a vacuum but is instead one of several plans that address public safety and related topics. The Safety Element must be consistent with these other plans to minimize conflicts between documents and ensure that the County has a unified strategy to address public safety issues. The Safety Element incorporates information, technical analyses, and policies from these other documents where appropriate to help support this consistency.

Other General Plan Elements

The Safety Element is one of several elements of the Riverside County General Plan. Other social, economic, political, and aesthetic factors must be considered and balanced with safety needs. Rather than compete with the policies of related elements, the Safety Element provides policy direction and designs safety improvements that complement the intent and policies of other General Plan elements. Crucial relationships exist between the Safety Element and the other General Plan elements. How land uses are determined in areas prone to natural hazards, what regulations limit development in these areas, and how hazards are mitigated for existing development, are all issues that tie the elements together. For instance, Land Use Element diagrams and policies must consider the potential for various hazards identified in the Safety Element and must be consistent with the policies to address those hazards. The Multipurpose Open Space Element is also closely tied to the Safety Element. Floodplains, for example, are not only hazard areas, but often serve as sensitive habitat for threatened or endangered species or provide recreation or passive open space opportunities for residents and visitors. As such, flood and inundation policies balance the need to protect public health and safety with the need to protect habitat and open space. Safety Element policies, especially those concerning evacuation routes and critical facilities, must also be consistent with those of the Circulation Element. The County's Circulation Plan routes are considered the backbone routes for evacuation purposes. Policies and information in this Safety Element should not conflict with those in other elements.

Area Plans

The Safety Element provides a comprehensive set of hazard maps and policies that cover all unincorporated areas of Riverside County. The 19 area plans described in Chapter 1, Introduction, of the General Plan, provide additional policy direction, as appropriate, and depict major hazards on more detailed maps than the countywide maps can provide. They show more precisely where hazard areas are, providing a more visible link between geography, land use, and policies. For additional policy guidance in specific areas, please refer to the applicable area plan.

Multi-Jurisdictional Local Hazard Mitigation Plan

Riverside County's Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP) is a plan to identify and profile hazard conditions, analyze risk to people and facilities, and develop mitigation actions to reduce or eliminate hazard risks in Riverside County.. The County prepared the MJLHMP in accordance with the federal Disaster Mitigation Act of 2000 and the Federal Emergency Management Agency's MJLHMP guidance. The mitigation actions in the MJLHMP include both short-term and long-term strategies, and involve planning, policy changes, programs,

projects, and other activities. The MJLHMP and Safety Element address similar issues, but the Safety Element provides a higher-level framework and set of policies, while the MJLHMP focuses on more specific mitigation, often short-term, actions. The MJLHMP, as its name implies, focuses on mitigation-related actions, while the Safety Element also includes policies related to emergency response, recovery, and preparation activities. The County's adopted Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP) can be found at; The County of Riverside Emergency Management Department (EMD) or via the link: <https://rivcoready.org/about-emd/plans/local-hazard-mitigation-plan>

Relationship to the Emergency Management Department

The County of Riverside Emergency Management Department (EMD) is responsible for providing emergency management services. EMD has four divisions that combine traditional emergency management, public health disaster management, and emergency medical services into a single, comprehensive, all hazards department. EMD works with local cities, fire and law enforcement agencies, and special districts to support and implement emergency mitigation and preparation activities across Riverside County, secure resources for first responders, and coordinate with state and federal emergency agencies. EMD's emergency preparation and response activities, including implementing many of the Safety Element policies, are laid out in this Safety Element.

EMD is the responsible agency for developing and implementing Riverside County's Multi-Jurisdictional LHMP. In preparation of the LHMP, the LHMP Steering Committee gathers information and updates the plan using a whole community approach by engaging local jurisdictions, private sector organizations, and community partners. The committee is comprised of representatives from agencies such as the Riverside County Fire Department, Riverside County Department of Environmental Health, Riverside County Sheriff's Office, and the Riverside County Transportation and Land Management Agency. Other contributors included federal, state, and local government agencies; special districts; tribal leaders; non-governmental organizations; and the County Board of Supervisors. Moreover, agencies such as EMD, Riverside County Fire Department, Riverside County Department of Environmental Health, and the Riverside County Sheriff's Office are responsible for implementing some of the policies within this Safety Element. The Riverside County Planning Department's coordination and participation with these agencies are a critical component to effective disaster and hazard planning in unincorporated Riverside County.

Hazard Reduction

Hazard-reduction programs are designed to improve the safety of existing development. For example, older structures, built to superseded code standards, may need seismic upgrading. Owners of older structures may voluntarily upgrade, be strongly persuaded to upgrade, or be required to do so. Additional examples of hazard-reduction programs include:

- Strengthening pipelines and developing emergency back-up capability by public utilities serving the County of Riverside;
- Collaborating with water purveyors to ensure adequate fire flow and enact preventative measures;
- Encouraging the construction of auxiliary water systems to supplement existing water lines. This will help ensure adequate water flow for fire suppression even if main water lines are damaged. Gravity-fed or generator-operated pumps for swimming pools and water storage tanks can also supplement flow;

- Planning for emergency response at the government and individual level to reduce the risk to the public from hazards; and
- Identifying unsafe structures and posting public notices.

To reduce hazards in areas mapped as hazard zones, the County of Riverside uses a combination of methods:

- Research, studies, and reporting requirements;
- Land use planning;
- Real-estate disclosure;
- Incentives to encourage mitigation;
- Public education; and
- Disincentives, including fines and fees for those who choose to take the risk of that hazard.

2. Issues and Policies

This section outlines general issues and the existing hazardous conditions and public safety issues in unincorporated Riverside County, including:

- Code conformance and development regulations
- Seismic and geologic hazards
- Flood and inundation hazards
- Drought
- Fire hazards (urban and wildland)
- Extreme heat
- Severe weather
- Agriculture and forestry hazards
- Hazardous waste and materials
- Disaster preparedness, response, and recovery
- Climate change vulnerability.

This section provides details pertaining to probable locations where each hazard or issue is likely (per availability of data), past notable events in and around unincorporated Riverside County, agencies responsible for providing protection from these public safety issues, and other background information required by the State of California.

Additionally, the County has prepared a Vulnerability Assessment that analyzes how climate-related hazards may harm the county. This assessment was prepared in accordance with the California-recommended guidance in the current *California Adaptation Planning Guide*. It incorporates the findings from a subregional vulnerability assessment prepared for western Riverside County as part of the Resilient IE project. This Vulnerability Assessment refines the findings from Resilient IE to focus on the unincorporated areas of Riverside County and expands the scope to include unincorporated areas in the Coachella Valley and eastern Riverside County, thus more accurately reflecting unincorporated Riverside County as a whole.

The Vulnerability Assessment considers the threats from all relevant natural hazards, which are events or physical conditions that have the potential to cause harm or loss and will emphasize changes to hazard frequency and severity due to climate change. The Vulnerability Assessment also assesses populations or assets facing potential harm from the hazards. This includes the risk of physical damage to buildings and infrastructure, social vulnerability of persons likely to be disproportionately harmed by hazards, potential disruption to the County's economic engines, loss of important services, and damage to sensitive ecosystems. The results of the Vulnerability Assessment are integrated into the hazardous conditions and other public safety issues previously mentioned. A full list of the Vulnerability Assessment results is also provided in **Appendix A**.

Code Conformance and Development Regulations

The Riverside County Department of Building and Safety and the Riverside County Fire Department provide technical expertise in reviewing and enforcing the County Building and Fire Codes. These codes establish site-specific investigation requirements, construction standards, and inspection procedures to ensure that development does not pose a threat to the health, safety, and welfare of the public. California's Building Standards Commission updates these codes on a regular cycle, generally every three years, based on the International Building Codes and State policies. The County adopts these codes along with any locally-appropriate amendments as needed. These codes contain baseline minimum standards to guard against unsafe development.

At a minimum, it is imperative to enforce the most recently adopted regulatory codes for new development and significant redevelopment, including the County's Land Use Ordinance No. 348 (aka zoning ordinance), and Ordinance Regulating the Division of Land (Ord. 460), which support the California Building and Fire Codes. The California Environmental Quality Act (CEQA) adds another level of safety review, requiring that recognized environmental constraints, such as the presence of earthquake faults, landslide risks, floodplains, and other risk zones, be considered prior to approval of significant projects. The County may require that projects in locations with these environmental constraints include mitigation measures to reduce the risk. Additional guidelines and standards are introduced through the Safety Element. Special development regulations can reinforce and augment existing code standards by raising the level of hazard-conscious project's design and mitigation engineering. Examples include additional geologic/geotechnical investigation and additional reinforcement of foundations in areas of potential ground failure.

While foundation investigations are required by Riverside County's Building Code, it is important to emphasize expected levels of investigation and protection. Furthermore, some requirements that may only apply to critical facilities, such as detailed seismic analyses, could be expanded to include other structures and lifelines. Where engineering methods cannot mitigate the hazards, such as where ground rupture along active or potentially active fault traces are identified during project investigation, avoidance of the hazard is an appropriate option. Special minimum setbacks away from active faults, which are already required for critical facilities, can also be defined for other structures and lifelines.

Through Ordinance 457 and Board of Supervisors Policy F-6, Riverside County prohibits grading without permits, levies penalties for illegal grading, and requires the restoration of illegally graded land to prevent off-site drainage and slope erosion. The penalties for illegal grading include fines and five-year suspensions on the issuance of building permits and land use approvals involving subject properties. Larger fines may be levied for illegal grading where it can be shown that violations have occurred to federal and state laws, which permit the larger fines.

Policies

The following policies address code conformance and development regulations enforced by Riverside County. These policies are intended to eliminate the threat of natural hazards on Riverside County's citizens, property, and economy through various code conformance and development regulations. Policies with an asterisk next to them (*) are those that apply to development projects.

- S 1.1 * Mitigate hazard impacts through adoption and strict enforcement of current building codes, which will be amended as necessary when local deficiencies are identified.
- S 1.2 * Enforce state laws aimed at identification, inventory, and retrofit of existing vulnerable structures, focusing on unreinforced masonry structures. Work to secure funding and other resources and establish inter-agency coordination to support this effort. (AI 100, 101, 148, 156)

- S 1.3 * Continue to enforce penalties against grading without permits and ensure the restoration of degraded land. Continue to educate the public about the benefits of grading with permits and the penalties for grading without them. If the penalties are determined to be ineffective, explore whether levying greater penalties would be more effective in deterring illegal grading and ensuring proper restoration of damaged lands.
- S 1.4 Incorporate the current County of Riverside Multi-Jurisdictional Local Hazard Mitigation Plan (approved by FEMA) into this Safety Element by reference, and work to implement the Plan with local partners. (AI 88, 100)
- S 1.5 * Request structural and non-structural assessment and, when necessary, request mitigation of potentially hazardous buildings that: (1) are undergoing substantial repair or improvements resulting in more than half of the assessed property value, or (2) are considered an element of blight. Potential implementation measures may include: (AI 81, 88, 89, 90, 100, 101, 156)
- a) Use of variances, tax rebates, fee waivers, credits, or public recognition as incentives.
 - b) Inventory and structural assessment of potentially hazardous buildings based on screening methods developed by the Federal Emergency Management Agency, after funding and other necessary resources are secured.
 - c) Development of a mandatory retrofit program for hazardous, high-occupancy, essential, dependent, or high-risk facilities.
 - d) Development of a mandatory program requiring public posting of unreinforced masonry buildings.

Seismic and Geologic Hazards

Seismic and geologic hazards are risks caused by the movement of different parts of the Earth's crust, or surface. Seismic hazards include earthquakes and hazardous events caused by them. Geologic hazards are other hazards involving land movements that are not linked to seismic activity and are capable of inflicting harm to people or property.

Seismic activity occurs along boundaries in the Earth's crust, called faults. Pressure along the fault builds over time and is ultimately released, resulting in ground shaking that we refer to as an earthquake. Earthquakes can also trigger other hazards, including surface rupture (cracks in the ground surface), liquefaction (causing loose soil to lose its strength), landslides, and subsidence (sinking of the ground surface). Earthquakes and other seismic hazards often damage or destroy property and public infrastructure, and falling objects or structures pose a risk of injury or death.

Earthquakes are likely to be the hazard with the greatest potential for loss of life and property damage in unincorporated Riverside County. These events can result in urban fires, dam failures, and toxic chemical releases. Earthquake risk is very high in the most heavily populated western portion of the county and the Coachella Valley, due to the presence of two of California's most active faults, the San Andreas and San Jacinto Faults. Risk is moderate in the eastern portion of the county beyond the Coachella Valley due to the lack of major faults in this region.

Unincorporated Riverside County is at risk for a significant earthquake causing catastrophic damage and strains on response and mitigation resources. The San Andreas, San Jacinto, and Elsinore Faults are all capable of producing significant earthquakes, with a magnitude of 6.7 or greater. Other faults, both in and outside unincorporated Riverside County, may also be capable of generating significant earthquakes with damaging effects in the county. In the event of an earthquake, the location of the epicenter and the timing of the earthquake can have a profound

effect on the number of deaths and casualties, as well as property damage. Earthquakes are likely to continue to occur on an occasional basis. Most earthquakes are likely to be small and cause no substantive damage, and may not even be felt by most people, but there is a significant risk of a major earthquake in coming years and decades.

Geologic hazards, such as landslides and erosion, depend on the geologic composition of the area. Landslides and rockfalls may occur on sloped areas, especially areas with steep slopes, and usually in areas of loose and fragmented soil. Landslides, rockfalls, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, often with disastrous results. They often occur as a consequence of seismic activity or heavy rainfall, either of which may cause slopes to lose their structural integrity and slide.

Unincorporated Riverside County contains regions susceptible to slope instability. This instability can include deep-seated landslides, rockfalls, soil slumps, and debris flows. Most areas susceptible to slope instability are designated for open space or rural development. Land subsidence and related issues have been well-documented in unincorporated Riverside County, and most of the early documented cases of subsidence affected only agricultural land or open space. As urban areas have expanded, so too have the impacts of subsidence on structures for human occupancy.

The county also contains area susceptible to soil collapse. In unincorporated Riverside County, collapsible soils occur predominantly at the base of the mountains. In addition, some windblown sands may be vulnerable to collapse. Wind and wind-blown sand are an environmentally-limiting factor throughout much of unincorporated Riverside County. The Coachella Valley, the Santa Ana River Channel in northwestern Riverside County, and areas in and around the cities of Hemet and San Jacinto are zones of high wind erosion susceptibility. With significant rainfall, additional failures are likely in landslide hazard areas, minor landslides will likely continue to impact the area when heavy precipitation occurs, as they have in the past.

Climate change is unlikely to increase earthquake frequency or strength. While total average annual rainfall may not change significantly, rainfall may be concentrated in more intense precipitation events. Heavy rainfall could cause an increase in the number of landslides or make landslides larger than normal.

Policies

The following policies address fault rupture; seismically-induced liquefaction, landslides, and rockfalls; subsidence and expansive and collapsible soils; and wind erosion. These policies are intended to minimize the impact of seismic and geologic hazards on Riverside County's citizens, property, and economy. Policies with an asterisk next to them (*) are those that apply to development projects.

Fault Rupture

- S 2.1 * Minimize fault rupture hazards through enforcement of Alquist-Priolo Earthquake Fault Zoning Act provisions and the following: (AI 80, 91, 152).
- a) Require geologic studies or analyses for critical structures, lifelines, high-occupancy, schools, and high-risk structures, within 0.5 miles of all Quaternary to historic faults shown on the Earthquake Fault Studies Zones map. The County geologist shall review and make recommendations based on the results to reduce the potential risk.

- b) Request geologic trenching studies within all designated Earthquake Fault Studies Zones, unless adequate evidence, as determined by the Riverside County Geologist, is accepted. The County of Riverside may request geologic trenching of non-zoned faults for especially critical or vulnerable structures or lifelines.
- c) Require that infrastructure systems, such as energy, communications, and transportation infrastructure be designed to resist, without failure to the extent feasible, their crossing of a fault, should fault rupture occur.
- d) Support efforts by the California Department of Conservation, California Geological Survey, to develop geologic and engineering solutions in areas of ground deformation due to faulting and seismic activity, in those areas where a fault cannot be reliably located.
- e) Encourage and support efforts by the geologic research community to define better the locations and risks of Riverside County faults. Such efforts could include data sharing and database development with regional entities, other local governments, private organizations, utility agencies or companies, and local universities

Seismically-Induced Liquefaction, Landslides, and Rock Falls

- S 2.2 * Request geological and geotechnical investigations in areas with potential for earthquake-induced liquefaction, landslides, or settlement, for any building proposed for human occupancy and any structure whose damage would cause harm, except for accessory structures/buildings, as determined by County officials. Any studies or surveys should be prepared/completed by a state-licensed professional. (AI 81)
- S 2.3 * Require that a state-licensed professional investigate the potential for liquefaction in areas designated as underlain by “Susceptible Sediments” and “Shallow Groundwater” for all proposed critical facilities, except for accessory buildings. Any studies must be prepared/completed by a state-licensed professional.
- S 2.4 * Request that engineered slopes be designed to resist seismically-induced failure as appropriate. For lower-risk projects, this may include requiring slope design to be based on pseudo-static stability analyses using soil engineering parameters that are established on a site-specific basis. For higher-risk projects, appropriate standards may include requiring the stability analyses to factor in the intensity of expected ground-shaking, using a Newmark-type deformation analysis or other analyses as appropriate.
- S 2.5 * Request that cut-and-fill transition lots appropriately mitigate the potential of seismically-induced differential settlement, including through using over-excavation or other techniques as required by geotechnical, soils, and grading requirements.
- S 2.6 * Request structures in liquefaction and slope instability hazard zones to mitigate the potential of seismically-induced differential settlement through appropriate techniques as determined by geotechnical studies, including a 100-percent maximum variation of fill depths as warranted.
- S 2.7 Encourage research into new foundation design systems that increase resilience to hazards posed by Riverside County’s climatic, geotechnical, and geological conditions. (AI 104)

Landslides, Rockfalls, and Debris Flows

- S 2.8 * Request the following in landslide potential hazard management zones, or when deemed necessary for compliance with the California Environmental Quality Act (CEQA), prior to the issuance of development permits or approval of project designs: (AI 104)
- a) Preliminary geotechnical and geologic investigations, including certification regarding the stability of the site against adverse effects of earthquake and subsidence.
 - b) Evaluations of site stability, including any possible impact on adjacent properties.
 - c) Consultant reports, investigations, and design recommendations required for grading permits, building permits, and subdivision applications, shall be prepared by state-licensed professionals.
- S 2.9 * Require new development in areas prone to geologic hazards (e.g., landslides, steep topography, slope instability) to be adequately mitigated against these hazards, as feasible. Any development in hillside areas should prepare drainage plans to direct runoff and drainage away from potentially unstable slopes. New developments should incorporate hillside design techniques and features to mitigate and support slope stability. (AI 102)
- S 2.10 * Identify and request mitigation of on-site slope instability, debris flow, and erosion hazards on lots undergoing substantial improvements, particularly during the entitlement or permitting process.
- S 2.11 * Request grading plans, environmental assessments, engineering and geologic technical reports, irrigation and landscaping plans, including ecological restoration and revegetation plans, as appropriate, to ensure the adequate demonstration of a project's ability to mitigate the potential impacts of slope and erosion hazards and loss of native vegetation.
- S 2.12 Conduct mitigation on existing public property, and support mitigation activity on private property through any appropriate programs, located on unstable hillside areas, especially slopes with recurring failures where unincorporated Riverside County property or public right-of-way is threatened from slope instability, or where considered appropriate and urgent by the Riverside County Engineer, Fire Department, or Sheriff Department. (AI 148)
- S 2.13 * Consider establishing neighborhood and building design standards that minimize landslide hazards in high landslide susceptibility areas.
- S 2.14 Encourage building retrofits that improve resiliency to geologic and seismic hazards. (AI 100, 101, 156)

Subsidence and Expansive and Collapsible Soils

- S 2.15 * Request geotechnical studies within documented subsidence zones, as well as zones that may be susceptible to subsidence, prior to the issuance of development permits. Within the documented subsidence zones of the Coachella, San Jacinto, and Elsinore Valleys, the studies should address the potential for reactivation of these zones, consider the potential impact on the project, and provide adequate and acceptable mitigation measures.
- S 2.16 Encourage a liaison program with all Riverside County water districts to prevent water extraction-induced subsidence (AI 4).

- S 2.17 Encourage and support efforts for long-term, permanent monitoring of topographic subsidence in all producing groundwater basins, irrespective of past subsidence.

Wind Erosion

- S 2.18 * Request studies that assess the potential of this hazard on proposed development within “High” and “Very High” wind erosion hazard zones and request appropriate mitigation to wind erosion hazards prior to the issuance of development permits.
- S 2.19 Request a disclosure about wind erosion susceptibility on property title for those properties located within “High” and “Very High” wind erosion hazard zones, in connection with entitlement requests. (AI 92)
- S 2.20 * Request buildings to be designed to resist wind loads as appropriate for their form and location.

Flood and Inundation Hazards

Flooding is the rising and overflowing of a body of water onto normally dry land. History highlights floods as one of the most frequent natural hazards impacting communities in unincorporated Riverside County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities, as well as life-safety issues.

Floods are usually caused by large amounts of precipitation, either from a period of very intense precipitation or a long period of steady precipitation. Historically, unincorporated Riverside County has been at risk of flooding primarily during the spring months when stream systems in the county swell with heavy rainfall. Flooding susceptibility in unincorporated Riverside County is primarily associated with several major stream drainages, including, but not limited to, the Santa Ana, San Jacinto and Whitewater Rivers, as well as smaller-scale and flash flood events on many of the alluvial fans that flank unincorporated Riverside County’s hillsides.

Flash flooding is a common problem, especially in the Coachella Valley and the eastern portions of the county. Flash flooding is typically associated with short duration, high-intensity precipitation events, such as those that may occur during summer thunderstorms. Unincorporated Riverside County occasionally experiences periods of substantial rainfall that can lead to flash floods. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Dam failure also poses a risk to unincorporated Riverside County. Dam break floods are usually associated with intense rainfall or prolonged flood conditions. Dam failures can range from fairly minor to catastrophic and can potentially harm human life and property downstream from the failure. In addition, ecosystems and habitats are destroyed as a result of waters flooding them. Many dam failures are also the secondary result of other natural disasters, such as earthquakes, landslides, extreme storms, or heavy snow-melt.

In unincorporated Riverside County, a major earthquake could cause a dam failure. In a dam failure scenario, the greatest threat to life and property typically occurs in those areas immediately below the dam since flood depths and discharges generally decrease as the flood wave moves downstream. The Mathews Dam, Robert A. Skinner Dam, and Railroad Canyon Dam present an extremely high downstream hazard to the communities of Home Gardens, French Valley, and Lakeland Village, respectively, although the overall risk of dam failure is extremely low.

Floods are among the most damaging natural hazards in unincorporated Riverside County, and climate change is expected to make flood events worse. While climate change may not change average precipitation levels significantly, scientists expect that it will cause more years with extreme precipitation events. Although there are no specific flooding projections for the county, floods are expected to occur more often in and around unincorporated Riverside County and climate change may expand the parts of the county that are considered flood-prone.

Policies

The following policies address flood and inundation hazard abatement, high-risk facilities, and risk assessment. These policies are intended to minimize the impact of flood and inundations hazards on Riverside County's citizens, property, and economy. Policies with an asterisk next to them (*) are those that apply to development projects.

Flood and Inundation Hazard Abatement

- S 3.1 * All residential, commercial, and industrial structures should be flood-proofed, to the maximum extent possible and as required by law, from the mapped 100-year storm flow, or to an appropriate level determined by site-specific hydrological studies for areas not mapped by the Federal Emergency Management Agency. This may require that the finished floor elevation be constructed at such a height as to meet this requirement. Nonresidential (commercial or industrial) structures may be allowed with a “flood-proofed” finished floor below the Base Flood Elevation (i.e., 100-year flood surface) to the extent permitted by state, federal, and local regulations. New critical facilities should be constructed above-grade to the satisfaction of the Building Official, based on federal, state, or other reliable hydrologic studies. Residential commercial, and industrial structures shall meet these standards as a condition of approval. (AI 25, 59, 60, 88)
- S 3.2 * Agricultural, recreational, or other low-intensity uses may be allowable within a 100-year floodplain if flood control and groundwater recharge functions are maintained. (AI 25, 59, 60)
- S 3.3 * Prohibit alteration of floodways and channelization unless alternative methods of flood control are not technically feasible or alternative methods are used to the maximum extent practicable. The intent is to balance floodway protection with prudent land use solutions, recreational needs, and habitat requirements, and as applicable to provide incentives for natural watercourse preservation. (AI 25, 59, 60)
 - a) Prohibit the construction, location, or substantial improvement of structures in areas designated as floodways, except upon approval of a plan which provides that the proposed development will not result in any significant increase in flood levels during the occurrence of a 100-year flood discharge.
 - b) Prohibit the filling or grading of land for nonagricultural purposes and for non-authorized flood control purposes in areas designated as floodways, except upon approval of a plan which provides that the proposed development will not result in any significant increase in flood levels during the occurrence of a 100-year flood discharge.

- S 3.4 * Prohibit substantial modification to watercourses, unless the modification does not adversely affect adjacent wetlands or riparian habitat, or become detrimental to adjacent property as a result of increased erosion, sedimentation, or water velocity. Substantial modifications to watercourses shall be done in the least environmentally damaging manner practicable and shall restore natural conditions to the greatest extent possible, to maintain adequate wildlife corridors and linkages and maximize groundwater recharge. (AI 25, 59, 60, 61)
- S 3.5 * Development within the floodway fringe should only be allowed if the proposed structures can be adequately flood-proofed and will not contribute to property damage or risks to public safety, as required by law. Such developments shall be required to be capable of withstanding flooding and minimize the use of fill. Compatible uses shall not, however, obstruct flows or adversely affect upstream or downstream properties with increased velocities, erosion backwater effects, or concentrations of flows. (AI 25, 59, 60, 61)
- S 3.6 * All projects in unincorporated Riverside County should address and mitigate where applicable, adverse impacts to the carrying capacity of local and regional storm drain systems.
- S 3.7 Collaborate with neighboring jurisdictions to mitigate the impacts of new development in unincorporated Riverside County that could increase runoff onto parcels downstream in a neighboring jurisdiction and encourage neighboring jurisdictions to require development occurring adjacent to the county to consider the impact of flooding and flood-control measures on properties within unincorporated Riverside County. (AI 62)
- S 3.8 * Update stormwater infrastructure design requirements as needed to maintain consistency with federal, state, and local regulatory requirements. (AI 25)
- S 3.9 * Ensure that new development projects and retrofits to existing large-scale projects incorporate design strategies and features to reduce the area of impervious surfaces. (AI 4, 25, 100, 101, 156)
- S 3.10 Collaborate with the Rancho California Municipal Water District, Eastern Municipal Water District, and other dam owners to maintain all dams in Riverside County to a high degree of structural stability.
- S 3.11 Consider identifying areas of poor drainage and installing new or upgrade existing drainage systems to accommodate drainage needs. Use natural infrastructure to the extent possible. (AI 148)

High-Risk Facilities

- S 3.12 * Public facilities and other facilities essential for emergencies and large public assembly within the County Regulatory Floodplain as mapped by the Federal Emergency Management Agency shall not be approved unless the project is adequately protected from flood hazards, incorporates all required flood protection specific to that area in accordance with County ordinances and guidelines, as feasible, and will not result in any increase in flood levels during the occurrence of a flood event. Such facilities that are new shall have at least two routes for emergency egress and ingress, and the project design shall minimize the potential for debris or flooding to block emergency routes, either through the construction of dikes, bridges, or large-diameter storm drains under roads used for primary access. (AI 25)

- S 3.13 * Existing essential, dependent-care, and high-risk facilities not in conformance with provisions of the County of Riverside zoning should upgrade or modify building use to a level of safety consistent with the inundation risk. (AI 25, 88, 148)
- S 3.14 * Development using, storing, or otherwise involved with substantial quantities of on-site hazardous materials should not be permitted within a 100-year floodplain or dam inundation zone, unless all standards for evaluation, anchoring, and flood-proofing have been satisfied. Hazardous materials should be stored in watertight containers, not capable of floating, to the extent required by state and federal laws and regulations. Facilities storing substantial quantities of hazardous materials within inundation zones should be adequately flood-proofed and hazardous materials containers shall be anchored and secured to prevent flotation and contamination. (AI 25)
- S 3.15 * Dependent-care facilities should have all flood-vulnerable electrical circuitry flood-proofed. (AI 25)
- S 3.16 * High-risk facilities should be required to maintain and rehearse inundation response plans. (AI 25)

Risk Assessment

- S 3.17 Continue to assess the dam inundation risk within unincorporated Riverside County and upgrade facilities and infrastructure at risk, as feasible. (AI 83, 88)
- S 3.18 Designs and upgrades of street storm drains should be based on the depth of inundation, relative risk to public health and safety, the potential for hindrance of emergency access and regress from excessive flood depth, and the threat of contamination of the storm drain system with sewage effluent. In general, the 10-year flood flows should be contained within the top of curbs and the 100-year flood flows within the street right-of-way.
- S 3.19 During updates to the Safety Element or the Multi-Jurisdictional Local Hazard Mitigation Plan, or when otherwise necessary, the County shall review the 500-year, 100-year, and 10-year flood hazard in the unincorporated county by state, federal, county, and other standards. The County shall use such sources to improve existing protection, review protection standards proposed for new development and redevelopment, and update emergency response plans, to the extent necessary. (AI 83)
- S 3.20 Promote flood-control measures that maintain natural conditions within unincorporated Riverside County's regulatory floodplain of rivers and streams. (AI 25, 59, 60)
- S 3.21 Encourage the use of Specific Plans to allow increased densities in certain areas of a proposed development or apply Transfer of Development Credits to encourage the placement of appropriate land uses in natural hazard areas, including open space, passive recreational uses, or other development capable of better adapting to these hazards. (AI 25, 59, 60)
- S 3.22 The County should take an active role in acquiring property in high-risk flood zones and designating the land as open space for public use or wildlife habitat. (AI 59, 60)
- S 3.23 Coordinate with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife, the Resource Conservation District, the Federal Emergency Management Agency, the California Department of Water Resources, and the Riverside County Flood Control and Water Conservation District, in defining existing and potential flood problem areas. (AI 4)

Fire Hazards

Fire hazards can come in the form of both wildfires and urban fires. California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires. Risk and vulnerability to unincorporated Riverside County from wildfire is of significant concern, especially in the forests and shrublands in the western county. Three types of fires are of concern to unincorporated Riverside County: (1) wildfires, (2) wildland-urban interface fires, and (3) structural fires.

Wildfire hazard is the highest-priority hazard in the county and is the hazard with the greatest potential for catastrophic loss. Wildfires can occur on mountains, hillsides, and grasslands. In unincorporated Riverside County, native vegetation, such as chaparral, sage, and grassland provide fuel that allows fire to spread easily across large tracts of land. A significant portion of the county is undeveloped and consists of rugged topography with highly flammable vegetation. In particular, the hillside terrain of unincorporated Riverside County has a substantial fire risk. Fire potential for unincorporated Riverside County is typically greatest in the months of August, September, and October, when dry vegetation coexists with hot, dry Santa Ana winds. However, in unincorporated Riverside County, fires with conflagration potential can increasingly occur at any time of the year.

The wildland-urban interface is an area where buildings and infrastructure (e.g., cell towers, schools, water supply facilities) mix with areas of flammable wildland vegetation. Wildfire threat within the county ranges from moderate to very high. Some of the highest threats occurs in Western Riverside County, especially along the San Jacinto Mountains near communities such as Idyllwild and Mountain Center. A majority of this region is considered a Very High Fire Hazard Severity Zone. The Little San Bernardino Mountains northeast of the Coachella Valley have hazard severity zones ranging from Moderate to Very High, and most of Eastern Riverside County is considered a Moderate Fire Hazard Severity Zone. As development continues throughout the county, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

Urban fires occur in built-up environments, destroying buildings and other human-made structures. These disasters are often due to faulty wiring or mechanical equipment, combustible construction materials, or the absence of fire alarms and sprinkler systems. Structural fires are largely caused accidentally, although deliberate fires (arson) are a cause of some events. Older buildings that lack modern fire safety features may face greater risk of damage from fires. The risk and vulnerability to structural fires is unpredictable and will vary across unincorporated Riverside County due to the unique conditions of a built environment.

Changing climate conditions are expected to increase the wildfire risk in and around unincorporated Riverside County. Warmer temperatures brought on by climate change can exacerbate drought conditions. The biggest increase in wildfires is projected to occur in Western Riverside County, along the San Jacinto Mountains. Due to warmer temperatures, the fire season is also likely to begin earlier in the year and extend later than it has historically.

Policies

The following policies address building code and conformance standards, wind-related hazards, and general and long-range fire safety planning. These policies are intended to reduced earthquake and wind-induced fire as a threat and to develop an integrated approach to minimizing the threat of wildland and urban fires. Policies with an asterisk next to them (*) are those that apply to development projects.

Building Code and Performance Standards

- S 4.1 * All development and construction within Fire Hazard Severity Zones shall be reviewed by the Riverside County Fire Department and Building and Safety Department for consistency with the following requirements before the issuance of any building permits: (AI 25, 81.1, 81.2, 104.1)
- a) All proposed development and construction shall meet minimum state, county, and local standards and other legal requirements for fire safety, as defined in the Riverside County Building or Fire Codes, or by County zoning, or as dictated by the Building Official or the Transportation Land Management Agency, based on building type, design, occupancy, and use.
 - b) In addition to the standards and guidelines of the California Building Code, California Fire Code, the Riverside County Code of Ordinances, Title 14 of the California Code of Regulations, and other appropriate fire safety provisions, developments shall incorporate additional standards for high-risk, high-occupancy, and dependent facilities where appropriate under the Riverside County Fire Code (Ordinance No. 787) Ordinance. These shall include assurance that structural and nonstructural architectural elements of the building will not impede emergency egress for fire safety staffing/personnel, equipment, and apparatus; nor hinder evacuation from fire, including potential blockage of stairways or fire doors.
 - c) Proposed development and construction in Fire Hazard Severity Zones shall provide secondary public access, in accordance with Riverside County ordinances, where required. There shall be multiple points of ingress and egress that allow for emergency response vehicle access. Points of access shall also include visible street addresses and signs and sufficient water supplies, infrastructure for structural fire suppression, and other applicable local and state requirements.
 - d) Proposed development and construction in Fire Hazard Severity Zones shall use single loaded roads to enhance fuel modification areas, unless otherwise determined by the Riverside County Fire Chief.
 - e) Proposed development and construction in Fire Hazard Severity Zones shall provide a defensible space or fuel modification zones to be located, designed, constructed, and maintained to provide adequate defensibility from wildfires.
 - f) Prior to the approval of all parcel maps and tentative maps, the County shall require, as a condition of approval and as feasible and appropriate, the developer meet or exceed the State Responsibility Area Fire Safe Regulations and the Fire Hazard Reduction Around Buildings and Structures Regulations, particularly those regarding road standards for ingress, egress, and fire equipment access (see Gov. Code, Section 66474.02.)
 - g) Proposed development and construction of more than four residential units or more than 10,000 square feet of nonresidential space located in Very High Fire Hazard Severity Zones, or other appropriate zones as determined by the Riverside County Fire Department, shall submit and implement a fire protection plan as feasible and appropriate. This plan shall include provisions for roadways and access, firefighting infrastructure, signage, vegetation management, construction materials, and evacuations.

- S 4.2 Require continued long-term operation and maintenance of fuel breaks, brush management, controlled burning, revegetation, and fire roads by Riverside County and private landowners. (AI 25)
- S 4.3 Monitor fire-prevention measures (e.g., fuel reduction) through a site-specific fire-prevention plan to reduce long-term fire risks in Very High Fire Hazard Severity Zones. (AI 25, 88)
- S 4.4 * Discourage development and activities in areas with limited water and access roads, unless adequate measures are implemented. (AI 60)
- S 4.5 * Require proposed development in High or Very High Fire Hazard Severity Zones be located where fire and emergency services are available or will be constructed as part of the proposed development activities, to the extent such locations are available. These services should meet the minimum response times as established by the Riverside County Fire Department. (AI 60, 61)
- S 4.6 * Request that conceptual landscaping plans for development in Fire Hazard Severity Zones be reviewed by TLMA and Fire Department prior to the issuance of development permits. The conceptual landscaping plan of the proposed development should, at a minimum, include: (AI 25)
- a) Plant palette suitable for high fire hazard areas to reduce the risk of fire hazards.
 - b) Retention of existing natural vegetation to the maximum extent feasible.
 - c) Removal of on-site combustible plants.
- S 4.7 * Site design for development in Fire Hazard Severity Zones should be required to account for topographical conditions and reduce the increased risk for sites located near ridgelines, plateau escarpments, saddles, hillsides, peaks, or other areas where the terrain or topography affect its susceptibility to wildfires by: (AI 60, 81.2, 91)
- a) Providing fuel modification zones with removal of combustible vegetation while minimizing visual impacts and limiting soil erosion.
 - b) Replacing combustible vegetation with fire resistant vegetation to stabilize slopes.
 - c) Submitting topographic map with site-specific slope analysis.
 - d) Submitting erosion and sedimentation control plans.
 - e) Providing a setback from the edge of the fuel modification zones as deemed appropriate by the Fire Department.
 - f) Minimizing disturbance of 25 percent or greater natural slopes.
 - g) Or enacting other efforts as appropriate to provide comparable protection.
- S 4.8 * Locate new critical public facilities outside of High or Very High Fire Hazard Severity Zones or other areas facing elevated risk of wildfire events. Critical facilities include emergency shelters, emergency command and communication facilities, and hospital and healthcare centers. If no feasible alternative site exists, ensure that these facilities incorporate all necessary protections to allow them to continue to serve community needs during and after disaster events. (AI 25, 60)

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- S 4.9 * Site all new public facilities in areas outside of identified fire hazard severity zones and wildland-urban interface or fire threat areas, as feasible. (AI 60)
- S 4.10 * Establish neighborhood and building design standards that minimize fire hazards in high fire hazard severity zones, as feasible.
- S 4.11 Collaborate with local governments to establish fire fuel management practices in local and regional parks and open spaces., as feasible
- S 4.12 Identify existing public and private roadways in fire hazard areas not in compliance with contemporary fire-safe standards, including road standards, vegetation clearance, and other requirements of Sections 1273 and 1274 of the California Code of Regulations to the extent resources are available. Work at retrofitting County-owned roadways as needed to meet current standards and require private property owners to do the same, to the extent feasible and given the absence of other site constraints. (AI 25, 81.1, 88, 101, 148, 156)

Wind-Related Hazards

- S 4.13 Use ongoing brush clearance fire inspections to educate homeowners on fire prevention tips by implementing annual countywide weed abatement program. (AI 25, 96, 97)
- S 4.14 Coordinate with local fire agencies to develop high-visibility fire prevention programs, including those offering voluntary home inspections and promoting awareness of home fire prevention measures. (AI 96, 97, 98)

General and Long-Range Fire Safety Planning

- S 4.15 * Seek to conduct and implement long-range fire safety planning, including stringent building, fire, subdivision, and municipal code standards, improved infrastructure, and improved mutual aid agreements with the private and public sector. (AI 88, 93)
- S 4.16 Continue to work cooperatively with the California Department of Forestry and Fire Protection and Tribal government fire departments to strengthen fire-fighting capabilities and successfully respond to multiple fires. (AI 4, 88, 150)
- S 4.17 Consider developing a program to use existing reservoirs, tanks, and water wells in the county for emergency fire suppression water sources.

- S 4.18 When updating the Safety Element, the Multi-Jurisdictional Local Hazard Mitigation Plan, or at other times as appropriate, review inter-jurisdictional fire response agreements and improve firefighting resources as recommended in the Riverside County Fire Department Fire Protection Plan and Emergency Medical Services (EMS) Strategic Master Plan. Ensure that fire response agreements and firefighting resources are able to meet current and future needs, including increased demand from new development and changing fire regimes. Ensure that: (AI 4, AI 88, 104, 104.1):
- Fire reporting and response times do not exceed the goals listed in the Riverside County Fire Department Fire Protection Plan and EMS Strategic Master Plan identified for each of the development densities described in these plans.
 - Fire flow requirements (e.g., water for fire protection) are consistent with Riverside County Ordinance 787, including requirements for fire hydrant size and outlets, sprinklers, and other water supply needs.
 - The planned deployment and height of aerial ladders and other specialized equipment and apparatus are sufficient for future development types.
 - County firefighting agencies have access to water supplies that are regular, reliable, and sufficient to meet long-term needs, including accounting for changes in water supply availability.
- S 4.19 Continue to use the Riverside County Fire Department Fire Protection Plan and Emergency Medical Services (EMS) Strategic Master Plan as the foundational document to implement the Safety Element's goals and objectives. (AI 59, 60, 104.1, 104.4)
- S 4.20 * Encourage property owners to use clustering and Transfer of Development Rights (TDR) program when developing lands within Fire Hazard Severity Zones, as appropriate, by: (AI 59, 61)
- Exploring restricting the development of a property through placement of conservation easement.
 - Considering acquiring the conservation easements similar to that of the Multiple Species Habitat Conservation Plan (MSHCP).
- S 4.21 Identify, map, and update Fire Hazard Severity Zone maps on an as-needed continual basis. (AI 25, 91)
- S 4.22 Ensure that the Riverside County Fire Department has appropriate municipal staffing and Office of the Fire Marshall staff to address development pressure and adequately respond to expected future fire protection needs. (AI 59)
- S 4.23 * Implement a coordination program with fire protection and emergency service providers to reassess fire hazards after wildfire events and adjust fire prevention and suppression needs, including needs for new or revised development and reconstruction standards. (AI 104.6)
- S 4.24 Implement a regional coordination program to increase support for coordination among fire protection and emergency service providers.

- S 4.25 Implement a long-term fire protection training and education program for government agencies and communities. (AI 93)
- S 4.26 Require as feasible automatic natural gas shutoff earthquake sensors in high-occupancy industrial and commercial facilities and encourage these sensors for all residences.

Hazardous Waste and Materials

Hazardous materials are materials that pose a significant risk to public safety and environmental health. These include toxic chemicals, flammable or corrosive materials, petroleum products, and unstable or dangerously reactive materials. A release or spill of bulk hazardous materials could result in fire, explosion, toxic cloud, or direct contamination of water, people, and property. The effects may involve a local site or many square miles. Health problems may be immediate, such as corrosive effects on skin and lungs, or gradual, such as the development of cancer from a carcinogen. Damage to property could range from immediate destruction by explosion to permanent contamination by a persistent hazardous material.

The majority of hazardous materials in the county are being transported by trucks on Interstate (I-) 10, I-15, I-215, and State Route (SR-) 60 and SR-91. The most vulnerable areas along these routes are considered to be the on/offramps and interchanges. Pipeline systems also carry hazardous materials, and under some conditions these pipelines can rupture and cause a release of hazardous materials. Major freeways are areas of concern for potential hazardous material release events, as are the Union Pacific Railroad tracks that roughly parallel I-10. In addition to highway traffic, other hazardous materials are transported through the county on the Southern Pacific Railroad.

Given past hazardous materials incidents in the county, it is highly likely that hazardous materials incidents will continue occur in unincorporated Riverside County every year, although the vast majority of these incidents are small, limited, and do not pose a public or environmental health risk. Climate change is unlikely to affect hazardous materials transportation incidents. However, increases in the frequency and intensity of hazards, such as floods, landslides, and severe storms, may create a greater risk of hazardous materials releases during these events.

Policies

The following policies address emergency preparedness, disaster preparedness, public power safety shutoffs, evacuation needs, and mutual aid. These policies are intended to reduce hazardous waste and materials as a threat and ensure that the land use and siting decisions take hazardous waste management and risk reduction into account. Policies with an asterisk next to them (*) are those that apply to development projects.

- S 5.1* Enforce land use policies and existing criteria related to hazardous materials and waste through ongoing implementation of the programs identified in the County's Hazardous Waste Management Plan (CHWMP). (AI 88)
- S 5.2 * Review all proposed development projects that manufacture, use, or transport hazardous materials for compliance with the CHWMP. Such projects shall provide a buffer zone, to be determined by the County, between the installation and property boundaries sufficient to protect public safety.
- S 5.3 * Require that applications for discretionary development projects that will generate hazardous wastes or use hazardous materials include detailed information on hazardous waste reduction, recycling, and storage.
- S 5.4 * Ensure that industrial facilities are constructed and operated in accordance with current safety and environmental protection standards.

- S 5.5 Regulate the storage of hazardous materials and wastes and require secondary containment and periodic examination for all such materials as necessary.
- S 5.6 * Require that any business that handles a hazardous material prepare a plan for emergency response to a release or threatened release of a hazardous material, including providing updated information to emergency responders on the type and quantity of hazardous materials kept on-site.
- S 5.7 * Identify sites that are inappropriate for hazardous material storage, maintenance, use, and disposal facilities due to potential impacts on adjacent land uses and the surrounding natural environment. Prohibit the siting of new or expanded hazardous material facilities on such sites to the extent feasible.
- S 5.8 Ensure that the use and disposal of hazardous materials in the County complies with local, state, and federal safety standards.
- S 5.9 * Require commercial businesses, utilities, and industrial facilities that handle hazardous materials to install automatic fire and hazardous materials detection, reporting, and shut-off devices, and install an alternative communication system in the event power is out or telephone service is saturated following an earthquake.

Disaster Preparedness, Response, and Recovery

Riverside County Emergency Services establishes the responsibilities of the various Riverside County agencies in times of a disaster. Disaster preparedness and response planning include identifying short-term actions to reduce the scope of an emergency and managing necessary resources in the event of a disaster. After any disaster, particularly an earthquake, short-term disaster recovery requires many operations that are less urgent than fire suppression or medical attention but are equally important.

Emergency preparedness activities in unincorporated Riverside County are conducted through the County of Riverside's EMD and Emergency Operations Center (EOC) EMD, in cooperation with local cities, special districts, and fire and law enforcement agencies, provides emergency management services. EMD prepares emergency and contingency plans, ranging from evacuation plans to emergency operations plans that help specify the roles and responsibilities of first responders and emergency management personnel for an incident. The County of Riverside uses Alert RivCo, a phone alert system to alert residents and businesses in Riverside County who are affected, threatened, or might be endangered by an emergency event or a disaster, such as wildfires, floods, hazardous materials, severe weather, and certain law enforcement incidents. Alert RivCo is part of a group of alert and warning tools used in the county.

Additional emergency management and response services for jurisdictions throughout the county are provided through a mutual-aid agreement with the Riverside County Fire Department and CAL FIRE. The Riverside County Fire Department and CAL FIRE provide a variety of public safety services, including fire protection, medical aid, rescue, hazardous materials response, and educational safety programs.

In recent years, the County of Riverside has expanded its emergency preparedness planning. The County of Riverside is required under state law to prepare and maintain a Standardized Emergency Management System (SEMS) Multi-hazard Functional Plan. The California Governor's Office of Emergency Services has extensive guidelines outlining the requirements of the Riverside County SEMS.

During high wind events, high temperatures, and dry conditions, electricity utility companies servicing unincorporated Riverside County such as Southern California Edison (SCE), Anza Electric Cooperative, and

Imperial Irrigation District have begun to occasionally “de-energize,” or turn off the electricity for, power lines that run through areas where there is an elevated fire risk. These activities, called Public Safety Power Shutoffs (PSPSs), result in a loss of power for customers served by the affected power lines and may occur at any time of the year.

A loss of power can make it more difficult for homes or businesses to receive emergency notifications if needed. PSPS events can also create vulnerabilities for community members that lack backup power supplies and depend on electricity for heating or cooling homes and buildings, lighting, and internet. PSPS events may also be harmful to people who depend on electrically powered medical devices. Additionally, community members may be faced with economic hardships and be deprived of important services, such as grocery stores, gas stations, and banks/ATMs. Traffic lights and other traffic control systems may not work, which can complicate any evacuation needs and may hinder emergency response. Although critical public health and safety facilities often have backup generators, the loss of power may also disable other key infrastructure systems.

Some natural disasters or other public safety events may require evacuation of parts of unincorporated Riverside County. In some instances, these evacuations may be limited to a particular neighborhood or street. In other instances, entire communities may need to evacuate. To allow for a safe and effective evacuation, all community members should be able to easily access an evacuation route that allows them to safely travel out of the evacuation zone. If there is limited access to evacuation routes or if these routes cannot accommodate evacuation traffic, evacuation efforts may be severely hampered by slow traffic and collisions, which can put community members at risk. Evacuation constraints can also slow down the public safety response by hindering access by emergency responders.

Policies

The following policies address disaster preparedness, critical facilities and lifelines, disaster recovery plans, and public information and outreach. These policies are intended to adequately prepare Riverside County for emergencies and disasters and develop an integrated approach to minimizing the threat of natural and manmade hazards. Policies with an asterisk next to them (*) are those that apply to development projects.

Disaster Preparedness

- S 6.1 Continually strengthen the Riverside County Emergency Management Department’s Response Plan and Multi-Jurisdictional Local Hazard Mitigation Plan (as approved by the Federal Emergency Management Agency) and maintain mutual-aid agreements with federal, state, local agencies, and the private sector to assist in: (AI 88)
- a) Clearance of debris in the event of widespread slope failures, collapsed buildings or structures, or other circumstances that could result in blocking emergency access or regress
 - b) Heavy search and rescue
 - c) Fire suppression
 - d) Hazardous materials response
 - e) Temporary shelter
 - f) Geologic and engineering needs
 - g) Traffic and crowd control

h) Building inspection

- S 6.2 Provide alerts about potential, developing, and ongoing emergency situations through extensive early-warning and notification systems that convey information to all residents, in multiple languages and formats to ensure it is widely accessible. (AI 85)
- S 6.3 Prioritize multilingual staff personnel as a resource to assist in evacuation and short-term recovery activities. (AI 97)
- S 6.4 Use incentives and disincentives to encourage private businesses, consortiums, and neighborhoods to be self-sufficient in an emergency by maintaining a fire control plan, including an on-site firefighting capability and volunteer fire response teams to respond to small fires, and identifying medical personnel or residents capable and certified in first-aid and CPR.
- S 6.5 Conduct regional drills for earthquakes and other hazards as appropriate: (AI 82) Use HAZUS results in the Technical Background Report to develop internal scenarios for emergency response and test back-up power generators in public facilities and other critical facilities taking part in the earthquake drill. During emergency drills, encourage communication and cooperation between emergency response staff and designated contacts at hospitals, high-occupancy buildings, and dependent care facilities.
- S 6.6 Develop a system to respond to short-term increases in hazard on the southern San Andreas Fault, based on probabilities associated with foreshocks. (AI 85)
- S 6.7 As feasible, install solar energy and battery backup systems at critical facilities to ensure continuation of services if the power grid is disrupted.
- S 6.8 Maintain and continue to improve management and emergency dissemination of information using portable computers with geographic information systems (GIS) and disaster-resistant Internet access, to obtain: (AI 86)
- Hazardous Materials Disclosure Program Business Plans regarding the location and type of hazardous materials;
 - Real-time information on seismic, geologic, or flood hazards; and
 - The locations of high-occupancy, immobile populations, potentially hazardous building structures, utilities, and other lifelines.
- S 6.9 Continue to improve collaboration between public agencies, disadvantaged and vulnerable communities, and community-based organizations. (AI 82, 84)
- S 6.10 Regularly review and clarify emergency evacuation plans for dam failure, inundation, fire, and hazardous materials releases. The County shall also continue to maintain, periodically update, and test the effectiveness of the Emergency Operations Plan. (AI 104)
- S 6.11 Monitor the effectiveness of public safety, preparedness, and hazard mitigation policies under changing climate conditions to continue to protect the community as local and regional conditions change. (AI 88)

Chapter 6 **Safety Element**

- S 6.12 The County shall regularly update all appropriate planning documents, including the Safety Element, the Multi-Jurisdictional Local Hazard Mitigation Plan, emergency operations plans, and other public safety plans, and ensure these updates integrate climate change adaptation considerations.
- S 6.13 Develop a blueprint for managing evacuation plans, including allocation of buses, designation and protection of disaster routes to maximize capacity and redundancy, and creation of traffic-control contingencies. Ensure that evacuation transportation services are available for those with limited mobility or lacking access to a personal vehicle. (AI 84, 88)
- S 6.14 Adopt inundation alert and readiness levels corresponding with official forecasts by the State Office of Emergency Services, regarding earthquake prediction and potential for dam failure. (AI 83, 85, 93).

Critical Facilities and Lifelines

- S 6.15 * Strengthen the project permit and review process to ensure that proper actions are taken to reduce hazard impacts and encourage structural and nonstructural design and construction. Damage must be minimized for critical facilities, and susceptibility to structural collapse must be minimized, if not eliminated. (AI 104.2, 152, 155)
- a) Ensure that special development standards, designs, and construction practices reduce risk to tolerable levels for projects involving critical facilities, large-scale residential development, and major commercial or industrial development through conditional use permits and the subdivision review process. If appropriate, impact fees should be assessed to finance required actions.
 - b) Require mitigation measures to reduce potential damage caused by ground failure for sites determined to have potential for liquefaction to the extent feasible and appropriate. Such measures shall apply to critical facilities, utilities, and large commercial and industrial projects as a condition of project approval.
 - c) Require that planned lifeline utilities, as a condition of project approval and as feasible and appropriate, be designed, located, structurally upgraded, fit with safety shutoff valves, designed for easy maintenance, and have redundant backup lines where unstable slopes, earth cracks, active faults, or areas of liquefaction cannot be avoided.
 - d) Review proposed uses of fault setback areas closely to ensure that county infrastructure (roads, utilities, drains) are not unduly placed at risk by the developer. Insurance, bonding, or compensation plans should be used to compensate the County of Riverside for the potential costs of repair.
- S 6.16 * Promote strengthening of planned and existing utilities and lifelines, the retrofit and rehabilitation of existing weak structures, and the relocation of certain critical facilities. (AI 100, 101, 148, 152, 155, 156)
- S 6.17 * Identify critical facilities in hazard-prone areas and work to relocate or harden these facilities to reduce risk of damage and loss of service. (AI 87, 101)

- S 6.18 * Prohibit development of critical facilities that are proposed in dam failure inundation areas unless no feasible alternative exists and apply hazardous materials safety guidelines within such zones.
- S 6.19 * Coordinate with the Public Utilities Commission (PUC) and/or use the Capital Improvement Program, to strengthen, relocate, or take other appropriate measures to safeguard high-voltage lines, water, sewer, natural gas and petroleum pipelines, and trunk electrical and telephone conduits that (AI 4, 152, 155):
- Extend through areas of high liquefaction potential.
 - Cross active faults.
 - Traverse earth cracks or landslides.
- S 6.20 * Require additional design considerations as appropriate for lifelines within subsidence areas.
- S 6.21 Communicate climate risks to energy utilities and request they ensure that new and upgraded infrastructure is climate resilient. (AI 152, 155)
- S 6.22 * During the development review process, when developing alternatives and adaptation projects for consideration, the County shall require applicants to identify natural infrastructure that may be used through the conservation, preservation, or sustainable management of open space to reduce climate change hazards, where feasible.
- S 6.23 Establish a network of equitably located resilience centers throughout unincorporated Riverside County and ensure that resilience centers are situated outside of areas at risk from hazard impacts to the extent possible, offer refuge from extreme heat and extreme weather events, and are equipped with renewable energy generation and backup power supplies. Such facilities should be in easily accessible locations and be available to all community members as needed. (AI 151)
- S 6.24 Collaborate with utility companies to support and enhance grid reliability during regular operations and extreme conditions. (AI 152, 155)

Disaster Recovery Plans

- S 6.25 Develop plans for short-term and long-term post-disaster recovery. (AI 88, 103, 104.5)

Public Information and Outreach

- S 6.26 Conduct public outreach and education efforts to inform people in unincorporated Riverside County of the hazard risks, vulnerabilities, and threats in the community, and what steps community members should take to reduce their risks and provide all materials and information in both English and Spanish by default, as well as any other languages, as requested. (AI 82, 93, 94, 95, 96, 97, 98, 99, 153)
- S 6.27 Forge productive working relationships and foster good communication with researchers, other government agencies, and providers of mitigation services. (AI 93)

- S 6.28 The County shall coordinate and share data, experience, and strategies with other emergency management agencies in state or regional efforts on disaster preparedness coordination and disaster response procedures. (AI 93, 94)
- S 6.29 Maximize use of technology and the Internet to effectively distribute emergency communications and alerts to members of the public to improve resiliency. (AI 85, 93, 94, 99)
- S 6.30 Develop and maintain the County of Riverside Hazard Management website as a knowledge resource center for Riverside County officials, educators, developers, builders, and the general public. (AI 82, 93, 94, 95, 96, 97, 99)
- S 6.31 Provide information to members of the public about evacuation concerns, including designated evacuation routes and evacuation plan details, through multiple formats and in multiple languages. (AI 84, 93, 94)
- S 6.32 Work with local jurisdictions, Tribal governments, and community-based organizations to support implementation of community-identified resilience projects. (AI 82, 93, 150, 154)

Additional Climate Change-Related Hazards

Drought

Unincorporated Riverside County chronically experiences drought cycles. A drought is a long period when precipitation levels are well below normal. Based on historical information, the occurrence of drought in California, including unincorporated Riverside County, is cyclical, driven by weather patterns.

Drought can severely impact a region both physically and economically. Drought makes less water available for people, businesses, agricultural activities, and natural systems. Less snow falling in mountainous areas causes water levels in lakes and reservoirs to drop, which can affect recreation activities. Local ecosystems that are not well adapted to drought conditions can be more easily harmed by it. Droughts can also indirectly lead to more wildfires, and the stress caused by water shortages can weaken plants, making them more susceptible to pests and diseases. As of spring 2021, conditions range from “severe drought” in western and southern Riverside County to “exceptional drought” in the northeast corner of the county.

The vulnerability of unincorporated Riverside County to drought is countywide, but impacts may vary and include reduction in water supply, agricultural losses, and an increase in dry fuels. Although droughts are a regular feature of California’s climate, scientists expect that climate change will lead to more frequent and more intense droughts statewide.

Extreme Heat

Extreme heat tends to occur on an annual basis in unincorporated Riverside County. While there is no universal definition of extreme heat, California guidance documents define extreme heat as temperatures that are hotter than 98 percent of the historical high temperatures for the area, as measured between April and October of 1961 to 1990. Days that reach this level (an average of 106-degrees Fahrenheit (°F) across all of unincorporated Riverside County, although this threshold varies by location) are called extreme heat days. Extreme heat is any period of time when the temperatures are well above the usual level.

Health impacts are the primary concern with this hazard, though economic impacts are also an issue. The Centers for Disease Control and Prevention (CDC) recognizes extreme heat as a substantial public health concern. Extreme heat events are dangerous because people exposed to extreme heat can suffer a number of heat-related illnesses, including heat cramps, heat exhaustion, and (most severely) heat stroke. Very high temperatures can harm plants and animals that are not well adapted to them. This includes wild ecosystems as well as farm crops and livestock. Extreme heat is expected to have a severe effect on agriculture. Indirectly, extreme heat puts more stress on power lines, causing them to run less efficiently. The heat also causes more demand for electricity (usually to run air conditioning units), and in combination with the stress on the power lines, may lead to brownouts and blackouts.

While extreme heat is relative to the area, extreme heat events may occur anywhere in unincorporated Riverside County. However, the threshold for extreme heat is likely to be lower in the higher elevations of the San Jacinto Mountains than in Coachella Valley where temperatures at or above 90°F are common most summer days. The warmer temperatures brought on by climate change are likely to cause an increase in extreme heat events in different regions of unincorporated Riverside County. According to the California Energy Commission, the number of extreme heat days is projected to, where the average year could include approximately 25 to 35 extreme heat days between 2041 and 2060, and 40 to over 60 extreme heat days per year between 2070 and 2099. Overall, unincorporated Riverside County is expected to see an increase in the average daily high temperatures.

Severe Weather

Severe weather is generally any destructive weather event, but usually occurs in unincorporated Riverside County as localized storms that bring heavy rain, hail, lightning, and strong winds. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences. High winds, often accompanying severe storms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Santa Ana winds have caused large amounts of damage and increased the fire damage level dramatically. All wind events, including Santa Ana winds, pose several different types of threats. By themselves, the winds pose a threat to the health of people and structures in the county. Severe weather is an annual occurrence in unincorporated Riverside County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future.

Climate change is expected to cause an increase in intense rainfall, which is usually associated with strong storm systems. This means that unincorporated Riverside County could see more intense storms in the coming years and decades, possibly causing an increase in the frequency of severe weather events and any associated hazards. Such an increase may not affect all forms of severe weather and may not always be apparent.

Agricultural Hazards

Agriculture in unincorporated Riverside County must be considered from two standpoints, namely, both as a product producer/exporter and a major economic provider to the County of Riverside. In 2019, Riverside County ranked in the top 14 leading agricultural counties in California, with an agricultural production value of \$1.32 billion, according to the California Department of Food and Agriculture. Major agricultural industries include milk, nursery products, citrus, avocado, grapes, vegetables, and hay.

According to the Hazard Mitigation Planning Committee, agricultural losses occur on an annual basis and are usually associated with severe weather events, including heavy rains, floods, heat, and drought. The 2018 State of California Multi-Hazard Mitigation Plan attributes most of the agricultural disasters statewide to drought, freeze, and insect infestations. Other agricultural hazards include fires, crop and livestock disease, and noxious weeds. As long as severe weather and other natural hazard events continue to be an ongoing concern to unincorporated Riverside County, the potential for agricultural losses remains.

Extreme heat is expected to have the most severe effect on unincorporated Riverside County's agricultural assets, but drought, flooding, and severe weather may also cause significant harm. One of the most direct effects of climate change is that average temperatures will increase, and this has a bearing on many pests and diseases. Temperatures are expected to get warmer earlier in the year and remain warmer until later in the year due to climate change, creating a wider window for pests and diseases to be active. Moreover, excessive heat and prolonged dry or drought conditions can impact agriculture by creating worker safety issues for farm field workers, severely damaging crops, and reducing availability of water and food supply for livestock.

Policies

The following policies address drought, extreme heat, severe weather and agriculture hazards. These policies are intended to minimize the impact of climate change-related hazards on Riverside County's citizens, property, and economy through collaboration and coordination with agencies local and state agencies, and implementation of resilient strategies. Policies with an asterisk next to them (*) are those that apply to development projects.

- S 7.1 Collaborate with local governments and special districts in Riverside County as well as with Inland Southern California Climate Collaborative to develop and implement regional climate change adaptation and resilience initiatives. (AI 88, 149)
- S 7.2 Support the Resilient IE project to foster increased community resilience to climate-related hazards in unincorporated Riverside County and across the wider region. Incorporate the Resilient IE project files, including the Western Riverside County Vulnerability Assessment, the Western Riverside County Adaptation Strategies, and the WRCOG Subregion Hazard and Evacuation Maps, into this Safety Element by reference. (AI 91, 149, 153)
- S 7.3 Use the reported data and findings of applicable local, regional, or state documents or plans pertaining to climate change and climate-related hazards that could impact unincorporated Riverside County, including the California Climate Change Assessment, the California Adaptation Planning Guide, and the Safeguarding California plan. (AI 149)
- S 7.4 Prepare for a reduced, long-term water supply resulting from more frequent and severe drought events, including working with regional water providers to implement extensive water conservation measures and ensure sustainable water supplies.
- S 7.5 Coordinate with water agencies and irrigation districts to explore ways to improve and increase storage capacity and generation efficiency.
- S 7.6 Work with healthcare providers, including the Riverside University Health System to support free or reduced-cost vaccinations for vector-borne diseases that are widely available for unincorporated Riverside County residents, including to traditionally underserved communities.
- S 7.7 Coordinate with local governments, school districts, and regional transit providers to increase shading and heat-mitigating materials on pedestrian walkways, transit stops, parks, schools, and outdoor gathering places.
- S 7.8 Ensure that unhoused persons or groups in unincorporated Riverside County have access to temporary and/or emergency housing, food, and other essential living materials to keep them safe during anticipated hazard events.

- S 7.9 * Encourage new developments and existing property owners to incorporate sustainable, energy-efficient, and environmentally regenerative features into their facilities, landscapes, and structures to reduce energy demands and improve on-site resilience. Support financing efforts to increase community access to these features. (AI 88, 153)
- S 7.10 Ensure that lower-income households have access to low-cost programs (e.g., subsidies for National Flood Insurance Program participation, air-conditioning, low-cost healthcare) to protect their homes and wellbeing from climate-related hazards.
- S 7.11 * Promote and expand the use of drought-tolerant green infrastructure, including street trees and landscaped areas, as part of cooling strategies in public and private spaces. (AI 4)
- S 7.12 Use natural resources and infrastructure to absorb the impacts of climate change and associated natural hazards, as feasible.
- S 7.13 Work with regional educational and farming organizations to support efforts to develop and share best practices for improving climate resiliency in agricultural operations, including responding to changing temperature and precipitation patterns, increases in drought events, and new or more active pest regimes. (AI 153)
- S 7.14 Ensure that workers in outdoor industries have the training and resources to be adequately protected from environmental hazards, including extreme heat, poor air quality, and diseases. (AI 153)
- S 7.15 * Encourage the use of high-reflectivity pavement in new or significantly retrofitted large-scale paving projects, such as parking lots.

3. Technical Background Information

Seismic and Geologic Hazards

Seismic and geologic hazards are risks caused by the movement of different parts of the Earth's crust, or surface. Seismic hazards include earthquakes and hazardous events caused by them. Geologic hazards are other hazards involving land movements that are not linked to seismic activity and are capable of inflicting harm to people or property.

Seismic Hazards

Seismic activity occurs along boundaries in the Earth's crust, called faults. Pressure along the fault builds over time and is ultimately released, resulting in ground shaking that we refer to as an earthquake. Earthquakes can also trigger other hazards, including surface rupture (cracks in the ground surface), liquefaction (causing loose soil to lose its strength), landslides, and subsidence (sinking of the ground surface). Earthquakes and other seismic hazards often damage or destroy property and public infrastructure, and falling objects or structures pose a risk of injury or death.

While unincorporated Riverside County is at risk from many natural and human-caused hazards, the event with the greatest potential for loss of life or property and economic damage is an earthquake. This is true for most of Southern California, since damaging earthquakes affect widespread areas, trigger many secondary effects, and can overwhelm the ability of local jurisdictions to respond. In unincorporated Riverside County, earthquake-triggered effects include ground shaking, fault rupture, landslides, liquefaction, subsidence, and seiches. Earthquakes can also cause human-caused hazards such as urban fires, dam failures, and toxic chemical releases.

Earthquake risk is very high in the most heavily populated western portion of the county and the Coachella Valley, due to the presence of two of California's most active faults, the San Andreas and San Jacinto Faults. Risk is moderate in the eastern portion of the county beyond the Coachella Valley due to the lack of major faults in this region. Most of the loss of life and injuries from earthquakes are due to damage and collapse of buildings and structures. Building codes for new construction have generally been made more stringent following damaging earthquakes. However, in the County of Riverside, structures built prior to the enactment of these improved building codes have generally not been upgraded to current standards and are vulnerable in earthquakes. Comprehensive hazard mitigation programs that include the identification and mapping of hazards, prudent planning and enforcement of building codes, and expedient retrofitting and rehabilitation of weak structures can significantly reduce the scope of an earthquake disaster.

Unincorporated Riverside County contains parts of several known active and potentially active earthquake faults, including the San Andreas Fault, San Jacinto Fault, and Elsinore Fault. The San Andreas Fault, the largest fault in California, runs from the Salton Sea north along the east side of the Coachella Valley, continuing north along the Transverse and Coast Ranges until running offshore in Mendocino County. The San Jacinto Fault runs from the Imperial Valley northwest through western Riverside County until it ends at the Cajon Pass. The Elsinore Fault zone extends from western Imperial County to the Chino Hills, and runs along Riverside County's western border with Orange County. Historically, the San Andreas Fault is the most active among the fault network that cuts through rocks of the California coastal region. The San Jacinto Fault has had a higher level of moderate to large earthquakes during the past 50 to 100 years, although the rate of slip is not as high. The main trace of the Elsinore Fault zone has only seen one historical event greater than magnitude 5.2 – the earthquake of 1910, a magnitude 6 near Temescal Valley.

In the event of an earthquake, the location of the epicenter, as well as the time of day and season of the year, would have a profound effect on the number of deaths and casualties, as well as property damage. There are a number of small-scale earthquakes that happen weekly, but larger scale or catastrophe shaking is less likely. Unincorporated Riverside County is at risk for a significant earthquake causing catastrophic damage and strains on response and mitigation resources. Both property and human life are at high risk. The county experiences hundreds of minor quakes and tremblers each month from the myriad of faults in the area. Studies indicate that stress is building up in major faults like the San Andreas.

The San Andreas, San Jacinto, and Elsinore Faults are all capable of producing significant earthquakes, with a magnitude of 6.7 or greater. Table 1 shows the chances of a major earthquake on these three faults within unincorporated Riverside County by 2045, according to the Third California Earthquake Rupture Forecast. Other faults, both in and outside unincorporated Riverside County, may also be capable of generating significant earthquakes with damaging effects in the county.

Table 1: Chances of Significant Earthquakes on Major Riverside County Faults

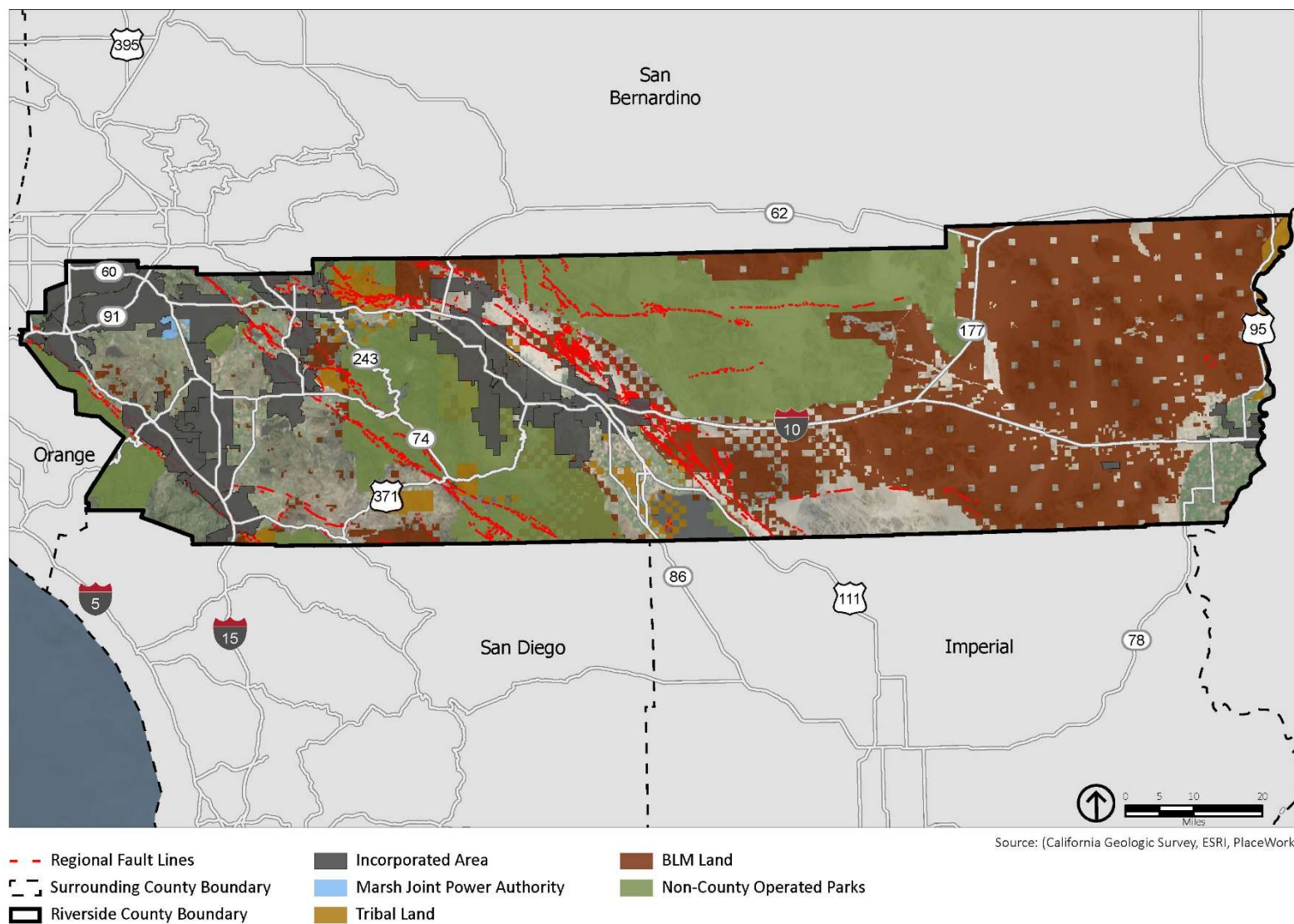
Fault	Mean Chance by 2045			
	Magnitude 6.7 or greater	Magnitude 7.0 or greater	Magnitude 7.5 or greater	Magnitude 8.0 or greater
SAN ANDREAS	24.21%	21.29%	11.62%	3.15%
SAN JACINTO	6.71%	6.43%	5.29%	2.75%
ELSINORE	3.66%	1.82%	0.95%	Less than 0.01%

Chances shown are the maximum mean probability for segments of these faults within unincorporated Riverside County.

Source: Third California Earthquake Rupture Forecast

Figure 1 shows the fault lines in and around unincorporated Riverside County.

FIGURE 1: FAULT LINES



Portions of the county are susceptible to liquefaction, which is a potentially destructive secondary effect of strong seismic shaking. Liquefaction occurs primarily in saturated, loose, fine- to medium-grained soils in areas where the groundwater table is within approximately 50 feet of the surface. Shaking causes the soils to lose strength and behave as liquid. Excess water pressure is vented upward through fissures and soil cracks and can result in a water-soil slurry flowing onto the ground surface. Liquefaction-related effects include loss of bearing strength, ground oscillations, lateral spreading, and flow failures or slumping. Site-specific geotechnical studies are the only practical and reliable way of determining the specific liquefaction potential of a site; however, a determination of general risk potential can be provided based on soil type and depth of groundwater. Areas identified as susceptible to liquefaction are identified on Figure 2.

Areas are susceptible to liquefaction based on a combination of known factors in some areas and the absence of known factors in other areas. In addition, these potential hazard zones are not an absolute indication that the hazard truly exists nor are they an indicator of the extent of damage that may or may not occur at a given site. Research confirms there is a potential for liquefaction to occur; however, this research also confirms minimal liquefaction-induced ground settlement is anticipated to occur for the areas that were studied. In most cases, proper design and construction of subgrade soils and building foundations provides a mechanism to mitigate the risk of seismic hazard to an acceptable level in conformance with the California Building Code. Development in areas of high risk may need additional safety features to appropriately mitigate the risk of seismic hazards. The representation of areas having a liquefaction potential is only intended as notification to seek further site-specific information and analysis of this potential hazard as part of future site development. It should not be solely relied upon, without site-specific information and analysis, for design or decision-making purposes.

Geologic Hazards

Geologic hazards, such as landslides and erosion, depend on the geologic composition of the area. Landslides and rock falls may occur on sloped areas, especially areas with steep slopes, and usually in areas of loose and fragmented soil. Landslides, rockfalls, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, often with disastrous results. They often occur as a consequence of seismic activity or heavy rainfall, either of which may cause slopes to lose their structural integrity and slide. There are predictable relationships between local geology and landslides, rockfalls, and debris flows. Slope stability is dependent on many factors and their interrelationships, including rock type, pore water pressure, slope steepness, and natural or human-made undercutting. Figure 3 shows the landslide risk in and around unincorporated Riverside County.

Subsidence refers to the sudden sinking or gradual downward settling and compaction of soil and other surface material with little or no horizontal motion. It may be caused by a variety of human and natural activities, including earthquakes and water saturation.

FIGURE 2: LIQUEFACTION ZONES

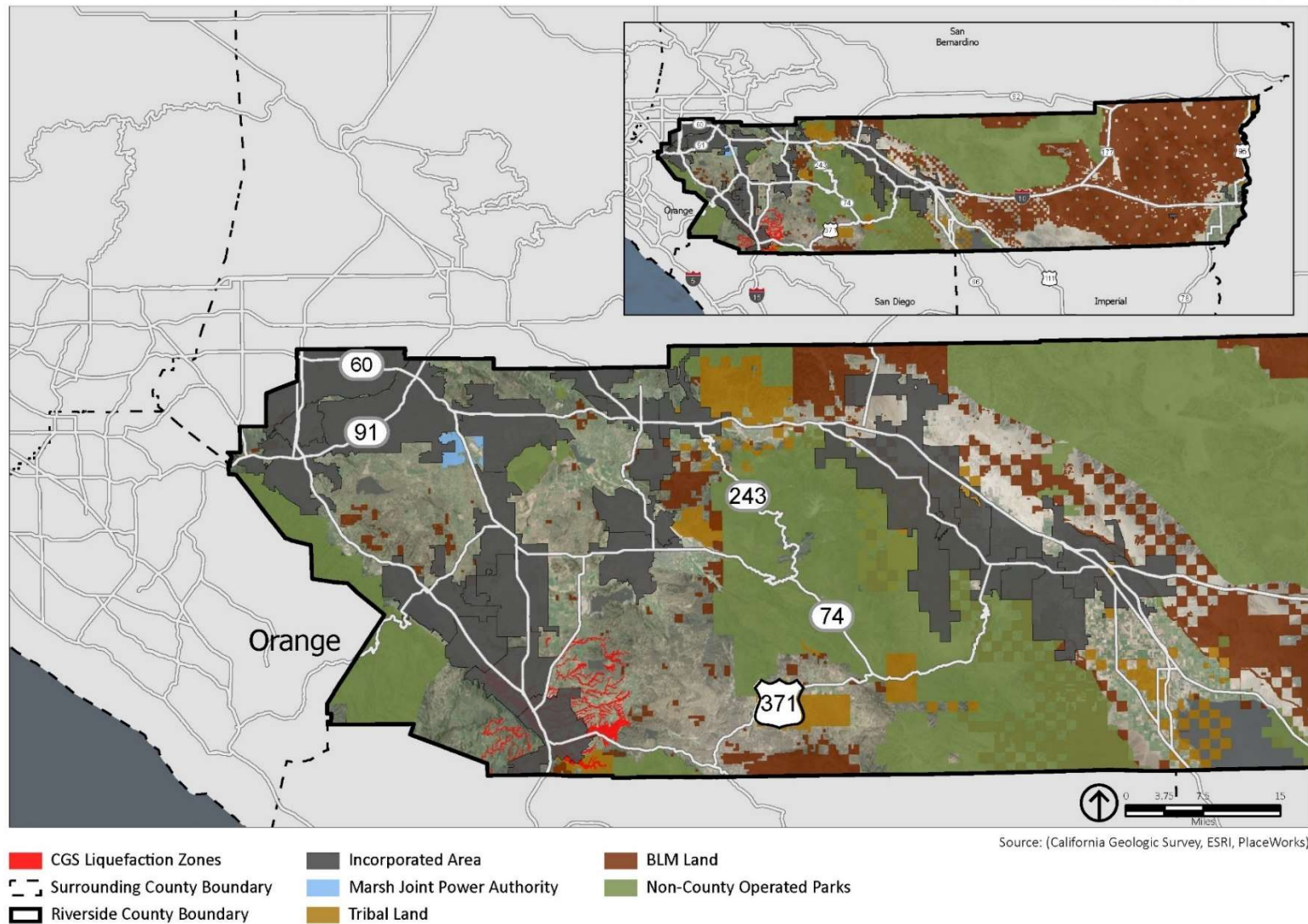
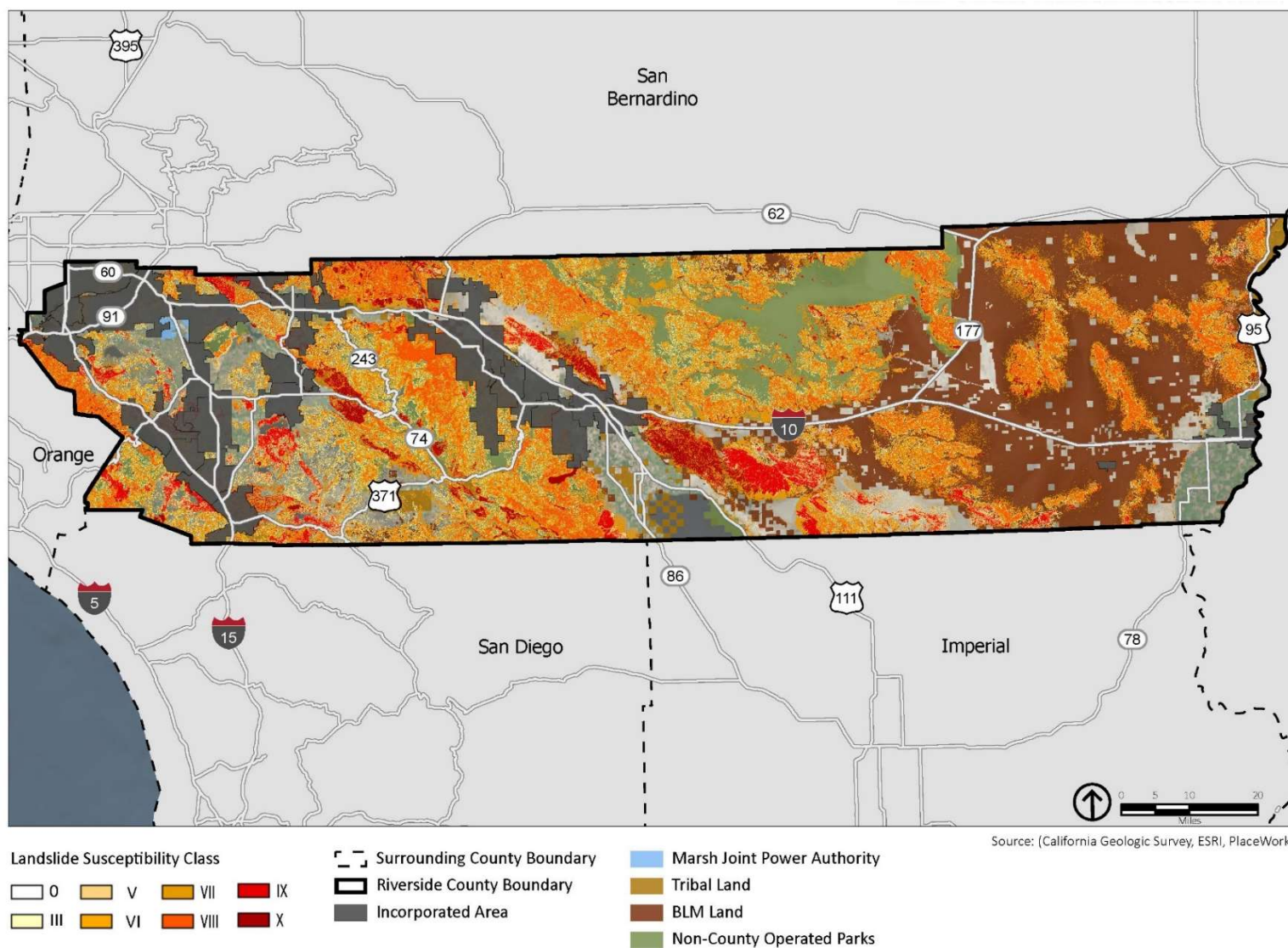


FIGURE 3: LANDSLIDE RISK



Expansive soils have a significant amount of clay particles that can give up water (shrink) or take on water (swell). The change in volume exerts stress on buildings and other loads placed on these soils. The occurrence of these soils is often associated with geologic units having marginal stability. Expansive soils can be widely dispersed and can be found in hillside areas as well as low-lying alluvial basins. Expansive soils are now routinely alleviated through the Riverside County's implementation of the Building Code. Expansive soils are not the only cause of structural distress in existing structures. Poor compaction and construction practices, settlement, and landslides can cause similar damage, but require different mediation efforts. Once expansion has been verified as the source of the problem, mitigation can be achieved through reinforcement of the existing foundation, or alternatively, through the excavation and removal of expansive soils in an affected area.

Hydroconsolidation, or soil collapse, typically occurs in recently deposited, Holocene (less than 10,000 years old) soils that were deposited in an arid or semi-arid environment. Soils prone to collapse are commonly associated with human-made fill, wind-laid sands and silts, and alluvial fan and mudflow sediments deposited during flash floods. When saturated, collapsible soils undergo a rearrangement of their grains, and the water removes the cohesive (or cementing) material. Rapid, substantial settlement results. An increase in surface water infiltration, such as from irrigation, or a rise in the groundwater table, combined with the weight of a building or structure, can initiate settlement and cause foundations and walls to crack.

Wind erosion is a serious environmental problem attracting global attention. Soil movement is initiated as a result of wind forces exerted against the surface of the ground. Dust particles in the air create major health problems. Atmospheric dust causes respiratory discomfort, may carry pathogens that cause eye infections and skin disorders, and reduces highway and air traffic visibility. Dust storms can cause additional problems; buildings, fences, roads, crops, trees, and shrubs can all be damaged by abrasive blowing soil.

Landslide Management Zones (LMZs) are County-designated areas that identify regions susceptible to slope instability. This instability can include deep-seated landslides, rockfalls, soil slumps, and debris flows. Without the presence of extensive flood-control devices, including large debris basins, the areas outlined by an LMZ may be subject to debris flow inundation. Most often, debris flow inundation results in roadways and improvements blocked by boulders. Rarely do debris-flow-generating storms affect the entire county. However, most of the area within potential LMZs of County of Riverside are designated for open space or rural development.

Land subsidence and related issues have been well-documented in unincorporated Riverside County. Most of the early documented cases of subsidence affected only agricultural land or open space. As urban areas have expanded, so too have the impacts of subsidence on structures for human occupancy. Ground subsidence and associated fissuring in unincorporated Riverside County have resulted from both falling and rising groundwater tables. In addition, many fissures have occurred along active faults that bound the San Jacinto Valley and the Elsinore Trough. Subsidence typically occurs throughout a susceptible valley. In addition, differential displacement and fissures occur at or near the valley margin, and along faults. In the County of Riverside, the worst damage to structures as a result of regional subsidence may be expected at the valley margins. Alluvial valley regions are especially susceptible.

In unincorporated Riverside County, collapsible soils occur predominantly at the base of the mountains, where Holocene-age alluvial fan and wash sediments have been deposited during rapid runoff events. In addition, some windblown sands may be vulnerable to collapse. Typically, differential settlement of structures occurs when lawns or plantings are heavily irrigated in close proximity to the structure's foundation. Forensic indications of collapsible soils include tilting or sagging floors, cracking or separation of structures, and windows and doors that cannot open due to shifts in the building.

Wind and wind-blown sand are an environmentally-limiting factor throughout much of unincorporated Riverside County. Approximately 20 percent of the land area of Riverside County is vulnerable to “high” and “very high” wind erosion susceptibility. The Coachella Valley, the Santa Ana River Channel in northwestern Riverside County, and areas in and around the cities of Hemet and San Jacinto are zones of high wind erosion susceptibility.

Wind-blown sand is a well-recognized hazard for developments in the Coachella Valley. It has forced abandonment of dwellings and subdivided tracts in the central Coachella Valley. The primary source of sand here is the Whitewater River. Increases in the amount of wind-blown sand are related to episodic flooding of the Whitewater River. A 15-fold increase in wind erosion rates in this area has been noted following heavy flood events. Therefore, mitigation of wind-blown sand is directly related to mitigation of flood potential on the Whitewater River. Efforts to control the wind, using hedges and other barriers, may not be effective in mitigating wind erosion. However, the Whitewater River provides a large component of sand to sustain the dune fields, which is home to several endangered species. Erosion intervention has had serious and unforeseen consequences in many places, so any proposed mitigation program should be approached carefully, with an extended period of preparatory study.

Potential Changes to Seismic and Geologic Risk in Future Years

Likelihood of Future Occurrence

Seismic Risk

Earthquakes are likely to continue to occur on an occasional basis and are likely to be small. They may cause no substantive damage and may not even be felt by most people. Major earthquakes are rare, but a possibility in the region, as in other areas of the state. No major earthquakes have been recorded with epicenters within the county since the 1910 Elsinore earthquake, although the county has felt ground shaking from earthquakes with epicenters located elsewhere. Large earthquakes from faults such as the San Andreas Fault may cause significant damage to homes, businesses, and communities in the county. Based on historical data and the location of unincorporated Riverside County relative to active and potentially active faults, the Uniform California Earthquake Rupture Forecast projects that southern California has a 93 percent chance of a significantly damaging earthquake (magnitude 6.7 or higher) by 2044.

If serious shaking does occur, newer construction is in general more earthquake resistant than older construction because of improved building codes. Older manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Earthquake losses would vary across unincorporated Riverside County depending on the source and magnitude of the event.

Geologic Risk

Minor landslides have occurred in the past, probably over the last several hundred years, evidenced by both past deposits exposed in erosion gullies and recent landslide events. Unincorporated Riverside County has a history of landslides during seasons of high precipitation. With significant rainfall, additional failures are likely in the identified landslide hazard areas, minor landslides will likely continue to impact the area when heavy precipitation occurs, as they have in the past. In addition, areas affected by recent fires show an increased landslide risk.

Climate Change and Seismic and Seismic Hazards

While climate change is unlikely to increase earthquake frequency or strength, the threats from other seismic and geologic hazards are expected to continue. Climate change may cause precipitation extremes (i.e., wetter wet periods and drier dry periods). While total average annual rainfall may not change significantly, rainfall may be concentrated in more intense precipitation events. Heavy rainfall could cause an increase in the number of landslides or make landslides larger than normal. Increased wildfire frequency can destabilize hillsides due to loss of vegetation and change soil composition, which can contribute to greater runoff and erosion. The combination of a generally drier climate in the future, which will increase the chance of drought and wildfires, and the occasional extreme downpour, is likely to cause more mudslides and landslides. Impacts from these conditions would compound landslide potential for the most susceptible locations.

Flood and Inundation Hazards

Flooding is the rising and overflowing of a body of water onto normally dry land. History highlights floods as one of the most frequent natural hazards impacting communities in unincorporated Riverside County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities, as well as life-safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. Floodwaters can transport large objects downstream, which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits.

Floods are usually caused by large amounts of precipitation, either from a period of very intense precipitation or a long period of steady precipitation. Historically, unincorporated Riverside County has been at risk of flooding primarily during the spring months when stream systems in the county swell with heavy rainfall. Flooding susceptibility in unincorporated Riverside County is primarily associated with several major stream drainages, including, but not limited to, the Santa Ana, San Jacinto and Whitewater Rivers, as well as smaller-scale and flash flood events on many of the alluvial fans that flank unincorporated Riverside County's hillsides.

Flash flooding is a common problem, especially in the Coachella Valley and the easterly portions of the county. Flash flooding is typically associated with short duration, high-intensity precipitation events often during summer thunderstorms. Such events can occur even during a drought. Localized flooding also occurs throughout unincorporated Riverside County at various times throughout the year with several areas of primary concern unique to each city. Historically, precipitation in and around unincorporated Riverside County has been low to moderate. Precipitation in the county area falls mainly in the fall, winter, and spring months, from November through April.

Although unincorporated Riverside County occasionally experiences periods of significant drought, the county can also experience periods of substantial rainfall. When unincorporated Riverside County does experience heavy rain, or rain over a period of days or weeks, many areas of the county are subject to flooding. Runoff from rain drains either naturally into rivers, washes, and creeks, or into flood-control facilities.

Unincorporated Riverside County has several major river systems, dams, and reservoirs. Excessive rainfall can stress these systems, causing serious damage to property and potential loss of life. Rivers can overflow their banks, destroying bridges and washing out roads and highways during major flood events.

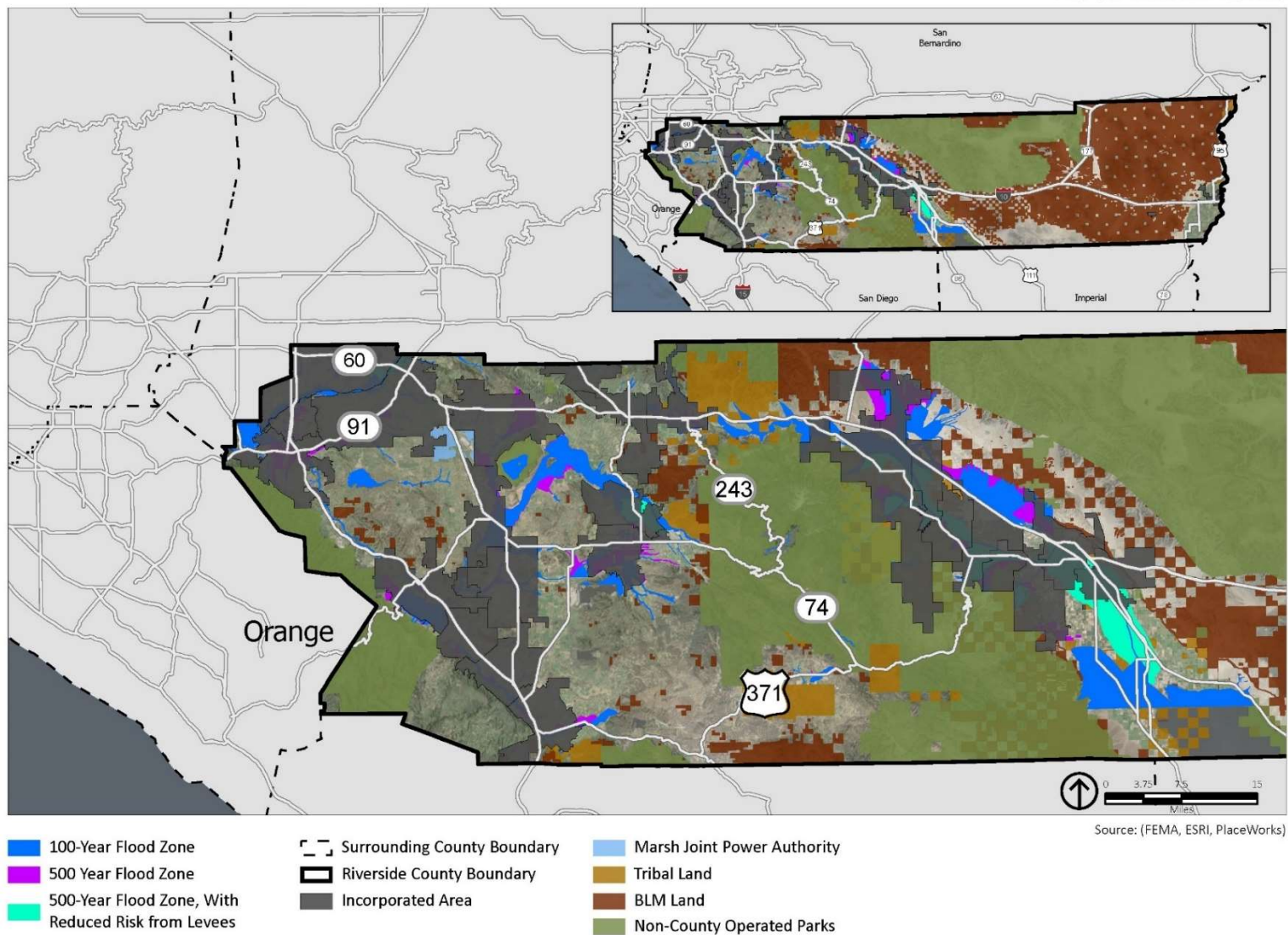
Areas at an elevated risk of flooding are generally divided into 100- and 500-year flood zones. A 100-year flood zone has a 1-percent chance of experiencing a major flood in any given year; a 200-year flood zone has a 0.5-percent

chance of flooding in any given year, a 500-year flood zone has a 0.2-percent chance of flooding in any given year. Figure 4 shows the 100- and 500-year flood zones in unincorporated Riverside County.

Agencies responsible for flood control in Riverside County include the County's Flood Control and Water Conservation District (RCFWCD), the United States Army Corps of Engineers (USACE), the Federal Emergency Management Agency (FEMA), the Federal Insurance Administration (FIA), and the Department of Water Resources (DWR).

- **RCFWCD:** RCFWCD is the regional flood management authority for the western part of Riverside County. RCFWCD provides the following: identification of flood hazards and problems; regulation of floodplains and development; regulation of drainage and development; county watercourse and drainage planning; education for flood prevention and safety; construction of flood control structures and facilities; flood warning and early detection; maintenance and operation of completed structures.
- **USACE:** The USACE identifies the need for and constructs major flood-control facilities. It also develops flood and dam inundation maps and reports.
- **FEMA:** FEMA manages the National Flood Insurance Program (NFIP), providing insurance to the public in communities that participate in the program. FEMA is the main federal government agency contact during natural disasters and publishes the Flood Insurance Rate Maps (FIRM), which identify the extent of flood potential in flood-prone communities based on a 100-year flood (or base flood) event.
- **FIA:** The FIA is the primary agency that delineates potential flood hazard areas and floodways through the FIRMs and the Flood Boundary and Floodway Map. Flood insurance is required of all homeowners who have federally subsidized loans.
- **DWR:** DWR is responsible for managing and protecting California's water. DWR works with other agencies to benefit the state's people, and to protect, restore, and enhance the natural and human environments. DWR also works to prevent and respond to floods, droughts, and catastrophic events that would threaten public safety, water resources and management systems, the environment, and property.

FIGURE 4: FLOOD HAZARD ZONE



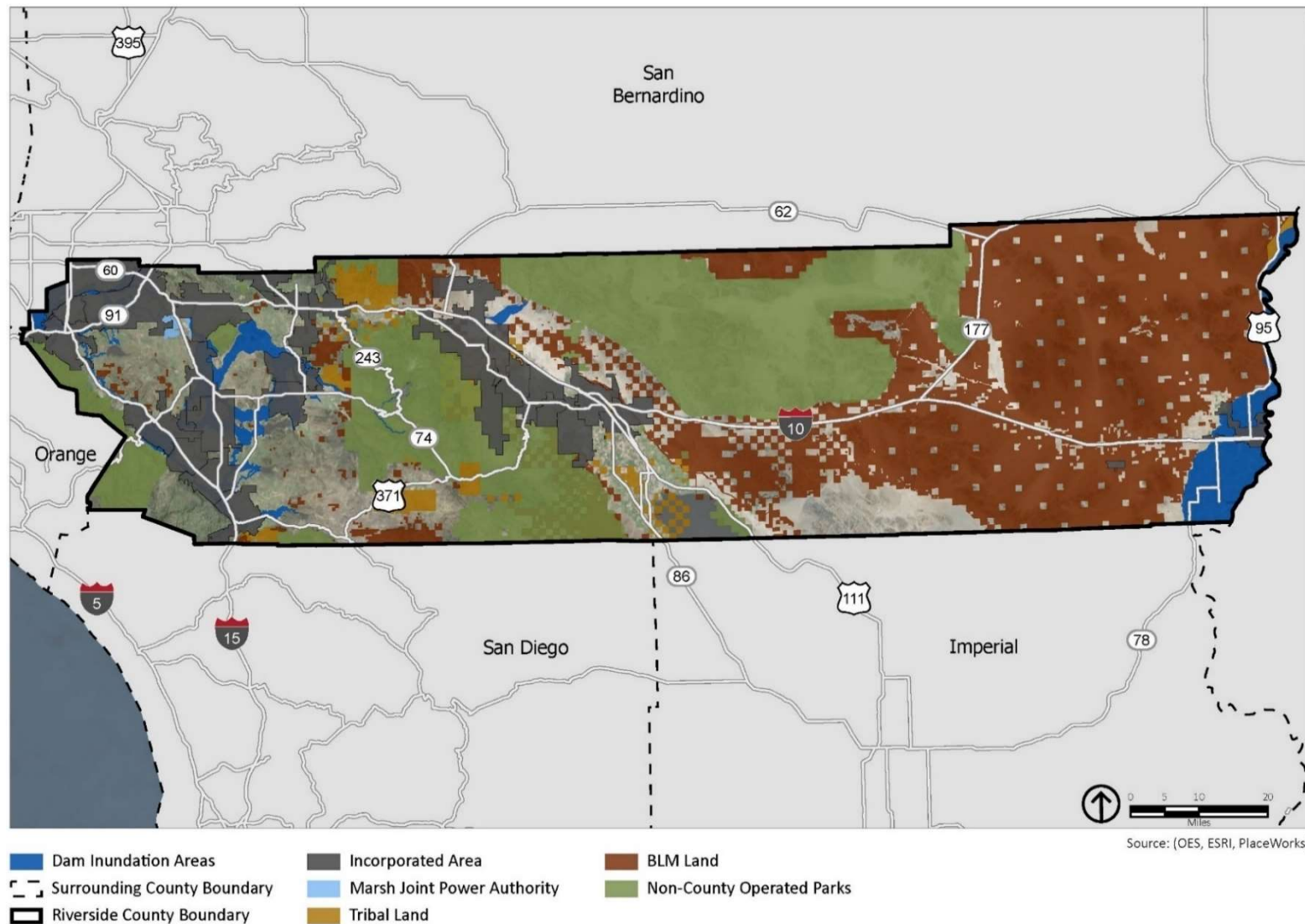
Dam failure also poses a risk to unincorporated Riverside County. Dam break floods are usually associated with intense rainfall or prolonged flood conditions. A dam failure is an uncontrolled release of water from a reservoir through a dam as a result of structural failures or deficiencies in the dam. Dam failures can range from fairly minor to catastrophic and can potentially harm human life and property downstream from the failure. In addition, ecosystems and habitats are destroyed as a result of waters flooding them. Although dam failures are very rare, these events are not unprecedented. Additionally, the older that dams get, the more potential exists for catastrophic dam failures. There are four major causes of dam failures, which include the following:

- **Overtopping:** These failures occur as a result of poor spillway design, leading to a reservoir filling too high with water, especially in times of heavy rainfall. Other causes of this type of failure include settling of the crest of the dam or spillway blockage.
- **Foundation defects:** These failures occur as a result of settling in the foundation of the dam, instability of slopes surrounding the dam, uplift pressures, and seepage around the foundation. All of these failures result in structural instability and potential dam failure.
- **Piping and seepage failures:** These failures occur as a result of internal erosion caused by seepage and erosion along hydraulic structures such as the spillways. As well, erosion as a result of animal burrows and cracks in the dam structure contribute to these failures.
- **Conduit and valve failure:** These failures occur as a result of problems with valves and conduits.

Other dam failures arise as a result of other miscellaneous causes. Many dam failures are also the secondary result of other natural disasters, such as earthquakes, landslides, extreme storms, or heavy snow-melt. Other causes include equipment malfunction, structural damage, and sabotage.

In unincorporated Riverside County, a major earthquake could cause a dam failure. Dams are constructed with safety features known as “spillways” that allow water to overtop the dam if the reservoir fills too quickly. Spillway overflow events, often referred to as “design failures,” result in increased discharges downstream and increased flooding potential. In a dam failure scenario, the greatest threat to life and property typically occurs in those areas immediately below the dam since flood depths and discharges generally decrease as the flood wave moves downstream. The primary danger associated with dam failure is the high-velocity flooding downstream of the dam and limited warning times for evacuation. The Mathews Dam, Robert A. Skinner Dam, and Railroad Canyon Dam present an extremely high downstream hazard to the communities of Home Gardens, French Valley, and Lakeland Village, respectively. Figure 5 identifies the areas at risk from dam failure. Both earthquake faults and developments reduce the total ground absorption area. Earthquake faults include bedrock features that create barriers to subsurface percolation, thus increasing the velocity and erosive capacity of stormwater runoff on hillsides. Development also creates impermeable surfaces (e.g., structures, pavement, streets). Storm runoff is augmented by water flows from development contributing to street flooding. Moreover, developed areas generate irrigation water runoff from landscaping, which may channel stormwater and other runoff flows into nearby underdeveloped areas and street gutters, increasing the possibility of flood events.

FIGURE 5: DAM HAZARD INUNDATION



Potential Changes to Flood Risk in Future Years

Likelihood of Future Occurrence

Flooding is a significant problem in unincorporated Riverside County. Historically, unincorporated Riverside County has been at risk to flooding primarily during the winter and spring months when river systems in the county swell with heavy rainfall runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood-control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 100- and 500-year floodplains and in other localized areas. As land uses and climate conditions shift and as improvements are made to flood-control channels, the size of these flood zones is likely to change.

Historically, much of the development in the county has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Climate Change and Flooding

Floods are among the most damaging natural hazards in unincorporated Riverside County, and climate change is expected to make flood events worse. Although climate change may not change average precipitation levels significantly, scientists expect that it will cause more years with extreme precipitation events. This means that more years are likely to see particularly intense storm systems that drop enough precipitation over a short enough period to cause flooding. Although Southern California is likely to experience a decrease in overall precipitation levels from climate change, the region is also expected to see an increase in the number of extreme precipitation events. A meteorological phenomenon known as the “atmospheric river,” a narrow stream of extremely moist air, is frequently responsible for the more intense storms that strike California. Atmospheric rivers generally deliver high levels of precipitation, up to 50 percent of the state’s total precipitation in any given year.

Because of this, floods are expected to occur more often in and around unincorporated Riverside County and climate change may expand the parts of the county that are considered flood-prone. Although there are no specific flooding projections for the county, flood events are expected to become more frequent, and it is possible that the areas subject to flooding will expand.

There are some indirect effects of climate change that may also increase flooding in unincorporated Riverside County. Climate change is expected to increase the frequency and severity of droughts that cause soil to dry out and become hard. When precipitation does return, more water runs off the surface rather than being absorbed into the ground, which can lead to floods. Wildfires, which are also expected to become more frequent due to climate change, cause a similar effect by baking the surface of the ground into a harder and less--penetrable layer. Trees and other vegetation help slow water down, which lets the water absorb into the soil and prevents it from turning into runoff. Because of this, the loss of trees and other plants from wildfires, pests, diseases, or other climate-related exposures can also increase flooding risk.

While the risk and associated short-and long-term impacts of climate change are uncertain, experts in this field tend to agree that among the most significant impacts include those resulting from increased heat and precipitation events that cause increased frequency and magnitude of flooding. Changes associated with climate change and flooding could be significant given the higher elevations in the county where winter snow could turn to more significant rain events. Increases in damaging flood events will cause greater property damage, public health and safety concerns, displacement, and loss of life. In addition, an increase in the magnitude and severity of flood events can lead to potential contamination of potable water and contamination of food crops given the agricultural industry in the county. Displacement of residents can include both temporary and long-term displacement, increase in insurance rates, or restriction of insurance coverage in vulnerable areas.

Fire Hazards

Fire hazards can come in the form of both wildfires and urban fires. California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires. Wildfire is an ongoing concern for communities in unincorporated Riverside County. Generally, the fire season extends from early spring through late fall of each year during the hotter, dryer months. Fire conditions arise from a combination of high temperatures, low-moisture content in the air and plant matter, an accumulation of vegetation, and high winds.

Three types of fires are of concern to unincorporated Riverside County: (1) wildfires, (2) wildland-urban interface fires, and (3) structural fires.

Wildfires

Wildfires occur on mountains, hillsides, and grasslands. Vegetation, wind, temperature, humidity, and slope are all factors that affect how these fires spread. In unincorporated Riverside County, native vegetation, such as chaparral, sage, and grassland provide fuel that allows fire to spread easily across large tracts of land. These plant species are capable of regeneration after a fire, making periodic wildfires a natural part of the ecology of these areas. A significant portion of the county is undeveloped and consists of rugged topography with highly flammable vegetation. In particular, the hillside terrain of unincorporated Riverside County has a substantial fire risk. Fire potential for unincorporated Riverside County is typically greatest in the months of August, September, and October, when dry vegetation coexists with hot, dry Santa Ana winds. However, in unincorporated Riverside County, fires with conflagration potential can occur at any time of the year. Seasonal drought conditions exacerbate fire hazards.

Wildland-Urban Interface Fires

The wildland-urban interface is an area where buildings and infrastructure (e.g., cell towers, schools, water supply facilities) mix with areas of flammable wildland vegetation. This interface is sometimes divided into the defense zone (areas in close proximity to communities, usually about a quarter mile thick) and threat zones (an approximately one-and-a-quarter-mile buffer around the defense zone). Hundreds of homes now border major forests and brush areas. With thousands of people living near and visiting wildland areas, the probability of human-caused fires is growing. The Idyllwild area in the San Jacinto Mountains is a heavily forested area that faces a high wildfire hazard risk.

In the wildland-urban interface, efforts to prevent ignitions and limit wildfire losses hinge on hardening structures and creating defensible space through a multi-faceted approach, which includes engineering, enforcement, education, emergency response, and economic incentive. Different strategies in the defense and threat zones of the wildland-urban interface help to limit the spread of fire and reduce the risk to people and property.

Wildfire threat within the county ranges from moderate to very high. Figure 6 shows the wildfire risk zones in unincorporated Riverside County, Figure 7 shows the risk zones in western Riverside County along with the locations of key emergency service facilities, and Figure 8 identifies the wildland-urban interface. The highest threat occurs in Western Riverside County, especially along the San Jacinto Mountains. A majority of this region is considered a Very High Fire Hazard Severity Zone, the Little San Bernardino Mountains northeast of the Coachella Valley have hazard severity zones ranging from Moderate to Very High, and Eastern Riverside County is considered a Moderate Fire Hazard Severity Zone.

Structural Fires

Urban fires occur in built-up environments, destroying buildings and other human-made structures. These disasters are often due to faulty wiring or mechanical equipment, combustible construction materials, or the absence of fire alarms and sprinkler systems. Structural fires are largely from human accidents, although deliberate fires (arson) may be a cause of some events. Older buildings that lack modern fire safety features may face greater risk of damage from fires. To minimize fire damage and loss, the County's Fire Code, based on the California Fire Code, sets standards for building and construction. It requires the provision of adequate water supply for firefighting, fire-retardant construction, and minimum street widths, among other things. Fire prevention awareness programs and fire drills are conducted to train residents to respond quickly and correctly to reduce injury and losses during fires.

Fire Responsibility Areas

In and around unincorporated Riverside County, different organizations all have some responsibility for wildfire protection in different areas. These responsibility areas are codified under state law into three categories: local responsibility areas (LRAs), state responsibility areas (SRAs), and federal responsibility areas (FRAs).

- 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. Approximately half of the land in Western Riverside County is an LRA and nearly all land in Eastern Riverside County is an LRA.
- 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. Approximately half of the land in Western Riverside County is an SRA; much of the SRA land encompasses the San Jacinto Mountains.
- FRAs are areas that are managed by a federal agency, including the U.S. Forest Service, the U.S. Fish and Wildlife Service, and the Bureau of Land Management. In the San Jacinto Mountains, most of the land is federally owned and consists of FRAs.

FIGURE 6: FIRE HAZARD SEVERITY ZONES

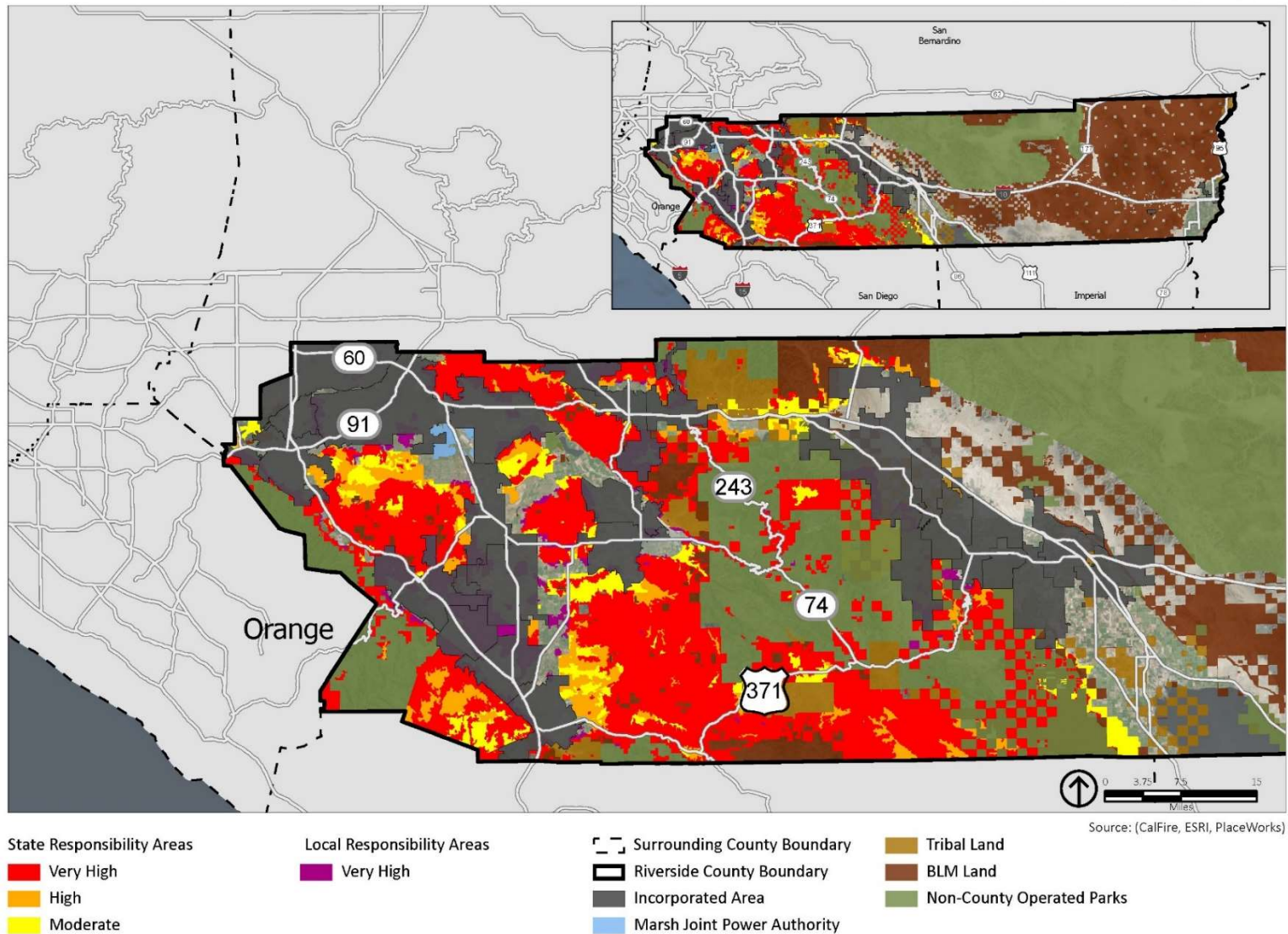


FIGURE 7: FIRE HAZARD SEVERITY ZONES (WEST COUNTY) AND EMERGENCY SERVICE FACILITIES

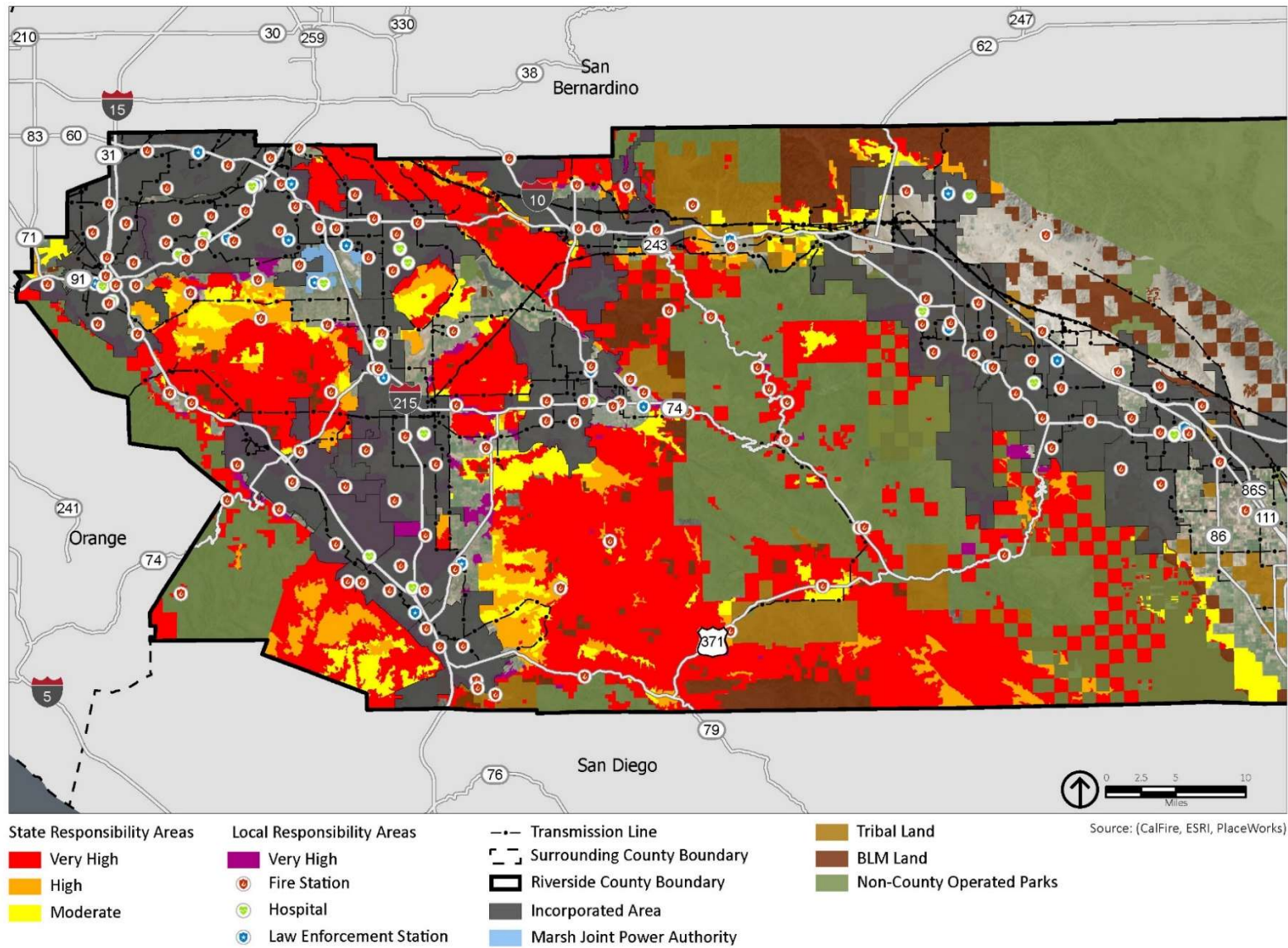
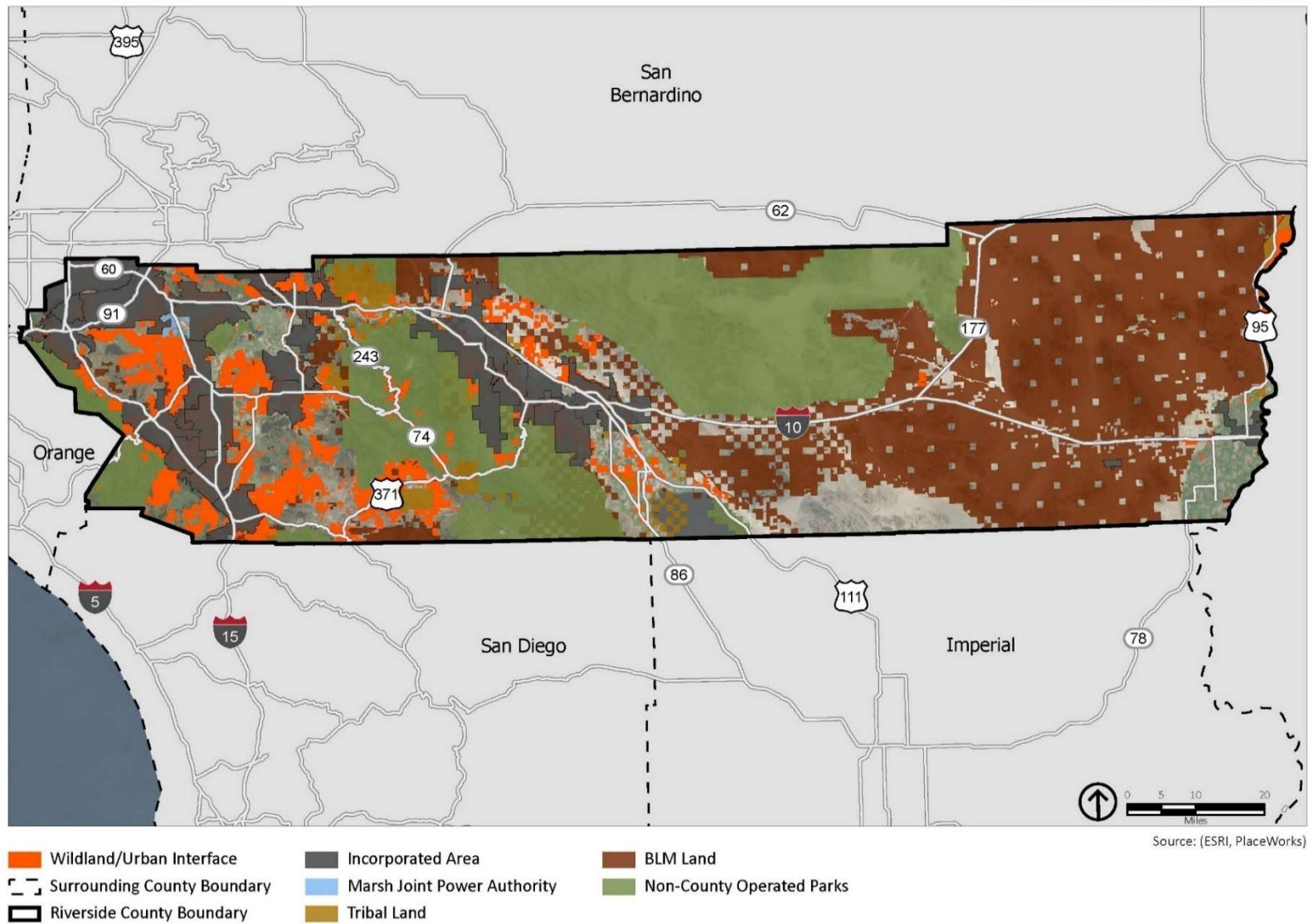


FIGURE 8: WILDLAND-URBAN INTERFACE



Past Occurrences

Table 2 contains a list of historical large fires that have occurred around the county dating back to 2008. Figure 9 shows the areas burned by historic wildfires in and around unincorporated Riverside County.

Table 2: Historical Large Fires in Riverside County, 2008 - 2019

Large Fires (500 Acres and Greater)							
Fire Name	Date		Acres Burned	Vegetation Type	Cause	Structures	
	Start	End				Destroyed	Damaged
LINCOLN FIRE	03/15/19	03/20/19	560	Grass	Arson	0	0
JERRY FIRE	06/21/19	06/21/19	500	Grass	Vehicle	0	0
TENAJA FIRE	09/04/19	09/14/19	1,926	Grass/Brush	Under Investigation	0	3
HORSESHOE FIRE	09/14/19	09/17/19	503	Grass/Brush	Undetermined	0	0
HILL FIRE	10/10/19	11/03/19	628	Grass/Brush	Under Investigation	0	0
SANDALWOOD FIRE	10/10/19	10/15/19	1,011	Grass/Timber	Undetermined	73	16
CRANSTON FIRE	07/25/18	08/09/18	13,139	Brush/Grass/Timber	Human	12	5
PATTERSON FIRE	05/17/18	05/18/18	1,261	Grass/Brush	Equipment Use	0	0
OPERA FIRE	04/30/17	05/02/17	1,350	Grass/Brush	Vehicle	0	0
MANZANITA FIRE	06/26/17	06/30/17	6,309	Grass/Brush	Vehicle	0	0
BLAINE FIRE	08/13/17	08/16/17	1,500	Grass/Brush	Undetermined	0	46
MIAS FIRE	08/14/17	08/18/17	600	Grass/Brush	Electrical Power	0	0
PALMER FIRE	09/02/17	09/09/17	3,800	Grass/Brush	Playing with Fire	0	0
WILDOMAR FIRE	10/26/17	11/01/17	866	Grass/Brush	Vehicle	0	0
BOGART FIRE	08/30/16	09/05/16	1,470	Grass/Brush	Undetermined	0	0
HIGHWAY FIRE	04/18/15	04/24/15	1,049	Timber/Grass	Equipment	0	0
ANZA FIRE	08/10/15	08/15/15	500	Brush	Human	0	0
SUMMIT FIRE	5/1/13	5/4/13	2,956	Grass/Brush	Undetermined	2	0
GORGONIO FIRE	5/4/13	5/4/13	650	Grass/Brush	Undetermined	0	0
MOUNTAIN FIRE	7/15/13	7/31/13	27,531	Timber/Brush	Electrical Power	23	1
SILVER FIRE	8/7/13	8/15/13	20,292	Brush	Undetermined	48	8
HATHAWAY FIRE	6/9/13	10/15/13	3,870	Brush	Under Investigation	0	0
FALLS FIRE	8/5/13	8/9/13	1,383	Grass/Brush	Under Investigation	0	0
HIGHLAND FIRE	6/16/12	6/18/12	2,171	Grass/Brush	Under Investigation	0	0
RUSHMORE FIRE	8/4/12	8/4/12	1,000	Grass	Undetermined	0	0
BUCK FIRE	8/14/12	8/18/12	2,681	Grass/Brush	Lightning	4	0
VISTA FIRE	8/20/12	8/21/12	500	Grass	Equipment	0	0
GILMAN FIRE	8/06/11	8/07/11	945	Grass	Undetermined	0	0
WINDY POINT FIRE	9/25/11	10/3/11	541	Grass	Miscellaneous	0	0
PEDLEY FIRE	5/12/10	5/13/10	850	Grass	Equipment	0	0
MCKINLEY FIRE	5/20/10	5/22/10	1,000	Grass	Equipment	0	0
SKINNER FIRE	7/15/10	7/18/10	503	Grass	Lightning	0	0
CACTUS FIRE	7/15/10	7/18/10	720	Grass	Lightning	0	0
OLIVER FIRE	05/27/09	05/27/09	500	Grass	Other	0	0
COTTONWOOD FIRE	08/27/09	08/31/09	2,409	Grass/Brush	Miscellaneous	0	0
FREEWAY COMPLEX FIRE	11/15/08	11/22/08	30,305	Grass	Structure	0	245
APACHE FIRE	4/29/08	5/4/08	769	Timber/Grass/Brush	Smoking	0	0

Source: Cal Fire Historical Wildfire Activity Statistics 2008 - 2019

Notable recent fires in Riverside County include:

2019 Tenaja Fire – The Tenaja Fire started in the rural community of La Cresta southwest of Murrieta. The fire burned approximately 1,926 acres and damaged three structures.

2019 Sandalwood Fire – The Sandalwood Fire, located in the City of Calimesa, burned approximately 1,011 acres. This wind-driven fire engulfed most of the Villa Calimesa mobile home park, ultimately destroying 73 structures, damaging 16 structures, and resulting in two civilian deaths.

2018 Cranston Fire – This fire was the result of arson, burning approximately 13,139 acres. The Cranston Fire impacted the communities of Idyllwild and Mountain Center, as well as recreational activities in the Lake Hemet area, San Bernardino National Forest, and Mount San Jacinto State Park. It also caused road closures along Highway 74 and Highway 243, impacting access to Hemet. Parts of Highway 74 and Highway 243 were later closed multiple times due to the threat of mudslides caused by the fire. The fire resulted in 12 destroyed structures, 5 damaged structures, and an evacuation of over 7,000 people; no fatalities occurred.

2017 Blaine Fire – The Blaine Fire occurred in the Box Springs Mountain Area and resulted in the evacuation for homes in Moreno Valley. The fire burned approximately 1,500 acres and damaged 46 structures.

2013 Summit Fire – The Summit Fire started in the Mias Canyon area north of Banning. The fire burned approximately 2,956 acres and forced the evacuation of over 1,200 people, leading to the closure of multiple school districts in the Murrieta, Perris, and Lake Elsinore area. The fire destroyed two structures and one firefighter suffered minor injuries.

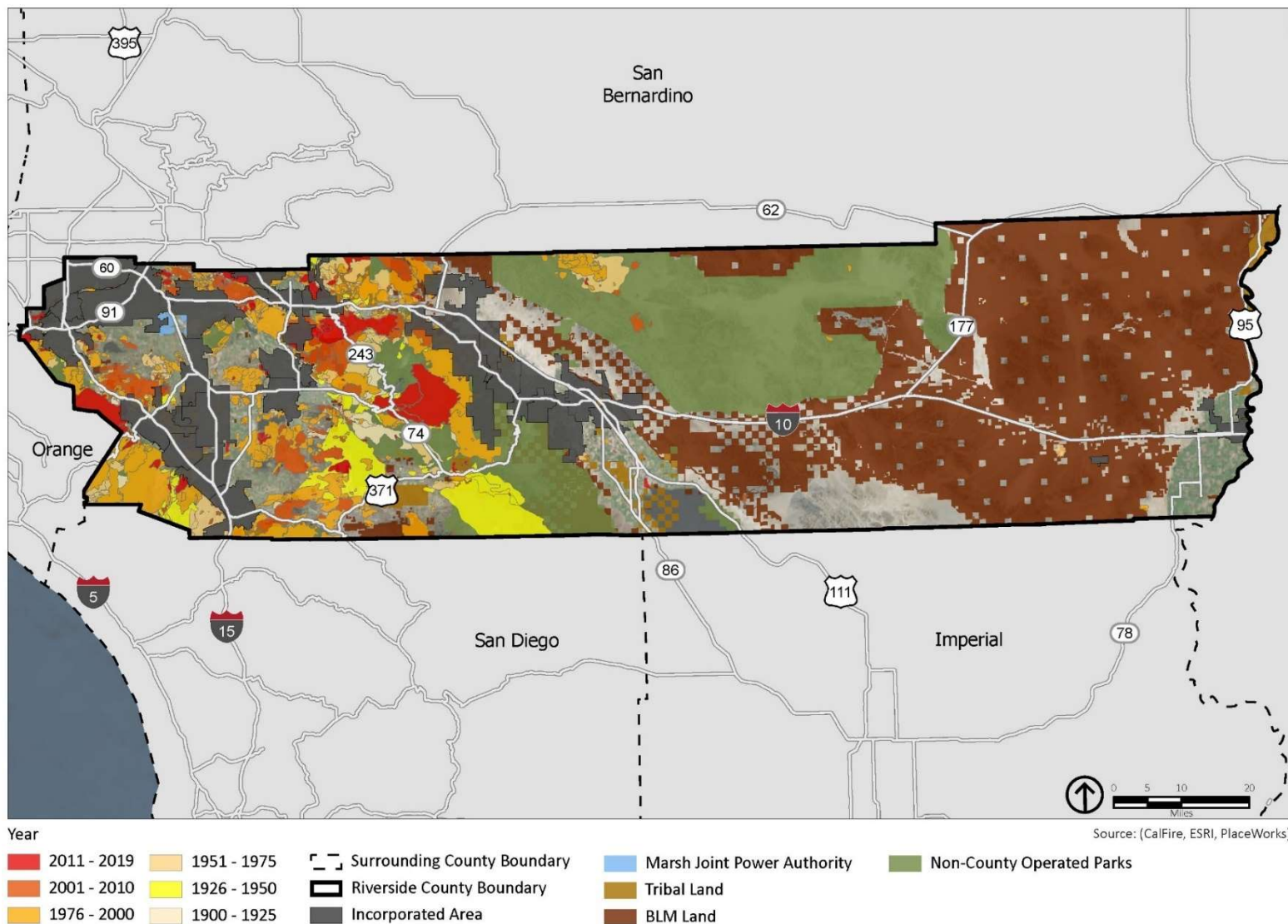
2013 Mountain Fire – The Mountain Fire burned 27,531 acres in Mountain Center. The fire burned for 16 days along steep slopes of timber and chaparral primarily in the San Jacinto Mountains of the San Bernardino National Forest. The fire threatened the town of Idyllwild, other small towns, and reached within two miles of Palm Springs. Nearly 6,000 residents of the Idyllwild and Fern Valley areas were ordered to evacuate; however, those communities were not damaged by the fire. While 23 structures were destroyed, and one structure was damaged, no fatalities occurred.

2013 Silver Fire – The Silver Fire burned 20,292 acres in the San Jacinto Mountains of the San Bernardino National Forest. Nearby communities of Poppet Flats, Twin Pines, and Silent Valley ordered to evacuate, displacing at least 1,500 residents. Highway 243 was also shut down as the fire quickly jumped the highway. Two firefighters and one civilian were reportedly injured. The fire destroyed 48 structures and damaged eight structures; no fatalities occurred.

2012 Buck Fire – The Buck Fire was a fire started by lightning in a rugged, rural area east of Temecula. Evacuations were ordered in the sparsely populated area near Aguanga, resulting in more than 30 homes to relocate. The fire burned approximately 2,681 acres, destroying four structures, and injuring one civilian that suffered serious burns.

2008 Freeway Complex Fire – The Freeway Complex Fire started along the Riverside Freeway in the riverbed of the Santa Ana River, located in Corona. The fire spread west and north into the hillsides of Yorba Linda and south into Anaheim Hills, where multiple businesses and residences were destroyed. It also burned homes in Olinda Ranch along Carbon Canyon Road in Brea, burned through much of Chino Hills, then spread north into Diamond Bar. Approximately 40,000 residents were evacuated during the fire. Areas under mandatory evacuation during the fire included Anaheim, Carbon Canyon, Chino Hills, Corona, Diamond Bar, and Yorba Linda. The fire burned approximately 30,305 acres and resulted in 245 damaged and destroyed structures; no fatalities occurred.

FIGURE 9: HISTORIC WILDFIRE AREAS



Fire Protection

Fire protection in unincorporated Riverside County is provided by the Riverside County Fire Department and CAL FIRE. Riverside County contracts with CAL FIRE to provide fire protection and rescue services in the unincorporated areas of the county. The Riverside County Fire Department and CAL FIRE participate in a Cooperative Fire Response Agreement, where fire agencies have agreed to automatically support each other on incidents using the closest available resource.

The Riverside County Fire Department is one of the largest regional fire service organizations in California. It is staffed with a combination of County of Riverside and CAL FIRE personnel and responds to both urban and wildland emergencies. The Riverside County Fire Department serves a vast geographic area and diverse communities. The County of Riverside supplements its staff by contracting with CAL FIRE to provide fire protection services. The Riverside County Fire Department, a unique partnership between CAL FIRE and the County of Riverside, serves residents of unincorporated areas as well as 21 partner cities. The Idyllwild Fire Protection District also provides firefighting, rescue, emergency medical services, and ambulance transport services for the unincorporated communities of Idyllwild and Fern Valley.

The Riverside County Fire Department provides fire protection, emergency medical services, and disaster preparedness and response. The department operates 101 fire stations in six divisions consisting of 15 line battalions, providing fire suppression, emergency medical, technical rescue, fire prevention, and related services.

CAL FIRE has a legal responsibility to provide fire protection on all SRA lands, which are defined based on land ownership, population density, and property use.

Potential Changes to Fire Risk in Future Years

Likelihood of Future Occurrence

Risk and vulnerability to unincorporated Riverside County from wildfire is of significant concern, especially in the forests and shrublands in the western county. High fuel loads in the county, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. During the historic August to October fire season, the dry vegetation and hot and dry Santa Ana winds, combined with continued growth in the wildland-urban interface areas, results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the county, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

Structural fires can occur at any time throughout the year. Structural fires may occur in any buildings, often due to faulty wiring or mechanical equipment or combustible construction materials. The absence of fire alarms and sprinkler systems can allow small fires to rapidly grow and spread, potentially threatening the entire building and any neighboring structures. In general, the propagation rates of structural fires vary depending on the types of materials used in building construction. Building materials such as concrete and fire-resistive coated steel used in high rise or commercial buildings are most fire resistive. In contrast, building materials such as heavy timber for community-based buildings and wood frame for residential buildings are least resistive. The risk and vulnerability to structural fires is unpredictable and will vary across unincorporated Riverside County due to the incidental nature of human accidents and unique conditions of a built environment.

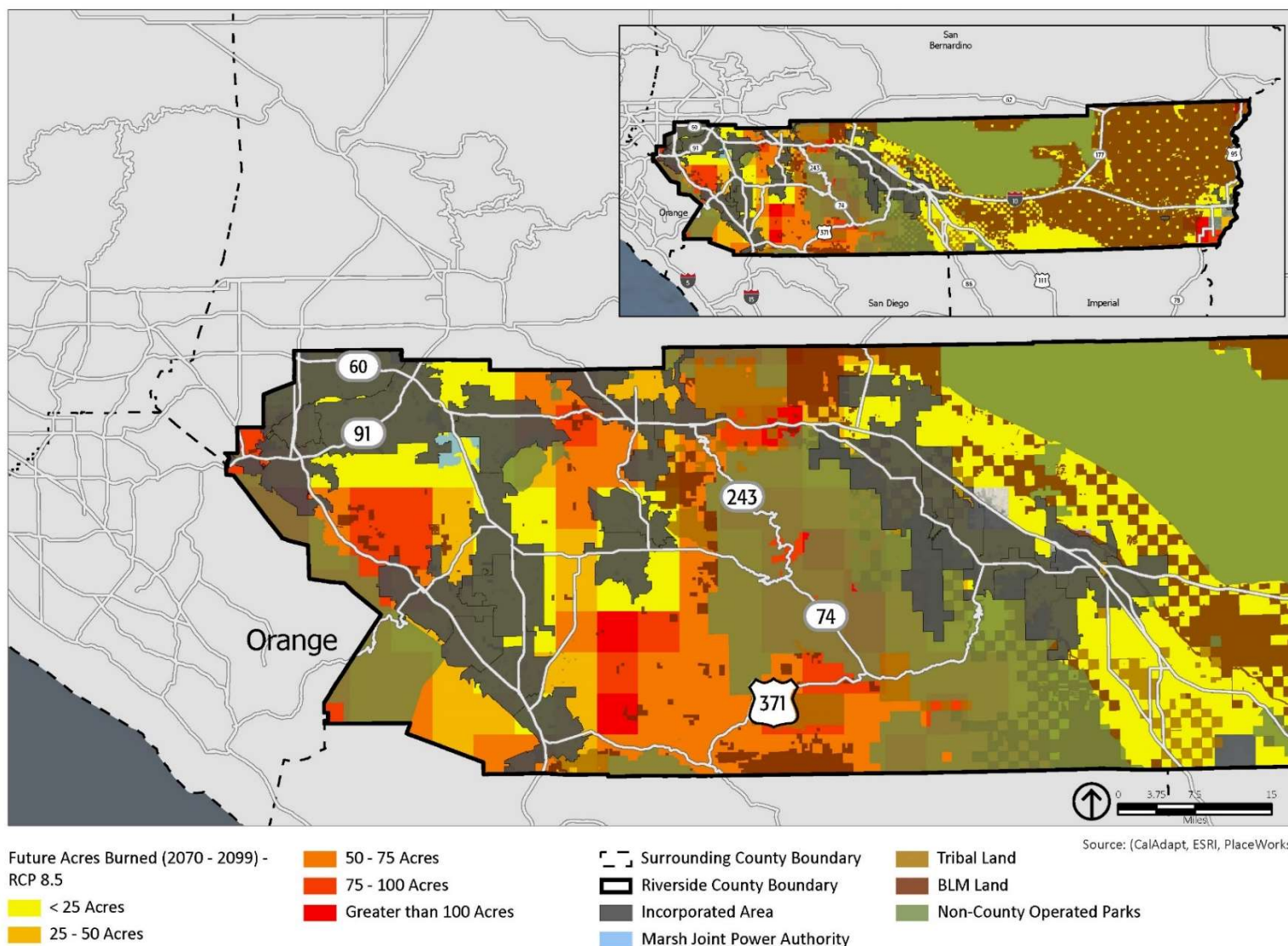
Wildfire hazard is the highest-priority hazard in the county and is the hazard with the greatest potential for catastrophic loss. Wildfires can cause short-term and long-term disruption to the County. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the county by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires, including wildfires and structural fires, may result in casualties and can destroy buildings and infrastructure.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is also important to recognize that they can cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In some cases, the economic impact of this loss of services may be comparable to the economic impact of physical damages or, in some cases, even greater. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Fires can also cause major damage to power plants and power lines needed to distribute electricity to operate facilities. The effects can be far-reaching in terms of the number of acres involved, the toll on human life, and the economic consequences. Wildfire and structural fires will continue to be a high-risk hazard for unincorporated Riverside County.

Climate Change and Fire

Changing climate conditions are expected to increase the wildfire risk in and around unincorporated Riverside County. Warmer temperatures brought on by climate change can exacerbate drought conditions. Droughts can kill or dry out plants, creating more fuel for wildfires. The biggest increase in wildfires is projected to occur in Western Riverside County, along the San Jacinto Mountains. Warmer temperatures are also expected to increase the number of pest outbreaks, such as the western pine beetle, creating more dead trees and increasing the fuel load. Due to warmer temperatures, the fire season is also likely to begin earlier in the year and extend later than it has historically. According to the California Fourth Climate Change Assessment, overall burned area may increase by as much as 60 percent during Santa Ana Wind events (typically October to March), and 75 percent during periods without Santa Ana Winds (typically April to September). Figure 10 shows the anticipated increase in areas burned by wildfires as a result of climate change. Structural fires are not expected to change directly as a result of climate change, although hotter and drier conditions may indirectly contribute to structural fires.

FIGURE 10: ANNUAL FUTURE WILDFIRE ACRES BURNED



Hazardous Waste and Materials

Hazardous materials are materials that pose a significant risk to public safety and environmental health. These include toxic chemicals, flammable or corrosive materials, petroleum products, and unstable or dangerously reactive materials. They can be released through human error, malfunctioning or broken equipment, or as an indirect consequence of other emergencies (e.g., if a flood damages a hazardous material storage tank). Hazardous materials can also be released accidentally during transportation, as a consequence of vehicle accidents.

A release or spill of bulk hazardous materials could result in fire, explosion, toxic cloud, or direct contamination of water, people, and property. The effects may involve a local site or many square miles. Health problems may be immediate, such as corrosive effects on skin and lungs, or gradual, such as the development of cancer from a carcinogen. Damage to property could range from immediate destruction by explosion to permanent contamination by a persistent hazardous material.

The majority of hazardous materials in the county are being transported by truck on Interstate (I-) 10, I-15, I-215, and State Route (SR-) 60 and SR-91. The most vulnerable areas along these routes are considered to be the on/offramps and interchanges. Pipeline systems also carry hazardous materials, and under some conditions these pipelines can rupture and cause a release of hazardous materials. The above-mentioned freeways are areas of concern, as are Union Pacific Railroad tracks that roughly parallel I-10. In addition to highway traffic, other hazardous materials are transported through the county on the Southern Pacific Railroad. Since 1970, approximately 1,067 rail and roadway hazardous materials incidents have occurred in Riverside County.

Several state agencies monitor hazardous materials/waste facilities. Potential and known contamination sites are monitored and documented by the Department of Health Services (DHS) and the Regional Water Quality Control Board (RWQCB). A review of the leaking underground storage tank list produced by the RWQCB, and the Hazardous Waste and Substances Sites List produced by the Office of Planning and Research indicates hazardous waste sites throughout the county.

If an imminent public health threat is posed by an outside factor, the County will support local regulating agencies in notifying the public. The transport of hazardous materials/wastes and explosives through the county is regulated by the California Department of Transportation (DOT). I-10, I-15, I-215, SR-60, and SR-91 are open to vehicles carrying hazardous materials/wastes. Transporters of hazardous wastes are required to be certified by the DOT and manifests are required to track the hazardous waste during transport. The danger of hazardous materials/waste spills during transport does exist and will potentially increase as transportation of these materials increases on freeways and the railroads. The Riverside County Sheriff's Department, Riverside County Fire Department, CAL FIRE, Riverside County EMD, and Riverside County Department of Environmental Health are responsible for hazardous materials accidents at all locations within the county.

Potential Changes to Hazardous Materials in Future Years

Likelihood of Future Occurrence

Given that 1,067 hazardous materials incidents have happened in transport through the county in the past 50 years, it is highly likely a hazardous materials incident will occur in unincorporated Riverside County every year. However, according to the California Department of Transportation (Caltrans), most incidences are related to releases of fluids from the transporting vehicles themselves and not the cargo, thus the likelihood of a significant hazardous materials release within the county is more limited and difficult to predict.

Climate Change and Hazardous Materials

Climate change is unlikely to affect hazardous materials transportation incidents. However, increases in the frequency and intensity of hazards, such as floods, landslides, and severe storms, may create a greater risk of hazardous materials releases during these events.

Disaster Preparedness, Response, and Recovery

Riverside County Emergency Services establishes the responsibilities of the various Riverside County agencies in times of a disaster. Disaster preparedness and response planning include identifying short-term actions to reduce the scope of an emergency and managing necessary resources in the event of a disaster. After any disaster, particularly an earthquake, short-term disaster recovery requires many operations that are less urgent than fire suppression or medical attention but are equally important.

Emergency Preparedness

Emergency preparedness activities in unincorporated Riverside County are conducted through the County of Riverside's EMD and Emergency Operations Center (EOC) EMD, in cooperation with local cities, special districts, and fire and law enforcement agencies, provides emergency management services. EMD prepares emergency and contingency plans, ranging from evacuation plans to emergency operations plans that help specify the roles and responsibilities of first responders and emergency management personnel for an incident. Moreover, EMD plans and organizes trainings and exercises involving Riverside County and local, state, federal, and regional agencies.

The Riverside County Fire Department and CAL FIRE are prepared to handle most everyday emergencies, such as all types of fire, medical, or hazardous situations. However, during a disaster, the number and scope of incidents may exceed the fire department's and CAL FIRE's ability to provide effective emergency services. For this reason, Riverside County provides the public with access to a community emergency response team (CERT) training program. The CERT Program provides for community and employee self-sufficiency to meet the general public's urgent life-saving and sustenance needs until emergency personnel arrive. The CERT Program educates people about disaster preparedness and trains them in basic response skills, such as fire safety, light search and rescue, and disaster medical operations. CERT members assist their fellow citizens/coworkers in their community or workplace following a disaster. CERT members take an active role in their community by preparing for a disaster, thus reducing their own impact risk.

The County of Riverside uses Alert RivCo, a phone alert system to alert residents and businesses in Riverside County who are affected, threatened, or might be endangered by an emergency event or a disaster, such as wildfires, floods, hazardous materials, severe weather, and certain law enforcement incidents. Alert RivCo is part of a group of alert and warning tools used in the county. Other systems include the Emergency Alert Systems (EAS) and the Emergency Digital Information System (EDIS).

The EAS is a national public warning system commonly used by state and local authorities to deliver important emergency information, such as weather and AMBER alerts, to affected communities. EAS participants – radio and television broadcasters, cable systems, satellite radio and television providers, and wireline video providers. FEMA, the Federal Communications System, and NOAA's National Weather Service (NWS) work collaboratively to maintain the EAS and Wireless Emergency Alerts, which are the two main components of the national public warning system and enable authorities at all levels of government to send urgent emergency information to the public. The EDIS is a wireless datacast-based emergency and disaster information service operated by the State of California Governor's Office of Emergency Services and is an enhancement to the EAS. These systems are available in multiple languages.

Disaster Preparedness

In recent years, the County of Riverside has expanded its emergency preparedness planning. The County of Riverside is required under state law to prepare and maintain a Standardized Emergency Management System (SEMS) Multi-hazard Functional Plan. The California Governor's Office of Emergency Services has extensive guidelines outlining the requirements of the Riverside County SEMS.

Public Safety Power Shutoffs

Unincorporated Riverside County is primarily served by Southern California Edison (SCE). Parts of the unincorporated area are also served by Anza Electric Cooperative and Imperial Irrigation District. Anza Electric Cooperative services over 700 miles of line in Southwest Riverside County covering the areas of Anza, Garner Valley, Pinyon, Alpine Village, Royal Carrizo, and parts of Aguanga. Imperial Irrigation District services Coachella Valley cities, including Mecca, Thermal, La Quinta, Coachella, Indio, Bermuda Dunes, Thousand Palms, Indio Hills, and Sky Valley.

Electricity utilities throughout California, including SCE, Anza Electric Cooperative, and Imperial Irrigation District, have begun to occasionally “de-energize,” or turn off the electricity for, power lines that run through areas where there is an elevated fire risk. This is intended to reduce the risk of power lines sparking or being damaged and starting a wildfire. These activities, called Public Safety Power Shutoffs (PSPSs), result in a loss of power for customers served by the affected power lines. A PSPS may occur at any time of the year, usually during high wind events, high temperatures, and dry conditions. PSPS events may be limited to specific communities or they may affect broad swaths of the state. In October 2019, SCE conducted four large-scale events, shutting off power to approximately 160,000 customers, including those in unincorporated Riverside County. The largest PSPS event during this time occurred on October 27 and ended on October 31, 2019. During this event, 498,660 customers in 12 counties (Fresno, Inyo, Kern, Los Angeles, Madera, Mono, Orange, Riverside, San Bernardino, Tulare, Tuolumne, and Ventura) served by 352 distribution circuits and seven transmission lines were identified as under consideration for PSPS. Ultimately, proactive de-energization was required for 126 circuits (including three transmission lines) affecting 126,364 customers, including some in unincorporated Riverside County, over two weather systems. PSPS events can impact emergency management activities. A loss of power can make it more difficult for homes or businesses to receive emergency notifications if needed. PSPS events can also create vulnerabilities for community members that lack backup power supplies and depend on electricity for heating or cooling homes and buildings, lighting, and internet. PSPS events may also be harmful to people who depend on electrically powered medical devices. Additionally, community members may be faced with economic hardships and be deprived of important services, such as grocery stores, gas stations, and banks/ATMs. Traffic lights and other traffic control systems may not work, which can complicate any evacuation needs and may hinder emergency response. Although critical public health and safety facilities often have backup generators, the loss of power may also disable other key infrastructure systems.

Evacuation Needs

Some natural disasters or other public safety events may require evacuation of parts of unincorporated Riverside County. In some instances, these evacuations may be limited to a particular neighborhood or street. In other instances, entire communities may need to evacuate. To allow for a safe and effective evacuation, all community members should be able to easily access an evacuation route that allows them to safely travel out of the evacuation zone. If there is limited access to evacuation routes or if these routes cannot accommodate evacuation traffic, evacuation efforts may be severely hampered by slow traffic and collisions, which can put community members at risk. Evacuation constraints can also slow down the public safety response by hindering access by emergency responders. Figures 11 through 13 show residential areas with only one access point, and so face a higher risk of

evacuation constraints. These include areas located on dead-end routes, are at least half a mile from a major roadway, or cannot be reached by at least two roads.

There are a number of routes in the unincorporated areas of Riverside County that can support evacuations, some of which have been identified by the Resilient IE project. Evacuation routes should have sufficient road capacity and freedom of traffic flow. Where possible, they should have limited exposure to hazard-prone areas as well. Table 3 list potential evacuation routes for unincorporated communities, although this is not meant to be an exhaustive list.

TABLE 3: EVACUATION ROUTES BY UNINCORPORATED COMMUNITY

Community	Evacuation Routes
Highgrove	Interstate 215, Center Street
University City	Interstate 215, Sycamore Canyon Boulevard
Temescal Canyon (El Cerrito, Montecito Ranch, Painted Hills, Sycamore Creek, etc.)	Interstate 15, Temescal Canyon Road, De Palma Road, Palm Canyon Drive, Trilogy Parkway/Knabe Road
Elsinore area (Rancho Carrillo, El Cariso, Warm Springs, etc.)	Interstate 15, State Route 74, Temescal Canyon Road, Grand Avenue
Southwest area (La Cresta, Deluz, Murrieta Hot Springs, French Valley, etc.)	Interstate 15, State Route 79, Rancho California Road, Borel Road/Washington Street, Sandia Creek Drive, De Portola Road, Deluz Road, Clinton Keith Road
Lake Matthews/Woodcrest	Interstate 15, Cajalco Road, La Sierra Avenue
Mead Valley area	Interstate 215, Cajalco Road
Harvest Valley/Winchester area	State Route 74, State Route 79, Domenigoni Parkway
Reche Canyon/Badlands area	State Route 60, Gilman Springs Road, Ramona Expressway, San Timoteo Road
Lakeview/Nuevo	Ramona Expressway, Nuevo Road, Juniper Flats Road
San Jacinto Valley area (Valley Vista, Gilman Hot Springs, etc.)	State Route 74, State Route 79, Gilman Springs Road
The Pass area (Twin Pines, Cabazon, Cherry Valley, etc.)	Interstate 10, State Route 79, State Route 243, Oak Glen Road, Bluff Street
Riverside Extended Mountain area (Idyllwild, Mountain Center, Anza, Aguanga, etc.)	State Route 74, State Route 243, State Route 371
Western Coachella Valley area (Whitewater, North Palm Springs, Thousand Palms, etc.)	Interstate 10, State Route 62, Dillon Road
Eastern Coachella Valley area (Arabia, Mecca, Oasis, Salton, etc.)	Interstate 10, State Route 86, State Route 111, Box Canyon Road/66th Avenue, Harrison Street
Desert Center	Interstate 10, State Route 177
Palo Verde Valley area (Mesa Verde, Palo Verde, Ripley, etc.)	Interstate 10, US Route 95, State Route 78, Midland Road/North Lovekin Boulevard

Mutual Aid Agreements

Additional emergency management and response services for jurisdictions throughout the county are provided through a mutual-aid agreement with the Riverside County Fire Department and CAL FIRE. The Riverside County Fire Department and CAL FIRE provide a variety of public safety services, including fire protection, medical aid, rescue, hazardous materials response, and educational safety programs.

FIGURE 11: RESIDENTIAL PARCELS WITH EVACUATION CONSTRAINTS (WEST COUNTY)

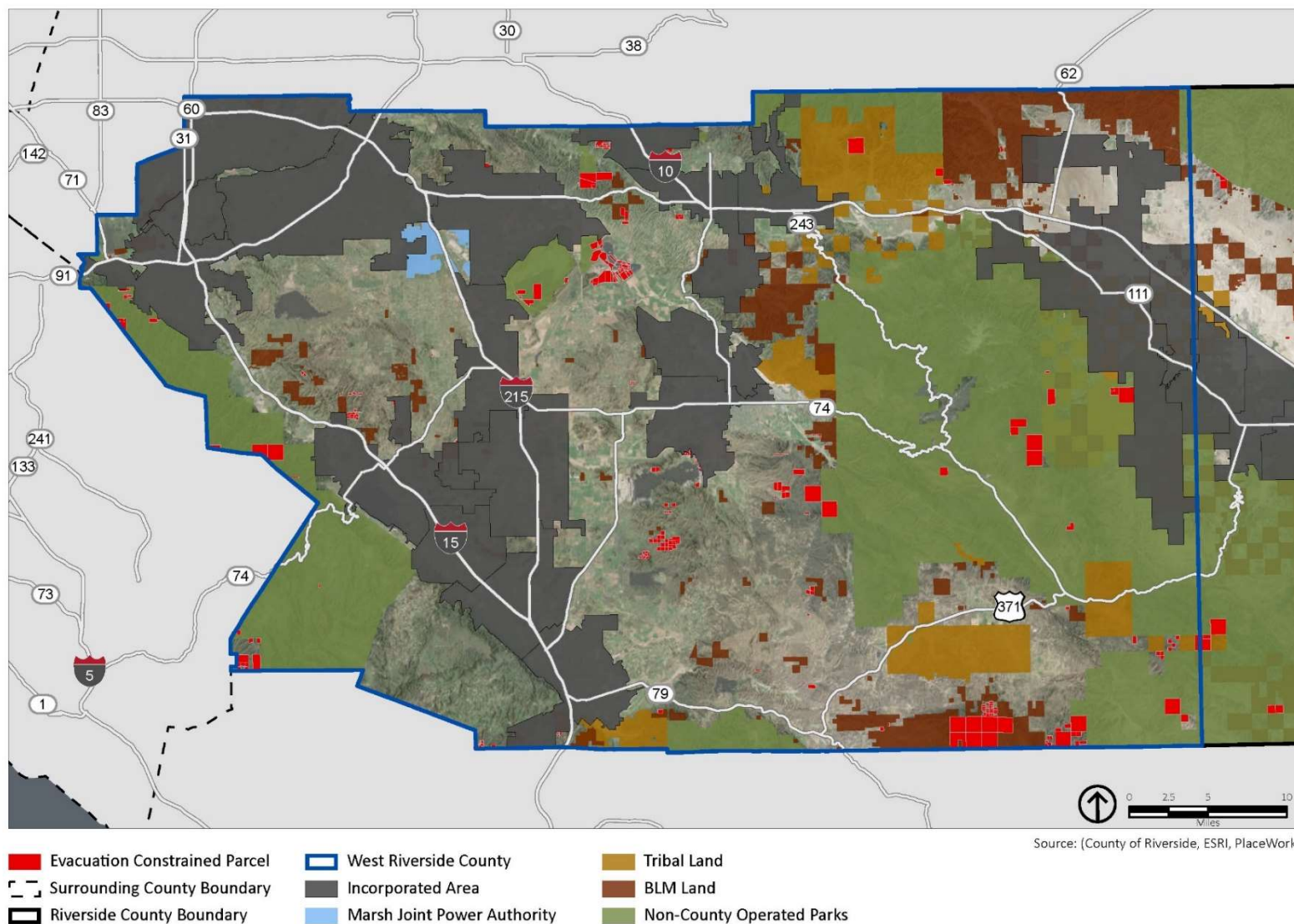


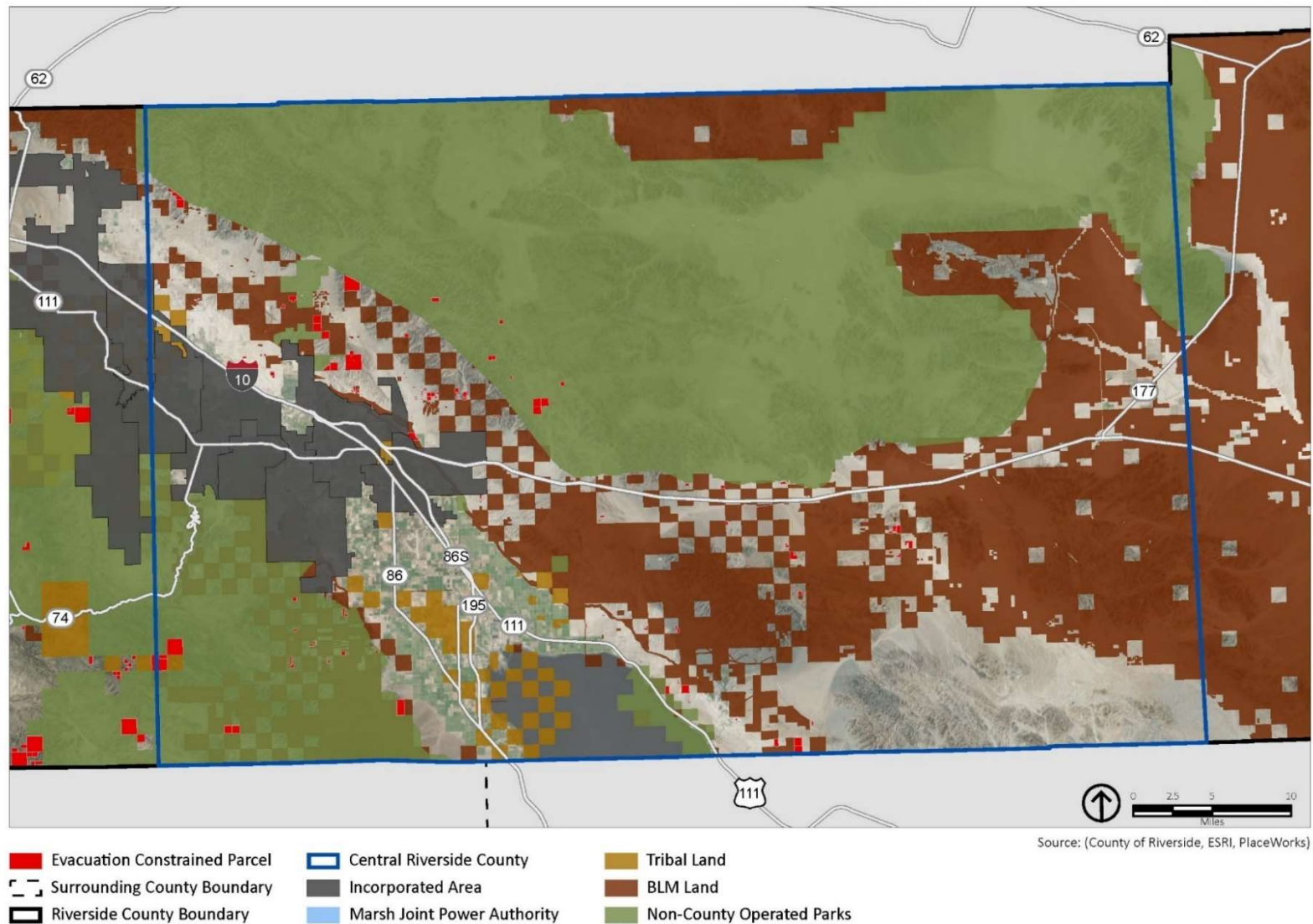
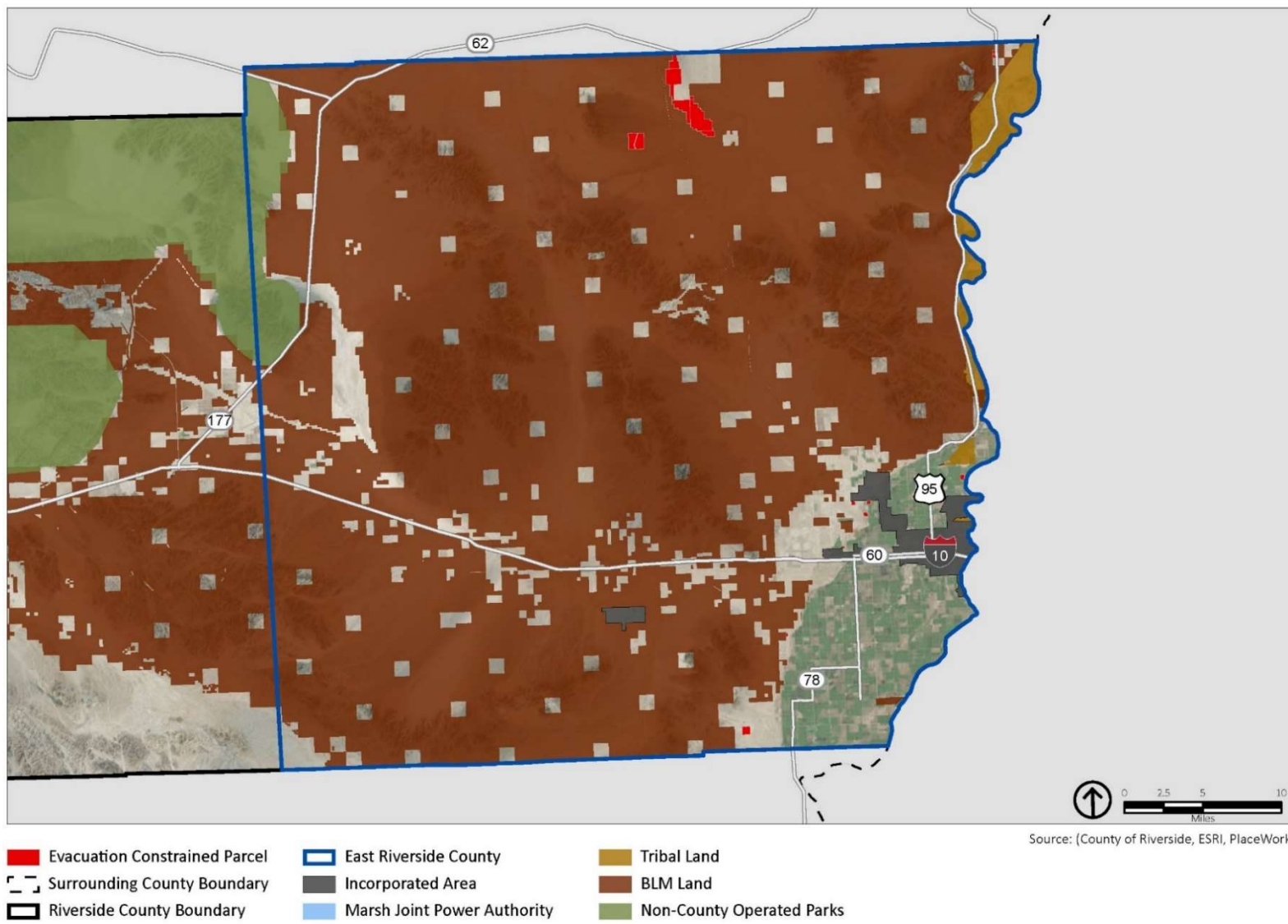
FIGURE 12: RESIDENTIAL PARCELS WITH EVACUATION CONSTRAINTS (CENTRAL COUNTY)

FIGURE 13: RESIDENTIAL PARCELS WITH EVACUATION CONSTRAINTS (EAST COUNTY)



Climate Change Vulnerability

Changes to the global climate system are expected to affect future occurrences of natural hazards in and around unincorporated Riverside County. Many hazards are projected to become more frequent and more intense in coming years and decades, and in some cases, these trends have already begun. According to California's *Fourth Climate Change Assessment*,¹ unincorporated Riverside County can expect the following changes to natural hazard events:

- Both droughts and floods are expected to become more frequent as periods of very high and very low precipitation become more common. Floods are among the most damaging natural hazards in unincorporated Riverside County, and climate change is expected to make them worse. Although Southern California is likely to experience a decrease in overall precipitation levels due to climate change, the region is also expected to see an increase in the number of extreme precipitation events. As a result, floods are expected to occur more often in and around unincorporated Riverside County and climate change may expand the parts of the county that are considered flood-prone. Climate change is expected to increase the frequency and severity of droughts that cause soil to dry out and become hard. When precipitation does return, more water runs off the surface rather than being absorbed into the ground, which can lead to floods.
- Warmer temperatures are projected to cause an increase in extreme heat events. Because extreme heat is relative to the area, this means that extreme heat events may occur anywhere in unincorporated Riverside County, even though temperatures in the eastern Riverside County will almost always be the hottest. Depending on emission levels, the number of extreme heat days is expected to rise from a historical annual average of 4 to between 26 and 37 by the middle of the century (2041 to 2060), and to between 39 and 63 by the end of the century (2070 to 2099), depending on the severity of climate change and the specific location. In addition to the increases in extreme heat events, all of unincorporated Riverside County is also expected to see an increase in the average daily high temperatures. Extreme heat poses a significant human health risk, especially to senior citizens, outdoor workers, and persons who do not have access to adequate cooling. Some buildings and infrastructure systems may be damaged by very high temperatures, constraining their ability to meet community needs. Pests and diseases may be active for longer periods of time due to warmer temperatures. Changes in temperature and precipitation patterns may cause pests and diseases that have historically not been present in unincorporated Riverside County to be more permanent in the community. This includes pests and diseases that are a threat to human health as well as those that may affect agricultural crops, livestock, and local wild ecosystems.
- Climate change can increase the rates of infection for various diseases because many of the animals that carry diseases are more active during warmer weather. There are a number of diseases that are linked to climate change and can be harmful to the health of unincorporated Riverside County community members, such as hantavirus pulmonary syndrome, Lyme disease, West Nile fever, and influenza. Many of these diseases are carried by animals such as mice and rats, ticks, and mosquitos, which are usually seen as pests even if they do not cause infections. Warmer temperatures earlier in the

¹ Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). 2018. *Statewide Summary Report. California's Fourth Climate Change Assessment*. Publication number: SUMCCCA4-2018-013.

spring and later in the winter can cause these animals to be active for longer periods, increasing the time that these diseases can be transmitted.

- Unincorporated Riverside County is expected to see an increase in wildfires due to hotter, drier weather. Although the risk is greatest in the forested areas of Western Riverside County along the San Jacinto Mountains, unincorporated Riverside County may still experience an increase in regional wildfire activity. More frequent regional wildfires may also create poor air quality. Wildfire activity across unincorporated Riverside County is expected to increase approximately 16 percent above historic levels by the middle of the century.
- Severe weather events, such as strong storms and high winds, may become more frequent and intense due to climate change. Climate change is expected to cause an increase in intense rainfall, which is usually associated with strong storm systems. Heavy rainfall may also contribute to an increased risk of landslides in the hills around unincorporated Riverside County. In unincorporated Riverside County, most severe weather is linked to high winds. The types of dangers posed by severe weather vary widely and include injuries or deaths, damage to buildings and structures, fallen trees, roads and railways blocked by debris, and fires sparked by lightning.

Vulnerability Assessment Results

The Climate Change Vulnerability Assessment indicates that unincorporated Riverside County's populations and assets are most vulnerable to wildfires, extreme heat, severe weather, and drought.

Populations in unincorporated Riverside County tend to be more vulnerable to extreme heat, human health hazards, and wildfire, which directly affect health outcomes. Due to financial limitations, mobility challenges, and lack of access to medical care, the most vulnerable populations include households in poverty, seniors living alone, outdoor workers, and persons experiencing homelessness. The homes that vulnerable populations live in, especially those located on single access roads, are also highly vulnerable to direct damage from hazards, such as landslides, severe weather, flooding, and wildfire.

Throughout unincorporated Riverside County, the electricity transmission system is vulnerable to multiple hazards, including severe weather, such as high winds that can trigger PSPS events, extreme heat that reduces the capacity and strains the system, and wildfires that damage the system, ultimately disrupting energy service. These conditions can damage communication infrastructure, decreasing network capacity. There may be a higher demand for communication services during severe weather, potentially putting stress on the network and increasing the risk of service interruptions. Furthermore, energy delivery services, specifically electricity delivery, is subject to harm during extreme heat events. Extreme heat can lead to power outages by causing mechanical failure of grid equipment, by causing heat damage to power lines, and by creating a high demand for electricity to power air conditioners, all of which place stress on the network. This is likely to lead to greater service disruptions.

An increase in forestry pests and diseases, droughts, extreme heat, and wildfire create higher vulnerabilities for the montane coniferous forests and woodland. Drought and extreme heat can stress trees, weakening them or killing them outright. Weakened trees are more susceptible to forestry pests, creating a risk of further damage. Many conifers, especially some species of fir trees, are especially vulnerable to large and intense wildfires. Pests such as bark beetles, which have increased due to drought and higher temperature, can decimate woodland and coniferous habitats and these species may not be able to recover. This can in turn affect local economic activities in unincorporated Riverside County, such as outdoor recreation activities and visitors that travel through the county to get to state and national parks and forests.

Unincorporated Riverside County's agriculture industry is vulnerable to extreme heat, drought, flooding, and severe weather. Floods and severe weather can severely harm or kill crops, and damage infrastructure, reducing agricultural yields and creating costly repairs. Livestock in the county, especially cattle, are highly vulnerable to drought and extreme heat events. Extreme heat can damage a number of different crops and can result in widespread animal illnesses or even death for livestock. As a result, agriculture yields and the cost of operations will likely be affected and impact local economies.

PSPS events can also create vulnerabilities for unincorporated Riverside County community members. The vast majority of homes and businesses do not have backup power supplies, so a loss of electricity can cause a loss of refrigeration for food and medical supplies, limit cooking, cause loss of heating or cooling (particularly dangerous during extreme heat or cold events), lighting, and limited or no access to the Internet or other information systems. Many businesses are forced to close during a PSPS, causing economic hardships and depriving community members of important services, such as grocery stores, gas stations, and banks/ATMs. PSPS events may also be harmful to people who depend on electrically powered medical devices. Some property owners have purchased backup power generators, although these produce high levels of noise, pollution, and odors.

A full list of the Vulnerability Assessment results can be found in **Appendix A**.

Additional Climate Change-Related Hazards

Drought

A drought is a long period when precipitation levels are well below normal. Unincorporated Riverside County chronically experiences drought cycles. Since the 1950s, unincorporated Riverside County has received an average of 8 inches of rainfall per year, although that number can vary greatly between years.

Drought makes less water available for people, businesses, agricultural activities, and natural systems. Less snow falling in mountainous areas causes water levels in lakes and reservoirs to drop, which can affect recreation activities. Local ecosystems that are not well adapted to drought conditions can be more easily harmed by it. During drought events, the flow of water in creeks and streams is reduced, creating more slow-moving or standing water. This can concentrate sediment and toxins in the low water levels, causing harm to plants and animals. Many fish species also prefer specific stream flow speeds, especially for spawning and egg incubation, and changes to stream velocity as a result of drought conditions can affect reproduction. Droughts can also indirectly lead to more wildfires, and the stress caused by water shortages can weaken plants, making them more susceptible to pests and diseases.

The U.S. Drought Monitor recognizes a five-point scale for drought events: D0 (abnormally dry), D1 (moderate drought), D2 (severe drought), D3 (extreme drought), and D4 (exceptional drought). According to the U.S. Drought Monitor, the most intensive drought conditions in recent years occurred during most of 2007, when all of unincorporated Riverside County was classified as being in "extreme" drought. As of spring 2021, conditions range from "moderate drought" in western Riverside County and close to the Salton Sea to "extreme drought" in the far eastern part of the county. For 74 percent of the time since 2000, at least half of unincorporated Riverside County has been under some level of drought conditions. Similarly, 48 percent of the time since 2000, all of unincorporated Riverside County has faced drought conditions. These figures do not include times when sources of unincorporated Riverside County's imported water may have also been under drought events.

Potential Changes to Drought in Future Years

Likelihood of Future Occurrence

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue for agricultural, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Based on historical information, the occurrence of drought in California, including unincorporated Riverside County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of unincorporated Riverside County to drought is countywide, but impacts may vary and include reduction in water supply, agricultural losses, and an increase in dry fuels.

Most of the imported water used comes from the Sierra Nevada range. Reduced winter precipitation levels and warmer temperatures have greatly decreased the size of the Sierra Nevada snowpack (the volume of accumulated snow), which in turn makes less fresh water available for communities throughout California. Continued decline in the Sierra Nevada snowpack volume is expected, which may lead to lower volumes of available imported water.

Climate Change and Drought

Although droughts are a regular feature of California's climate, scientists expect that climate change will lead to more frequent and more intense droughts statewide. Overall, precipitation levels are expected to stay similar, and may even increase in some places. However, the state's current data say that there will be more years with extreme levels of precipitation, both high and low, as a result of climate change. This is expected to cause more frequent and intense droughts compared to historical norms. Higher air temperatures are expected to increase evaporation, causing more water loss from lakes and reservoirs, exacerbating drought conditions.

Extreme Heat

While there is no universal definition of extreme heat, California guidance documents define extreme heat as temperatures that are hotter than 98 percent of the historical high temperatures for the area, as measured between April and October of 1961 to 1990. Days that reach this level (an average of 106-degrees Fahrenheit (°F) across all of unincorporated Riverside County, although this threshold varies by location) are called extreme heat days. An event with five extreme heat days in a row is called a heat wave. Extreme heat is any period of time when the temperatures are well above the usual level. This level is relative to the area, which means that extreme heat events may occur anywhere in unincorporated Riverside County, even though temperatures in eastern Riverside County will almost always be the hottest.

Health impacts are the primary concern with this hazard, though economic impacts are also an issue. The Centers for Disease Control and Prevention (CDC) recognizes extreme heat as a substantial public health concern. Historically, National Oceanic and Atmospheric Administration (NOAA) data indicates that about 175 Americans succumb to the demands of summer heat, although this number has increased in recent years. From 2004 to 2018, studies by the U.S. Department of Health and Human Services indicate that there is an average of 702 deaths annually that are directly or indirectly linked to extreme heat.

Extreme heat events are dangerous because people exposed to extreme heat can suffer a number of heat-related illnesses, including heat cramps, heat exhaustion, and (most severely) heat stroke. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions. The elderly and individuals below the poverty level are the most vulnerable to extreme heat. Nursing homes and elder care facilities are especially vulnerable to extreme heat events if power outages occur and air conditioning is not available. In addition, individuals below the poverty level may be at increased risk to extreme heat if use of air conditioning is not affordable. Areas with lower extreme heat thresholds are not necessarily at lower risk, as persons and community assets used to cooler temperatures may be less prepared for extreme heat events.

Very high temperatures can harm plants and animals that are not well adapted to them. This includes wild ecosystems as well as farm crops and livestock. Extreme heat can increase the temperature of water in lakes, streams, creeks, and other water bodies, especially during drought events when water levels are lower. In some cases, water temperatures may exceed comfortable levels for a number of plants and animals, causing ecological harm. Extreme heat is expected to have a severe effect on agriculture. Excessive heat and prolonged dry or drought conditions can impact agriculture by creating worker safety issues for farm field workers, severely damaging crops, and reducing availability of water and food supply for livestock. Outdoor workers are much more exposed to the elements than most people, so they are more susceptible to extreme heat conditions and the potential illnesses associated with very high temperatures. Additionally, excessive heat can cause high levels of mortality among livestock as well as damage to crops. Extreme heat can damage a number of different crops in unincorporated Riverside County.

Indirectly, extreme heat puts more stress on power lines, causing them to run less efficiently. The heat also causes more demand for electricity (usually to run air conditioning units), and in combination with the stress on the power lines, may lead to brownouts and blackouts.

Potential Changes to Extreme Heat in Future Years

Likelihood of Future Occurrence

Extreme heat tends to occur on an annual basis in unincorporated Riverside County and is likely to continue occurring annually. The threshold for extreme heat is likely to be lower in the higher elevations of the San Jacinto Mountains than in Coachella Valley where temperatures at or above 90°F are common most summer days.

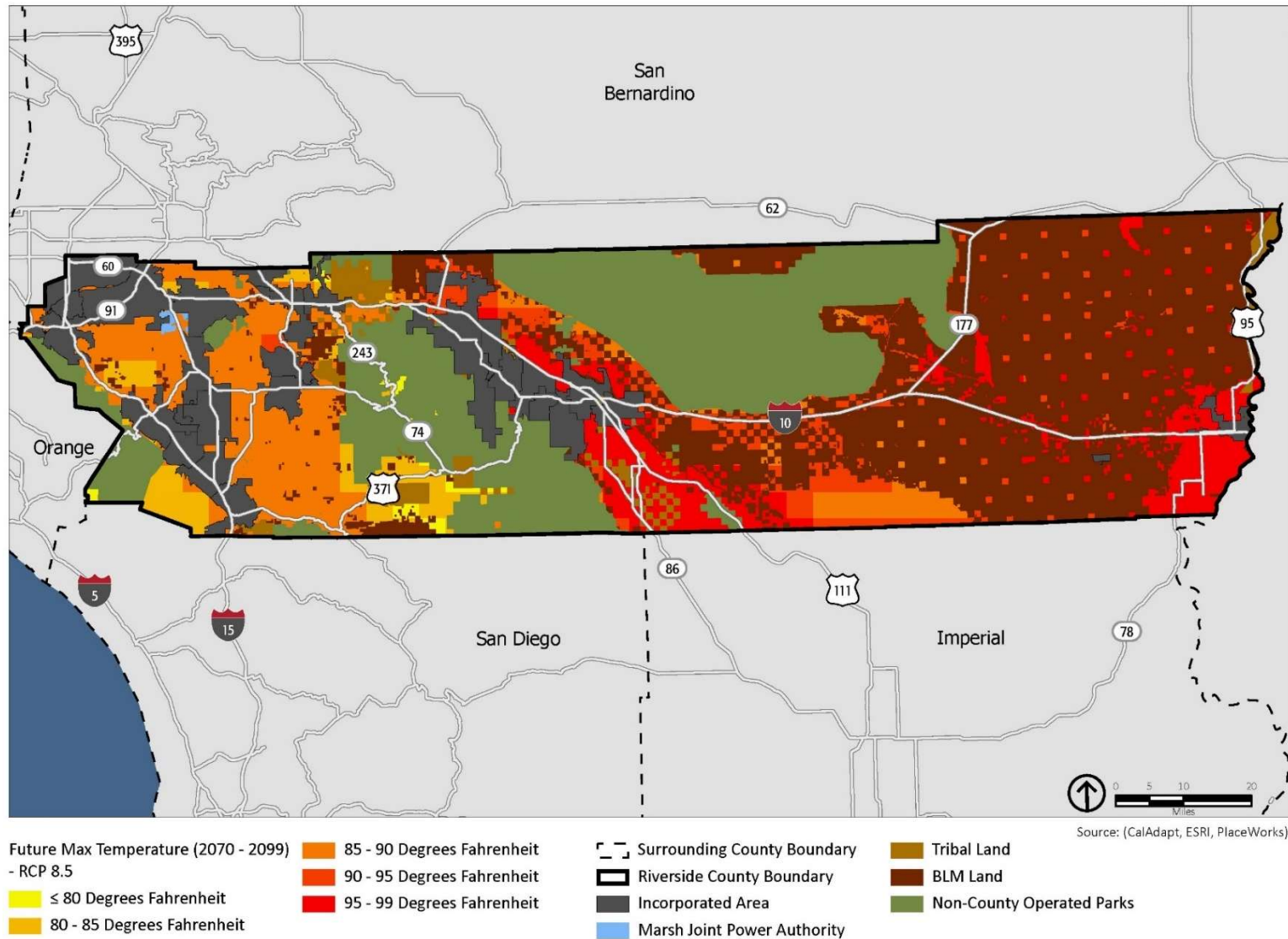
Climate Change and Extreme Heat

The warmer temperatures brought on by climate change are likely to cause an increase in extreme heat events in different regions of unincorporated Riverside County. Depending on the location and emissions levels, the state Cal-Adapt database indicates the number of extreme heat days is expected to rise from a historical annual average of 4 to between 26 and 37 by the middle of the century (2041 to 2060), and to between 39 and 63 by the end of the century (2070 to 2099), depending on the severity of climate change and the specific location. Cooler areas may see about as many extreme heat days as warmer areas. According to the California Energy Commission, the number of extreme heat days is projected to rise through 2050, where the average year could include 15 extreme heat days, and 30 extreme heat days per year by 2099.

Overall, unincorporated Riverside County is expected to see an increase in the average daily high temperatures. Although the temperature increases may appear modest, the projected high temperatures are substantially greater than historical norms. These increases also make it more likely that an above-average high temperature will cross the extreme heat threshold. Figure 14 shows the expected increases in average high temperatures as a result of climate change.

As temperatures increase, unincorporated Riverside County will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat. Climate change can also indirectly create a greater risk of agriculture and forestry pests and diseases. Many crop plants, trees, and livestock may be harmed and consequently weakened by extreme heat and warmer temperatures. The weaker plants and animals may not be able to fend off infestations or infections as well as a stronger plant or animal, causing pests and diseases to affect more of the population. These pests and diseases can cause plants and animals to grow slower, damage crops so their products are less appealing and harder to sell, or even kill them.

FIGURE 14: ANNUAL AVERAGE OF FUTURE HIGH TEMPERATURES



Severe Weather

Severe weather is generally any destructive weather event, but usually occurs in unincorporated Riverside County as localized storms that bring heavy rain, hail, lightning, and strong winds. Severe weather is usually caused by intense storm systems, although types of strong winds can occur without a storm. The types of dangers posed by severe weather vary widely and may include injuries or deaths, damage to buildings and structures, fallen trees, roads and railways blocked by debris, and fires sparked by lightning. Severe weather often produces high winds and lightning that can damage structures and cause power outages. Lightning from these storms can ignite forest and structure fires that can cause damage to buildings and endanger people. Objects can also be struck directly, which may result in an explosion, burn, or total destruction. Lightning happens occasionally and there have been six injuries and one death reported from lightning events since 1950. Hail events are rare and there have only been two reported injuries from hail in unincorporated Riverside County since 1950. In unincorporated Riverside County, most severe weather is linked to high winds. High winds, often accompanying severe storms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss.

Santa Ana winds have caused large amounts of damage and increased the fire damage level dramatically. Santa Ana winds are generally defined as warm, dry winds that blow from the east or northeast (offshore). These winds occur below the passes and canyons of the coastal ranges of Southern California. Santa Ana winds often blow with exceptional speed in the Santa Ana Canyon. The complex topography of Southern California, combined with various atmospheric conditions, creates numerous scenarios that may cause widespread or isolated Santa Ana events. Commonly, Santa Ana winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Nevada and west of the Rocky Mountains, including most of Nevada and Utah). Santa Ana winds commonly occur between October and February with December having the highest frequency of events. Summer events are rare. Wind speeds are typically north to east at 40 miles per hour (mph) through and below passes and canyons with gusts to 58 mph. Stronger Santa Ana winds can have gusts greater than 69 mph over widespread areas and, in rare instances, gusts greater than 115 mph in specific areas. Frequently, the strongest winds in the basin occur during the night and morning hours due to the absence of a sea breeze.

All wind events, including Santa Ana winds, pose several different types of threats. By themselves, the winds pose a threat to the health of people and structures in the county. Dust and plant pollen blown by the wind can create breathing problems. The winds can blow roofs off buildings and cause tree limbs to fall on structures. High winds also increase the threat of wildfires. Winds may dry out brush and forest areas, increasing the fuel load in fire-prone areas. Winds may spark wildfires by knocking down power lines or causing them to arc. If fires do start, high winds can push flames quickly into new areas, contributing to rapid spread of wildfires and making them harder to control.

Potential Changes to Severe Weather in Future Years

Likelihood of Future Occurrence

According to historical hazard data, severe weather is an annual occurrence in unincorporated Riverside County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the county. Wind and lightning often accompany these storms and have caused damage in the past. However, actual damage

associated with the primary effects of severe weather have been limited. It is the secondary hazards caused by weather, such as floods, fire, and agricultural losses that have had the greatest impact on the county.

Climate Change and Severe Weather

Climate change is expected to cause an increase in intense rainfall, which is usually associated with strong storm systems. This means that unincorporated Riverside County could see more intense storms in the coming years and decades, possibly causing an increase in the frequency of severe weather events and any associated hazards. Such an increase may not affect all forms of severe weather and may not always be apparent.

While average annual rainfall may increase or decrease slightly, climate change is expected to cause an increase in the number of years with intense levels of precipitation. Heavy rainfall can increase the frequency and severity of other hazards, including flooding and landslides. . Some already-rare forms of severe weather, such as tornados, are not expected to increase in a noticeable way.

Agriculture Hazards

Agriculture in unincorporated Riverside County must be considered from two standpoints, namely, both as a product producer/exporter and a major economic provider to the County of Riverside. In 2019, Riverside County ranked in the top 14 leading agricultural counties in California, with an agricultural production value of \$1.32 billion, according to the California Department of Food and Agriculture. Major agricultural industries include milk, nursery products, citrus, avocado, grapes, vegetables, and hay.

Riverside County is divided into two general agriculture regions, Desert and Western Riverside County, with the San Bernardino National Forest acting as a natural dividing line.

Desert – Coachella Valley and Palo Verde Valley

Agriculture, primarily crop growing, is the second largest industry in the Desert Valleys. Over 61 percent of Riverside County's crop production is grown in the Coachella and Palo Verde Valleys. In addition to crop production, many supporting industries, such as packing and distribution, are located in the desert area. The Coachella Valley produces 95 percent of all dates grown in the United States and the annual fruit crop exceeds 40 million pounds. The Desert region's list of agriculture-related products includes:

- Vegetable and melon crops (bell peppers, lettuce, corn, watermelon, etc.)
- Nursery stock
- Turf/sod producers
- Field crops (hay, cotton, wheat, etc.)
- Citrus
- Tree and vine crops (table grapes, dates)

Western Riverside County

Agriculture in the Western Riverside County region is an ever-changing industry. With the large increase in housing in this area of the county over the past few years, there has been a reduction of several agriculture-related industries. This reduction is primarily in the poultry and dairy industries. The Western Riverside County list of agriculture-related products includes:

- Dairy cattle
- Nursery stock
- Beef cattle
- Poultry and eggs
- Citrus crops
- Tree and vine crops (avocado, wine grapes)
- Field crops (wheat, hay, green chop)
- Vegetable crops (potatoes, etc.)
- Fish hatcheries (for domestic and international distribution)

According to the Hazard Mitigation Planning Committee, agricultural losses occur on an annual basis and are usually associated with severe weather events, including heavy rains, floods, heat, and drought. The 2018 State of California Multi-Hazard Mitigation Plan attributes most of the agricultural disasters statewide to drought, freeze, and insect infestations. Other agricultural hazards include fires, crop and livestock disease, and noxious weeds.

Potential Changes to Agriculture Hazards in Future Years

Likelihood of Future Occurrence

As long as severe weather and other natural hazard events continue to be an ongoing concern to unincorporated Riverside County, the potential for agricultural losses remains. The primary causes of agricultural losses are from extreme heat, drought, insect infestations, and severe weather events, such as high winds and freeze.

Climate Change and Agriculture Hazards

Extreme heat is expected to have the most severe effect on unincorporated Riverside County's agricultural assets, but drought, flooding, and severe weather may also cause significant harm. Droughts can make less water available for crop irrigation, potentially reducing yield if farmers cannot find alternative supplies. Extreme heat can damage a number of different crops in unincorporated Riverside County. Floods and severe weather can heavily harm or kill crops, and damage infrastructure, reducing agricultural yields and creating costly repairs. High winds often accompany severe storms and can result in significant damage to agriculture. One of the most

direct effects of climate change is that average temperatures will increase, and this has a bearing on many pests and diseases. Many pests and organisms that carry diseases are most active during warmer months, so the threat of infection or infestation can be higher during this time of year. Temperatures are expected to get warmer earlier in the year and remain warmer until later in the year due to climate change, creating a wider window for pests and diseases to be active.

Climate change can also indirectly create a greater risk of agriculture pests and diseases. Farms and ranches in unincorporated Riverside County all face risk from assorted pests and diseases that may affect crops, vineyards, and livestock. Many crop plants, trees, and livestock may be harmed and consequently weakened by warmer temperatures and changes in precipitation. The weaker plants and animals may not be able to fend off infestations or infections as well as a stronger plant or animal, causing pests and diseases to affect more of the agricultural areas. These pests and diseases can cause plants and animals to grow slower, damage them so their products are less appealing and harder to sell, or even kill them. Moreover, excessive heat and prolonged dry or drought conditions can impact agriculture by creating worker safety issues for farm field workers, severely damaging crops, and reducing availability of water and food supply for livestock.

Appendix A: Vulnerability Assessment Results

The tables below show the results of the Vulnerability Assessment prepared for Riverside County, in accordance with the requirements of Senate Bill 379. For each population or asset that may be vulnerable to each climate-related hazard, the population or asset is scored on a scale of one to five:

V1: Minimal vulnerability

V2: Low vulnerability

V3: Moderate vulnerability

V4: High vulnerability

V5: Severe vulnerability

The vulnerability scores reflect both the severity of climate-related impacts and the ability of populations and assets to resist and recover from these effects. Refer to the “Climate Change” and “Vulnerable Populations and Assets” sections of the Safety Element for additional details on the Vulnerability Assessment method.

POPULATIONS AND ASSETS	Agricultural Pests and Diseases	Air Quality	Drought	Extreme Heat	Flood	Human Health Hazards	Landslides	Severe Weather	Wildfire
POPULATIONS									
Children age <10		V4		V4		V2			V4
Ethnic communities/non-English speakers		V2		V2	V1	V2		V3	V2
Healthcare workforce (doctors, nurses)				V1	V1	V3		V1	V2
Homeless persons		V5	V3	V5	V4	V5		V5	V5
Household renters		V2	V3	V2	V2		V2	V3	V2
Householders age >65		V3		V4	V3	V3	V4	V2	V4
Households in poverty		V4	V5	V5	V4	V3	V3	V3	V4
Households overpaying for housing (>30% of income)		V3	V3	V3	V3	V1	V2	V1	V2
Individuals chronically ill		V4	V1	V5	V3	V5	V3	V4	V4
Individuals uncertain about available resources because of citizenship		V2		V2	V2	V2		V3	V2

POPULATIONS AND ASSETS	Agricultural Pests and Diseases	Air Quality	Drought	Extreme Heat	Flood	Human Health Hazards	Landslides	Severe Weather	Wildfire
Individuals with disabilities		V2		V4	V3	V2	V3	V3	V4
Individuals without access to lifelines		V3		V4	V5	V3	V3	V3	V4
Low-income individuals		V3	V4	V4	V5	V3	V2	V2	V3
Outdoor workers	V3	V5	V4	V5	V2		V1	V3	V4
Overcrowded households		V2	V1		V2	V2		V1	V2
Persons in mobile homes		V3		V3	V4	V1	V4	V4	V4
Pregnant or nursing women		V4		V3	V1	V5		V1	V2
Seasonal residents/migrant workers		V5	V5	V5	V2	V2	V2	V3	V4
Senior citizens living alone		V4		V5	V4	V4	V5	V3	V5
BUILDINGS AND STRUCTURES									
Adult residential care facilities							V2	V1	
Airports				V2	V4			V1	V3
Bridges					V3		V3	V3	V2
City Halls and government offices					V2		V1	V1	V2
Commercial structures					V4		V1	V3	V3
Communication infrastructure				V1	V2		V2	V2	V2
Community gathering areas					V1		V1	V1	V2
Dams					V1		V4	V1	V1
Emergency Systems					V1			V1	
Energy generation infrastructure		V2	V2		V2		V3	V2	V3
Energy transmission/delivery				V4	V3		V3	V4	V4

Chapter 6 Safety Element

POPULATIONS AND ASSETS	Agricultural Pests and Diseases	Air Quality	Drought	Extreme Heat	Flood	Human Health Hazards	Landslides	Severe Weather	Wildfire
Evacuation routes					V4		V3	V2	V4
Fire stations					V1		V2	V1	V1
Flood control center					V2			V1	V1
Foster homes					V3			V3	V3
Fueling infrastructure and pipelines				V1	V3		V3	V2	V3
Healthcare facilities				V1	V2		V1	V2	V3
Industrial structures					V3		V4	V3	V2
Major roads and highways				V3			V3	V2	V3
Military facilities									V1
Natural gas facilities					V2		V4		V3
Old residential structures				V2	V3		V3	V3	V4
Parks	V1		V1	V2	V2		V3	V3	V2
Police/sheriff stations					V2			V1	V1
Private recreational sites	V1		V2	V2	V1		V2	V2	V2
Public housing					V3			V3	V3
Public open space and protected land	V2		V3	V1	V1		V2	V3	V4
Public works corporation yards					V1			V1	
Railway				V4	V4		V4	V3	V2
Residential structures					V4		V4	V2	V4
Road signals/traffic control centers					V1		V2	V2	V3
Schools and childcare centers					V3		V3	V2	V2

POPULATIONS AND ASSETS	Agricultural Pests and Diseases	Air Quality	Drought	Extreme Heat	Flood	Human Health Hazards	Landslides	Severe Weather	Wildfire
Senior care centers					V3		V2	V1	V3
Sidewalks, bikeways, trails					V2		V3	V1	V2
Transit infrastructure					V4		V2	V3	V2
Transportation facilities and infrastructure				V1	V4		V2	V2	V3
Wastewater treatment plant and collection infrastructure			V2	V1	V4		V3	V2	V1
Water treatment plant and delivery infrastructure			V1	V1			V3	V2	V1
BIOLOGICAL RESOURCES									
Chaparral	V3		V4	V3			V2	V2	V3
Coastal sage scrub	V2		V3	V3	O		V3	V1	V3
Desert scrub	V1		V2	V1			V1	V1	V3
Grassland	V2		V3	V2	O		V2	V2	V2
Meadows and marshes	V2		V5	V4	O			V2	V2
Montane coniferous forest	V4		V5	V3			V2	V2	V4
Playas and vernal pools	V1			V3	O			V2	V2
Riparian scrub, woodland, and forest	V3		V4	V4	O		V3	V3	V5
Riversidean alluvial san sage scrub	V2		V4	V2	V1		V1	V1	V3
Woodland and forests	V4		V4	V4			V3	V2	V4
IMPORTANT ECONOMIC ASSETS									
Agricultural lands	V4	V2	V5	V5	V5		V3	V4	V3
Renewable energy		V2	V1	V1	V1		V1	V2	V4

POPULATIONS AND ASSETS	Agricultural Pests and Diseases	Air Quality	Drought	Extreme Heat	Flood	Human Health Hazards	Landslides	Severe Weather	Wildfire
State and federally owned land	V2		V3	V3	V1	V2	V3	V1	V3
Tourism	V1	V3	V2	V2	V2	V3	V2	V2	V3
KEY COMMUNITY SERVICES									
Communications				V2	V1		V1	V2	V3
Electricity			V2	V5	V2		V3	V4	V4
Emergency medical response				V1	V2	V2	V2	V2	V2
Government administration		V1			V1	V1			V1
Healthcare service delivery		V2		V1	V1	V3	V1	V1	V1
Natural gas							V3		V3
Public safety				V1	V2	V2	V3	V2	V3
Transit access				V3	V3		V2	V3	V2
Wastewater treatment			V3	V2	V4		V2	V3	V3
Water delivery			V4	V2			V3	V1	V4

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