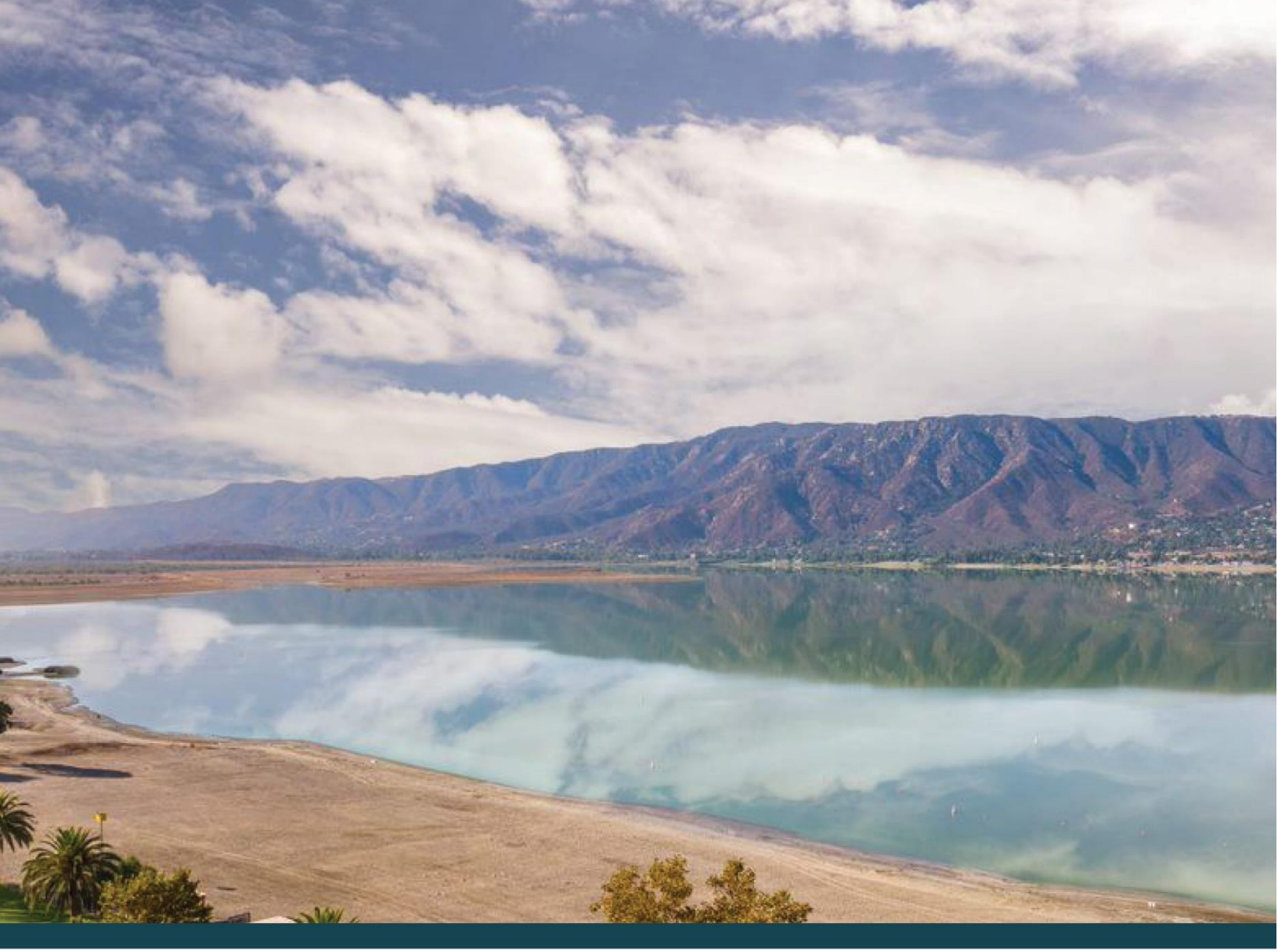

CLIMATE RESILIENCY VULNERABILITY ASSESSMENT

Lake Elsinore General Plan Update

FINAL
APRIL 2024

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ACRONYMS AND ABBREVIATIONS

AB: Assembly Bill

APG: Adaptation Planning Guide

CAL FIRE: California Department of Forestry and Fire Protection

CAP: Climate Action Plan

CalOES: California Office of Emergency Services

CEC: California Energy Commission

City: City of Lake Elsinore

CNRA: California Natural Resources Agency

EVMWD: Elsinore Valley Municipal Water District

FEMA: Federal Emergency Management Agency

FHSZ: Fire Hazard Severity Zone

FRA: Federal Responsibility Area (CAL FIRE)

GHG: Greenhouse Gas

ICS: California Incident Command System

IPCC: Intergovernmental Panel on Climate Change

LEUSD: Lake Elsinore Unified School District

LHMP: Lake Elsinore Local Hazard Mitigation Plan

LRA: Local Responsibility Area (CAL FIRE)

MJLHMP: Riverside County Multijurisdictional Local Hazard Mitigation Plan

OPR: California Office of Planning and Research

RPCs: Representative Concentration Pathways

RTA: Riverside Transit Agency

SB: Senate Bill

SRA: State Responsibility Area (CAL FIRE)

Executive Summary

PURPOSE

The City of Lake Elsinore is updating its Safety Element as part of the Lake Elsinore General Plan Update. A recent State of California law requires Safety Elements to assess climate change vulnerability and address climate change adaptation and resilience, as well as new information relating to flood and fire hazards. The goal of the State requirements is to increase Lake Elsinore's resiliency and enable the community to prepare for, respond to, withstand, and recover from disruptions created or worsened by climate change. The Climate Resiliency Vulnerability Assessment (Vulnerability Assessment) is the first step in updating the Safety Element to further include climate adaptation and resiliency planning and supports compliance with State laws.

REPORT STRUCTURE

The Vulnerability Assessment follows the process outlined in the California Adaptation Planning Guide 2.0 (APG) (released in 2020) to identify climate change related risks and hazards, assess community vulnerability, and discuss implications for the General Plan Update. The APG recommends that vulnerability assessments follow a four-step process: (1) characterizing the community's exposure to current and projected climate hazards; (2) identifying potential sensitivities and potential impacts to City populations and assets; (3) evaluating adaptive capacity; and (4) identifying priority vulnerabilities based on systematic vulnerability scoring. The report is structured around the APG's recommended four-step process.

KEY FINDINGS

Climate Change

In Lake Elsinore, climate change is expected to intensify existing hazards, such as flooding, wildfire, and drought, and create new hazards such as extreme weather.

Wet seasons will become wetter and dry seasons will become drier

According to the California Fourth Climate Change Assessment, Inland Deserts Region Report, precipitation in the Inland Empire will increase by 50 percent of current baseline climate models during the winter season, and summer monsoonal precipitation is expected to decrease by up to 40 percent.[1] The average annual precipitation for the historical baseline years of 1961 to 1990 was 13.7 inches. Projected annual rainfall in Lake Elsinore is projected to decrease to 13.2 inches by mid-century and 13.0 inches by the end of the century if emissions continue to rise strongly.[2] This could have dire impacts to potable water supplies and the natural recharge of Lake Elsinore. Drought can also lead to dry vegetative conditions, which can be a contributing factor to wildfires. During periods of intense rainfall, flooding could occur because there is too much water to be adequately drained into soils or drainage systems become overwhelmed. Landslides could also be caused by extreme precipitation events, flooding, and slope destabilization caused by vegetation loss and soil composition change from wildfires.

[1] Hopkins, Francesca. (University of California, Riverside). 2018. Los Angeles Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-008.
[2] Cal-Adapt. Maps of Projected Change. https://cal-adapt.org/tools/maps-of-projected-change/

Extreme heat events will become more frequent

Extreme heat occurs when temperatures rise significantly above normal levels. In Lake Elsinore, an extreme heat day occurs when temperatures reach above 103.9 °F. . The historical baseline (1961-1990) for the annual average maximum temperature in Lake Elsinore was 78.1°F. If emission continue to rise significantly, the annual average maximum temperature would reach 83.3°F by mid-century and 86.7°F by end of century. Although extreme heat usually does not cause substantial physical damage to the built environment, extreme heat creates a serious public health threat especially to vulnerable populations, including people with disabilities, the elderly, children, and outdoor workers. 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.

Wildfires will continue to be a threat

Recent research indicates that regional climate change will increase fire severity and frequency in Lake Elsinore. A warmer climate will bring drier winters with reduced snowpack, warmer springs with earlier snowmelts, and longer, drier summer fire seasons fueled by drier soils and vegetation from increasing drought frequency. Wildfires will remain a continuous threat in Lake Elsinore and can lead to a wide range of significant primary and secondary hazards. Beyond direct physical threats to life and property, wildfire smoke can reduce air quality and create public health concerns, especially for certain at-risk populations. Cascading hazards include flash floods, heavy erosion, landslides, and mudflows because of vegetation loss and slope destabilization in burn zones.[3]

Vulnerable Communities and Assets

People with limited financial resources, disabilities, and the elderly are highly vulnerable to climate change

Exposure to extreme heat, flooding, landslides, and wildfire leaves many populations highly or severely vulnerable due to the high impacts of exposure and lower levels of adaptive capacity. Adaptation to these hazards may not be possible or financially feasible for some populations.

Households in poverty (2,323 households in Lake Elsinore) have a higher vulnerability to climate hazards than low-income households (8,776 households in Lake Elsinore) because of the differences in financial resources between the two household categories (low-income households having more assets than households in poverty).

People with disabilities, populations over 65, and others with mobility challenges may face challenges in evacuating and thus are considered highly vulnerable to climate hazards which may require evacuation. Additionally, persons with disabilities, chronic illnesses, or seniors may rely on medical equipment that cannot be transported easily.

Lake Elsinore's health care workers, first responders and protective service occupations (13 percent of workers), outdoor workers (18 percent of workers) and houseless populations (an estimated 50

[3] County of Riverside Emergency Management Department, April 2023.

individuals) are highly vulnerable to many different climate hazards due to their high outdoor exposure and lack of alternative options that would reduce impacts of climate hazards.

Key infrastructure networks are the most vulnerable to climate change

Many of the key infrastructure networks (roads, freight routes, water systems, wastewater systems, electricity grid) in Lake Elsinore are vulnerable to climate change hazards due to their expensive and complex nature (integration within the system), high exposure to hazards, and the coordination and cost necessary to redesign or relocate the infrastructure.

Emergency and communication services are key services vulnerable to climate change hazards due to their active role in responding to climate events and local emergencies.

Areas of concentrated residential development are highly or severely vulnerable to several hazards. However, some homeowners, especially low-income or cost-burdened households, may not have the appropriate disaster insurance or the ability to pay to fix structure damage. Chronic climate change hazards could cause buildings to become permanently uninhabitable.

Lake Elsinore's wildlands and open spaces are highly susceptible to damage from drought, landslides, and wildfire. Drought can lower water levels and water quality, thus, stressing vegetative communities and wildlife. Higher temperatures and lack of water related to drought can stress the vegetative communities and make them more susceptible pest infestations and wildfire damage. Drought and wildfires can also lead to increased slope instability and landslide susceptibility across the Lake Elsinore's many steep slopes.

NEXT STEPS

Moving forward, the City will develop Safety Element goals and policies to address these issues and improve community resilience. Future community engagement is recommended to confirm the impact and adaptive capacity and of existing populations and assets and to identify future opportunities to increase community-wide climate resilience, especially of highly and severely vulnerable populations and assets.

Climate Resiliency Vulnerability Assessment

1. INTRODUCTION

The City of Lake Elsinore (City) is updating its Safety Element as part of the Lake Elsinore General Plan Update. A recent State of California law requires Safety Elements to assess climate change vulnerability and address climate change adaptation and resilience, as well as new information relating to flood and fire hazards. The goal of the State requirements is to increase Lake Elsinore's resiliency and enable the community to prepare for, respond to, withstand, and recover from disruptions created or worsened by climate change. The Climate Resiliency Vulnerability Assessment (Vulnerability Assessment) is the first step in updating the Safety Element to further include climate adaptation and resiliency planning; it helps Lake Elsinore comply with State laws, including Senate Bill (SB) 379, SB 1035, and SB 99, Assembly Bill (AB) 747 (Figure 1-1). This report follows the process outlined in the California Adaptation Planning Guide 2.0 (released in 2020) to identify climate change related risks and hazards, assess community vulnerability, and discuss implications for the General Plan Update.

WHAT IS A VULNERABILITY ASSESSMENT?

A vulnerability assessment is a detailed analysis of how changing climate conditions can harm people, physical structures, and other community assets throughout the City. The assessment looks at the increasing severity of climate change hazards to the City's people and assets and identifies which ones face the greatest risks. The City will use these results to prepare an update of the City's General Plan Safety Element to comply with the requirements of state law and increase resiliency throughout Lake Elsinore.

FIGURE 1-1: GUIDING LAWS

SB 379	SB 1035	SB 99	AB 747
SB 379 is the foundation for adaptation and resiliency in general plan safety elements—it requires local governments to conduct vulnerability assessments as part of their long-range public safety planning efforts and prepare policies that will protect against harm caused by climate change.	SB 1035 builds on earlier legislation and requires local governments to review and update their safety elements if needed during an update to their housing element or local hazard mitigation plan, or at least once every eight years. Any revisions should include updated information related to flood hazards, fire hazards, and climate adaptation and resilience.	SB 99 requires jurisdictions to review and update the safety element to include information identifying residential developments in hazard areas that do not have at least two emergency evacuation routes.	Assembly Bill 747 focuses on evacuation routes and requires local governments to identify evacuation route capacity, safety, and viability in the safety element or local hazard mitigation plan.

Community Profile

Lake Elsinore is located in the western portion of Riverside County, approximately 30 miles south of downtown Riverside; Lake Elsinore is bordered by the cities of Wildomar and Canyon Lake, and unincorporated communities of Meadowbrook, Quail Valley, Lakeland Village, Terra Cotta, and Alberhill. Los Angeles is approximately 60 miles northwest, Palm Springs 70 miles northeast, San Juan Capistrano 35 miles southwest, and San Diego 75 miles southwest.

Lake Elsinore is approximately 43 square miles in size. The City surrounds Lake Elsinore, the largest freshwater lake in southern California. The Cleveland National Forest within the Santa Ana Mountain range looms to the southwest of the City's Sphere of Influence. The majority of the City consists of rolling hills and heavily vegetated steep hillsides overlooking the Lake and City. Like many cities in the Inland Empire, Lake Elsinore contains large portions of undeveloped land and open spaces. Other land uses primarily consist of single-family residential homes, with multifamily homes and commercial land uses along major corridors. Industrial uses are predominantly located in Lake Elsinore's north-central area. Schools are located throughout the Lake Elsinore and other civic functions are largely located near the city center of the Historic Downtown District. Interstate 15 (I-15), also known as the Corona Freeway, runs northwest/southeast through Lake Elsinore's urbanized area connecting to nearby Corona and Murrieta. Ortega Highway (State Route 74 or SR-74) runs northeast/southwest connecting Lake Elsinore to Perris and Rancho Mission Viejo.

Lake Elsinore has a High Desert landscape and climate. The California Energy Commission divides California into several distinct climate zones. Lake Elsinore is within Zone 10, which encompasses San Bernardino, Riverside, and San Diego counties. According to Cal-Adapt, average high temperatures from years 1961 to 2005 ranged between 74.1 degrees Fahrenheit (°F) and 81.9 °F. For the same timeframe, the average low temperatures ranged between 43.8 °F and 49.2 °F. An average of five extreme heat days occurs per year, which are temperatures that exceed 103.9 °F[4]. According to Cal-Adapt, the City has historically received an annual average of 14.1 inches of precipitation. Most precipitation falls during the winter months with rare occurrences of late summer rainfall.

Regulatory Framework

As outlined in Figure 1-1, SB 379 requires General Plan safety elements to address climate change vulnerability, adaptation strategies, and emergency response strategies. SB 379 states:

> "This bill would, upon the next revision of a local hazard mitigation plan on or after January 1, 2017, or, if the local jurisdiction has not adopted a local hazard mitigation plan, beginning on or before January 1, 2022, require the safety element to be reviewed and updated as necessary to address climate adaptation and resiliency strategies applicable to that city or county. The bill would require the update to include a set of goals, policies, and objectives based on a vulnerability assessment, identifying the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, and specified information from federal, state, regional, and local agencies."

[4] The Cal-Adapt Extreme Heat Threshold is the 98th percentile of historical daily maximum temperatures for Lake Elsinore.

As specified in Government Code section 65302(g)(4)(A) vulnerability assessments must identify the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, utilizing federal, state, regional, and local climate vulnerability documentation such as APG 2.0 and the Cal-Adapt climate tool created by the California Energy Commission (CEC) and University of California, Berkeley Geospatial Innovation Facility. Other sources of information include data from local agencies regarding their adaptive capacity and historical data on natural events and hazards.

Per Government Code section 65302(g)(4)(B), adaptation policies, goals, and objectives are to be developed based on findings from the vulnerability assessment. Additionally, Government Code section 65302(g)(4)(C) requires jurisdictions to create a set of feasible implementation measures to reduce climate change impacts on new or proposed land uses. This Vulnerability Assessment has been prepared to meet those requirements.

SB 1035 builds on earlier legislation and requires local governments to review and update their safety elements if needed during an update to their housing element or local hazard mitigation plan, or at least once every eight years. Any revisions should include updated information related to flood hazards, fire hazards, and climate adaptation and resilience.

SB 99 requires jurisdictions to review and update the safety element to include information identifying residential developments in hazard areas that do not have at least two emergency evacuation routes.

AB 747 focuses on evacuation routes and requires local governments to identify evacuation route capacity, safety, and viability in the safety element or local hazard mitigation plan.

2. METHODOLOGY

This Assessment integrates information contained in numerous existing documents prepared by the City of Lake Elsinore and others describing various climate change hazards and identifying the vulnerability of populations or physical assets.

This Vulnerability Assessment generally follows the recommended process in the California Adaptation Planning Guide 2.0 (APG) (2020). The APG, published by the California Natural Resources Agency (CNRA) and California Office of Emergency Services (Cal OES), guides regional and local governments in identifying and reducing the harmful effects of climate change. The APG recommends that vulnerability assessments follow a four-step process: (1) characterizing the community's exposure to current and projected climate hazards; (2) identifying potential sensitivities and potential impacts to City populations and assets; (3) evaluating adaptive capacity; and (4) identifying priority vulnerabilities based on systematic vulnerability scoring (Figure 2-1).

WHAT IS VULNERABILITY?

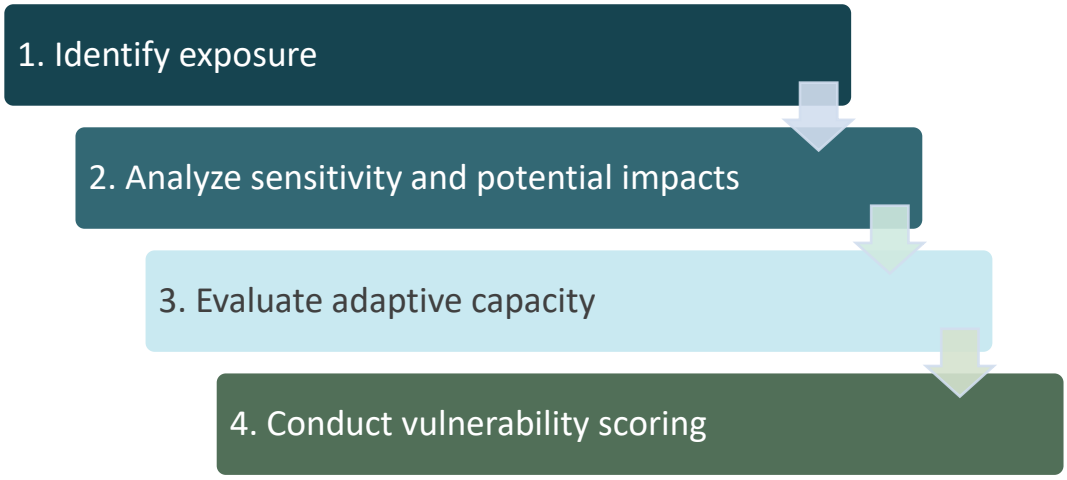
Vulnerability is the exposure of human life and property to damage from natural and human-made hazards. Climate vulnerability describes the degree to which natural, built, and human systems are at risk of exposure to climate change impacts.

Differences in exposure, sensitivity, and capacity to adapt affect an individual's or community's vulnerability to climate change. Vulnerability can increase because of physical (built and environmental), social, political, and/or economic factor(s).

Vulnerability is considered a function of exposure, sensitivity, and adaptive capacity.

Source: 2020 APG 2.0

FIGURE 2-1: CALIFORNIA ADAPTATION GUIDE VULNERABILITY ASSESSMENT METHOD



Step 1: Identify Exposure

Step 1's purpose is to understand existing hazards within Lake Elsinore and how these hazards will change. Existing hazards that can be worsened by the effects of climate change are identified and climate projection data was used to develop projections for how existing hazards are expected to change by mid- and late- century.

Lake Elsinore identified **six climate change hazards** for this assessment, listed here and discussed in detail in Chapter 3. These hazards were selected because they are required components of a General Plan safety element and they are worsened by climate change impacts.

Exposure is the presence of people, infrastructure, natural systems, and economic, cultural, and social resources in areas that are subject to harm.

Source: 2020 APG 2.0

- Drought
- Extreme Heat
- Flooding
- Landslides and Mudflows
- Severe Weather
- Wildfire

HOLY FIRE, LAKE ELSINORE (2018)

Source: FOX26 News, 2018.

Step 2: Analyze Sensitivity and Potential Impacts

Following the guidance in the APG, the City compiled a list of **population groups and community assets that are sensitive to localized climate change effects**. This list includes 17 population groups and 15 assets.

The City identified hazards likely to affect directly or indirectly specific populations and assets. Direct impacts affect buildings and infrastructure, populations, or immediate operations of economic activities or community services. Indirect impacts affect the broader system or community, including populations or asset types in a different category. For example, severe weather can directly damage electrical transmission lines (direct impact) causing power outages, which can indirectly impact persons with chronic illnesses (indirect impact) who depend on the electricity for life support systems. Therefore, both electrical transmission lines and persons with chronic illnesses were identified as being affected by severe weather and were evaluated in the assessment.

Sensitivity is the degree to which a species, natural system, or community, government, and other associated systems would be affected by changing climate conditions.

Impact is a specific negative result of a climate change effect, generally on a particular population or asset. Impact is often determined by the combination of exposure and sensitivity. For example, if the effect of climate change is that droughts are likely to become more frequent and severe, a potential impact to farmers is that less water could be available for irrigation.

Source: 2020 APG 2.0

To identify how great the impacts of each relevant exposure are on the sensitive populations and assets, the 2020 APG 2.0 recommends the following questions to help ensure the assessment broadly covers the range of potential harm:

- What types of impacts may occur?
- Could they cause physical injury or damage?
- Is there a risk of behavioral or mental harm, loss of economic activity, or other nonphysical effects?
- How many people or community assets could be affected by both direct and indirect harm?
- How long would the impacts persist?
- Is there a substantial chance of death or widespread destruction?

Based on the results of the impact assessments, impacts to each population and asset were ranked on a three-point scale from low to high for each relevant exposure (see Appendix A for rankings). As impact is a negative quality, a lower impact score is better (i.e. a lower score means less impact experienced from exposure to a specific climate hazard). This step is summarized in a series of tables identifying the exposure and impact of hazards to populations and assets.

TABLE 2-1: IMPACT SCORING

Impact Score	*Impact Meaning to Population or Ecosystem*	*Impact Meaning to Assets*
Low Impact	Impact is unlikely based on projected exposure; would result in minor consequences to public health, safety, and/or other metrics of concern. Some may not experience or notice any change.	There are minor interruptions in service, damage or negative effects on the economy. Effects may be small or intermittent enough to go mostly unnoticed.
Medium Impact	Impact is somewhat likely based on projected exposure; would result in some consequences to public health, safety, and/or other metrics of concern.	Damage, service interruptions, and other impacts are clearly evident. Impacts may be chronic and occasionally substantial.
High Impact	Impact is highly likely based on projected exposure; would result in substantial consequences to public health, safety, and/or other metrics of concern. This includes widespread injury or death to people or significant or total ecosystem loss.	Impacts are chronic. Buildings, infrastructure, and services may be often or always unable to meet community demand and cannot function as intended or needed. Large sections of the economy experience major hardships.

Step 3: Evaluate Adaptive Capacity

Step 3's goal is to characterize the City's current ability to cope with climate impacts. The City, partner agencies, and countywide organizations have taken steps to build resilience and protect sensitive populations and assets from hazards. The City's ability to adapt to each of the identified climate impacts is determined through a review of existing plans, policies, and programs.

Adaptive capacity is the "combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts [or] moderate harm or [to] exploit beneficial opportunities. Simply stated, it is the ability to adjust to potential damage, to take advantage of opportunities, or to respond to consequences."

Source: 2020 APG 2.0

Following a similar process as used to analyze impacts, the 2020 APG 2.0 recommends various questions to help make sure that the adaptive capacity assessment covers the full potential of a sensitivity to resist and recover from harm. Questions include:

- Are there existing programs and policies to provide assistance?
- Can affected community members take advantage of these programs?
- Are there barriers that limit response or recovery?
- Are these barriers financial limitations, political challenges, lack of access to technology or other resources, or others?
- For community assets, do alternatives exist in or near Lake Elsinore that community members can use?

Based on the results of the adaptive capacity assessment, Lake Elsinore ranked each sensitivity on a three-point scale from low to high. Adaptive capacity is a positive quality, so a higher adaptive capacity score is better. The outcome of this step is an assessment summarized in tables describing Lake Elsinore's capacity to adapt to each of the climate impacts based on existing polices, plans, and programs and the adaptive capacity scoring tables in Appendix A. The results of this step then feed into the final phase of vulnerability scoring.

In the context of this vulnerability assessment, the term "resources" can include financial, social, technological, and/or organizational means that a population or asset has access to. Access to resources can increase or decrease adaptive capacity.

TABLE 2-2: ADAPTIVE CAPACITY

Adaptive Capacity Score	*Meaning (all Populations and Assets)*
Low Capacity	Adaptive solutions are available, but they are expensive, technologically difficult, and/or politically unpopular. Alternatives may not exist that can provide similar services.
Some Capacity	Some adaptation methods are available, but not always feasible. Adapting may create significant challenges for some sensitivities. Some alternatives exist within the jurisdiction area that can provide similar services.
High Capacity	Adaptation solutions are feasible for most or all sensitivities. There may be occasional or small-scale challenges to implementing adaptation methods. Many alternatives exist in the area that can provide similar services.

Step 4: Conduct Vulnerability Scoring

Lastly, this step determines Lake Elsinore's greatest climate vulnerabilities through a vulnerability scoring process. Vulnerability is based on several factors including:

- How severe projected climate exposures will be,
- How sensitive population groups and assets are to the anticipated climate effects,
- Whether sufficient adaptive capacity exists to manage the potential impact.

The outcome of this step is a summary of vulnerabilities in a matrix showing the vulnerability score of the populations and assets for each applicable climate hazard. Vulnerability is assessed on a scale of 1 to 5:

- V1: Minimal vulnerability
- V2: Low vulnerability
- V3: Moderate vulnerability
- V4: High vulnerability
- V5: Severe vulnerability

The matrix below shows how different impact and adaptive capacity scores translate to a vulnerability score.

TABLE 2-3: VULNERABILITY SCORING MATRIX

		Impact Score		
		Low Impact	*Medium Impact*	*High Impact*
Adaptive Capacity Score	*Low Capacity*	V3	V4	V5
	Some Capacity	V2	V3	V4
	High Capacity	V1	V2	V3

The vulnerability scoring assessment helps the City understand which populations and assets are most sensitive to climate change, have the greatest adaptive capacity, and are most urgent and should be prioritized for developing adaptation strategies in the Safety Element.

Next Steps

Upon completion of the vulnerability assessment, Lake Elsinore will begin preparing the Safety Element update with a focus on filling in any identified gaps in existing resiliency planning policy and identifying implementation programs to carry out the policy. The Safety Element will be developed with climate adaptation and resiliency strategies that are based on the outcomes of this vulnerability assessment.

Guiding Documents

California Adaptation Planning Guide

The California Office of Emergency Services (CalOES) published the 2020 Adaptation Planning Guide 2.0 (APG) to provide vulnerability assessment and adaptation planning guidance for communities. CalOES released APG 2.0 (dated June 2020), which includes guidance with an increased focus on equity and outreach, and best practices. APG 2.0 provides a framework for communities to identify potential climate change effects and important physical, social, and natural assets, create adaptation strategies to address climate change impacts, and develop a monitoring and implementation framework for climate change adaptation (CalOES 2020). This vulnerability assessment was prepared according to the guidance provided in APG 2.0.

California's Fourth Climate Assessment

CNRA, OPR, and CEC prepared California's Fourth Climate Assessment in 2018. The Climate Assessment was designed to address critical information gaps that decision-makers at the state, regional, and local levels need to close to protect and build the resilience of people, infrastructure, natural systems, working lands, and waterways. The Vulnerability Assessment relies upon California's Fourth Climate Assessment to provide background information and evidence of regional climate change impacts.

Safeguarding California Plan

Alongside the update to the Climate Assessment, CNRA released the Safeguarding California Plan in 2018 which provides a roadmap for State government action to build climate resilience. The Safeguarding California Plan identifies actions the State government will take to protect communities, infrastructure, services, and the natural environment from climate change impacts and includes strategies for use as

local examples for climate adaptation. The Vulnerability Assessment relied upon the Safeguarding California Plan to provide guidance on assessing the City's vulnerability to climate change.

Lake Elsinore and Regional Planning Efforts

In addition to State adaptation efforts, the City and supporting agencies have developed planning documents focused on local and regional adaptation to climate change hazards. These planning documents analyze existing hazards and include strategies or guidelines to mitigate their severity. The City's Local Hazard Mitigation Plan (LHMP), Climate Action Plan (CAP), Emergency Operations Plan, and General Plan; Riverside County's Multijurisdictional Local Hazard Mitigation Plan (MJLHMP) and CAP; Western Riverside Council of Government's Western Riverside County Vulnerability Assessment and California's Fourth Climate Change Assessment Los Angeles Region Summary Report were all considered in the development of this vulnerability assessment.

Data Sources

The vulnerability assessment is based on the best available science and information contained in the available supporting documents. It uses data from a variety of credible sources including state and federal data, and locally provided data.

State and Federal Data

Lake Elsinore relied on data from state and federal agencies, including published reports and datasets. The state APG provided extensive information about climate-related exposures and vulnerabilities, as did federal reports such as the National Climate Assessment.

Cal-Adapt, a web-based tool developed by the California Energy Commission, provided highly specific information about historic climate conditions and future climate projections. The data available on this website offers a view of how climate change will likely affect Lake Elsinore.

Documents from the California Natural Resources Agency, such as the Safeguarding California and California Climate Adaptation Strategy reports, provided additional information about state climate vulnerabilities and adaptation strategies. Lake Elsinore also relied on information from several agencies including the California Department of Forestry and Fire Protection (CAL FIRE) and the California Energy Commission. Lake Elsinore also relied on demographic data from the US Census Bureau.

Local Data

In addition to the City and Regional documents listed under guiding documents, this Vulnerability Assessment also relied on spatial data maintained by Lake Elsinore and Riverside County. This data shows the location of various buildings and infrastructure, different land uses, boundaries, areas at risk of different hazards, and other items of importance to the vulnerability assessment. The documents described under guiding documents and used as sources of local data include:

1. Lake Elsinore Local Hazard Mitigation Plan (2017)
2. Lake Elsinore Climate Action Plan (2011)
3. Lake Elsinore General Plan (2011)
4. Lake Elsinore Emergency Operations Plan (2007)
5. Riverside County Multijurisdictional Local Hazard Mitigation Plan (2023)
6. Riverside County Climate Action Plan Update (2019)

7. Western Riverside Council of Governments Western Riverside County Vulnerability Assessment (2019)

3. CLIMATE CHANGE HAZARDS OF CONCERN

Climate Scenarios

Climate change is a long-term change in the average meteorological conditions in an area. Currently, the global climate is changing due to an increase in greenhouse gas (GHG) emissions that trap heat near the Earth's surface. While some levels of these gases are necessary to maintain a comfortable temperature on Earth, an increased concentration of these gases due to human activity traps additional heat, changing Earth's climate system in several ways ranging from extended periods of drought, extreme periods of heat, to increased frequency and intensity of storms. This can create intensified or new hazardous conditions that can increase the risk of damage to critical infrastructure, injury to populations, particularly sensitive populations, and disruption of essential services.

Climate Change Modeling Considerations

The Intergovernmental Panel on Climate Change (IPCC), an organization that represents the global scientific consensus about climate change, has identified four climate scenarios, also called Representative Concentration Pathways (RCPs), that can be used to project future conditions.[5] RCPs are labeled with different numbers (e.g., RCP 2.6, RCP 6) that refer to the increase in the amount of energy that reaches each square meter of Earth's surface under that scenario. The four RCPs are:

- RCP 2.6: Under this scenario, global GHG emissions peak around 2020 and then decline quickly.
- RCP 4.5: Under this scenario, global GHG emissions peak around 2040 and then decline.
- RCP 6: Global emissions continue to rise until the middle of the century.
- RCP 8.5: Global emissions continue to increase at least until the end of the century.

Climate hazard projections from Cal-Adapt and other sources rely on climate models, which are computer simulations that forecast future climate conditions under these different RCP scenarios. It is important that the City accounts for all reasonably plausible future conditions, including the most severe of plausible conditions, which will help ensure greater resiliency to climate change. Therefore, the projections in the Vulnerability Assessment use the RCP 8.5 scenario, following State of California guidance from the California Adaptation Planning Guide. No model can project future conditions perfectly, but current models are heavily reviewed by climate scientists and can accurately reproduce observed climate conditions.

The Vulnerability Assessment also relies on the understanding that "weather" and "climate" are two different phenomena.[6] "Weather" describes the conditions at a particular time and place, and "climate" describes the long-term average of conditions. As weather varies greatly, it is difficult to accurately project weather conditions more than a few days in advance. However, climate is a long-term average; it can be projected out for years or decades with a higher degree of accuracy. It is important to remember that, because climate is an average, climate projections do not say whether an event will or will not

[5] County of Placer. 2018. Placer County Sustainability Plan Vulnerability Assessment Report. Administrative Draft. October 2018.
[6] Ibid.

occur, only how likely it is. For example, extreme heat is likely to become more frequent in California but a year with few heat waves does not mean that this projection is wrong. The projection only says that extreme heat days are expected to occur, on average, more often than in the past.

Climate Change in Lake Elsinore

In Lake Elsinore, climate change is expected to intensify existing hazards, such as flooding, wildfire, and drought, and create new hazards such as extreme weather. The Riverside County MJLHMP Plan identifies fire, flood, power failure, extreme weather, and drought to be the top five hazards of concern impacting Lake Elsinore in chronological order. This Vulnerability Assessment evaluates how climate change hazards of concern are expected to occur, including frequency and severity, and how these hazards will affect community populations and assets.

Drought

Hazard Profile

Drought occurs when conditions are drier than normal for an extended period, making less water available for people and ecosystems. Droughts are a regular occurrence in California; however, scientists expect that climate change will lead to more frequent and more intense droughts statewide. Overall, precipitation levels are expected to remain similar, with more years of extreme precipitation events and droughts that last longer and are more intense. Drought conditions mean less water is available for human use and natural ecological systems. According to the California Fourth Climate Change Assessment, Inland Deserts Region Report, precipitation in the Inland Empire will increase by 50 percent of current baseline conditions during the winter season and summer monsoonal precipitation is expected to decrease by up to 40 percent.[7]

Lake Elsinore's water supply consists of a blend of local groundwater, surface water from Railroad Canyon Reservoir (Canyon Lake), and imported water.[8] Imported water is the main source of potable water in Lake Elsinore, accounting for approximately 65 percent of Elsinore Valley Municipal Water District's (EVMWD) supply. The majority of EVMWD's imported water is sourced from the Colorado River Aqueduct and State Water Project. Additional sources include disinfected water from Lake Skinner and Lake Mathews, located in the cities of Temecula and Riverside respectively.[9] The City's reliance on imported water mitigates the impact of local drought conditions on potable water users, unless imported water sources are also impacted by drought conditions.

Beyond potable water, drought can lead to a wide range of additional environmental, social, and economic impacts. The City relies on annual rainfall and urban runoff to recharge Lake Elsinore, which is a major source of local recreation and tourism. Under drought conditions, businesses and residents would be impacted by reduced use of the lake due to lower water levels and water quality issues such as algae blooms and fish kills. Drought can also lead to dry vegetative conditions, which can be a contributing factor to wildfires.

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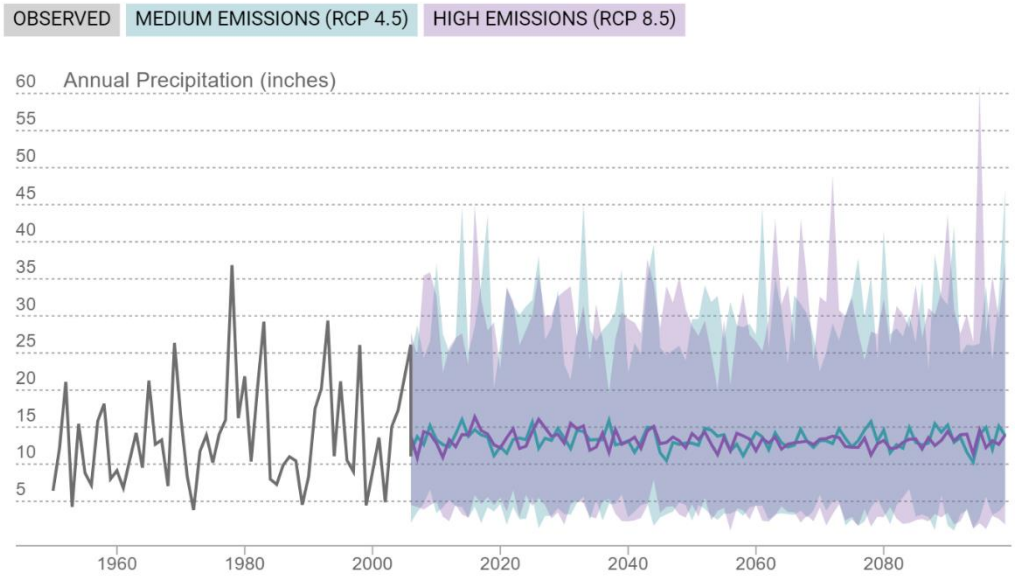
[7] Hopkins, Francesca. (University of California, Riverside). 2018. Los Angeles Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-008.
[8] "Water Resources," Elsinore Valley Municipal Water District, November 22, 2023, https://evmwd.com/who-we-are/water-resources/.
[9] Ibid.

Figure 3-1 below shows average annual precipitation under two different GHG emission scenarios; a medium emissions scenario (RCP 4.5) in which emissions peak around 2040, then decline and a high emissions scenario (RCP 8.5) in which emissions continue to rise strongly through 2050 and plateau around 2100. The average annual precipitation for the historical baseline years of 1961 to 1990 was 13.7 inches. Under the medium emissions scenario, projected annual rainfall in Lake Elsinore would decrease to 13.1 inches by mid-century (2035 to 2064) and then increase to 13.5 inches by the end of century (2070 to 2099). Under the high emissions scenario, projected annual rainfall decreases to 13.2 inches by mid-century and 13.0 inches.[10] The bold teal and purple lines in Figure 3-1 represent the most likely outcome and the less saturated teal and purple shading shows the range of future projections of annual precipitation.

FIGURE 3-1: PROJECTED ANNUAL PRECIPITATION IN LAKE ELSINORE



Source: Cal Adapt, Local Climate Change Snapshot for Lake Elsinore (2023)

Disaster History

Drought is a pervasive feature of Southern California, including Lake Elsinore. The most recent drought was experienced from 2011-2015 because of historically warm temperatures, dry soils, precipitation deficits, and low snowpack. Within the past 50 years, other significant droughts occurred during the following years: 1976-1977, 2002, 2007 and 2011-16.[11]

Probability of Future Events

Scientists expect that climate change will lead to more frequent and more intense droughts statewide. Overall precipitation levels are expected to stay similar but there will be more years with extreme levels

[10] Cal-Adapt. Maps of Projected Change. https://cal-adapt.org/tools/maps-of-projected-change/
[11] "COUNTY OF RIVERSIDE OPERATIONAL AREA Multi-Jurisdictional Local Hazard Mitigation Plan." County of Riverside Operational Area: County of Riverside Emergency Management Department, April 2023.

of precipitation, both high and low, due to climate change.[12] This is expected to cause more droughts that last longer and are more intense. Higher air temperatures and increasing extreme heat days are also expected to increase evaporation, causing more water loss from lakes and reservoirs, and decreasing soil moisture to greater depths.

Extreme Heat

Hazard Profile

Extreme heat occurs when temperatures rise significantly above normal levels. In Lake Elsinore, an extreme heat day occurs when temperatures reach above 103.9 °F.

Although extreme heat usually does not cause substantial physical damage to the built environment, extreme heat creates a serious public health threat especially to vulnerable populations, including people with disabilities, the elderly, children, and outdoor workers. Extreme heat events are dangerous because people exposed to extreme heat can suffer a number of heat related illnesses. Extreme heat events often result in increased nighttime temperatures, which prevents overnight cooling and, as a result, reduces the relief from heat typically provided by nighttime temperatures. Very high temperatures can harm plants and animals as well as farm crops and livestock. 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.

WHAT IS EXTREME HEAT?

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 are called extreme heat days.

WHAT IS A HEAT WAVE?

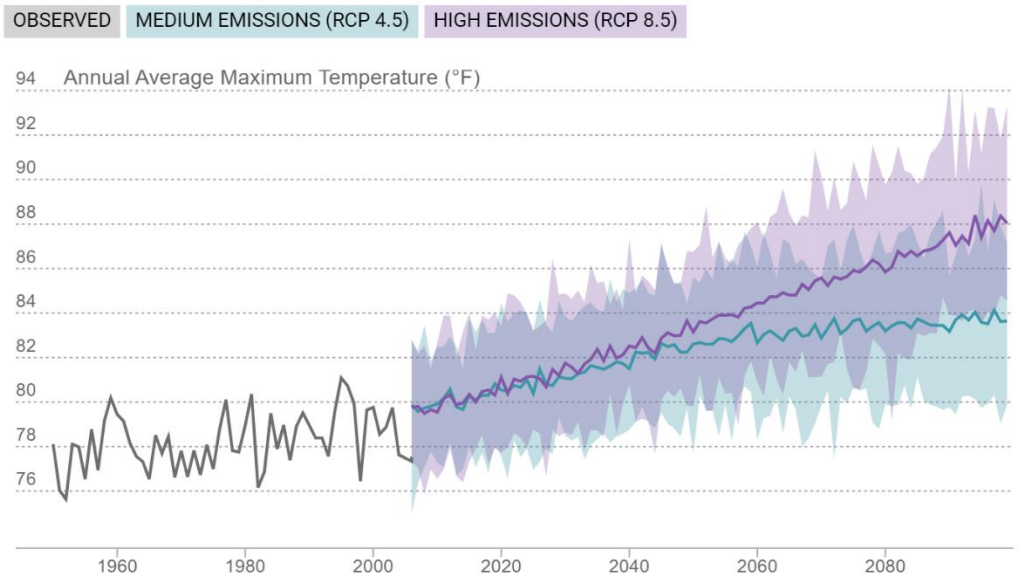
An event with five extreme heat days in a row.

Source: 2020 APG (2.0)

Figure 3-2 shows the projected average of all the hottest daily temperatures in a year in Lake Elsinore under medium (RCP 4.5) and high (RCP 8.5) emissions scenarios. The historical baseline (1961-1990) for the annual average maximum temperature in Lake Elsinore was 78.1°F. Under the medium emissions scenario, the annual average maximum temperature would reach 82.5°F by mid-century (2035-2064) and 83.5°F by end of century (2070-2099).[13] Under the high emissions scenario, the annual average maximum temperature would reach 83.3°F by mid-century and 86.7°F by end of century. The bold teal and purple lines in Figure 3-2 represent the most likely outcome and the less saturated teal and purple shading shows the range of future projections of annual average maximum temperature.

[12] Hall, Berg, Reich, Los Angeles Summary Report, 2018.
[13] "Lake Elsinore Local Climate Change Snapshot," Cal-Adapt, accessed November 2023, https://cal-adapt.org/tools/local-climate-change-snapshot/.

FIGURE 3-2: PROJECTED ANNUAL AVERAGE MAXIMUM TEMPERATURE IN LAKE ELSINORE



Source: Cal-Adapt, Local Climate Change Snapshot for Lake Elsinore (2023)

Disaster History

For purposes of the Cal-Adapt tool, a heat wave is defined as a period of four consecutive extreme heat days or warm nights when the daily maximum/minimum temperature is above the extreme heat threshold (103.9ºF). Lake Elsinore had an average of five extreme heat days and five warm nights between 1950 and 2005, lasting an average of three days. All extreme heat days and warm nights in this time period occurred between May and October.[14]

Average temperatures and the number of extreme heat events have increased in Lake Elsinore in recent years. The Cal-Adapt tool shows the projected annual average number of extreme heat days and warm nights to be thirteen from 2006 to 2023, lasting an average of four days. The average annual number of heat waves was projected to be one from 2006 to 2023.[15]

Probability of Future Events

The frequency, intensity, and duration of extreme heat events and heat waves are expected to rise significantly because of climate change, with an increased number of extreme heat days and nights, increased temperatures over extreme heat days and greater duration of extreme heat events. By the end of the century, Lake Elsinore will average four heat waves a year, with the average longest heat wave lasting eight days. Extreme heat events will also extend seasonally into early spring and fall.[16]

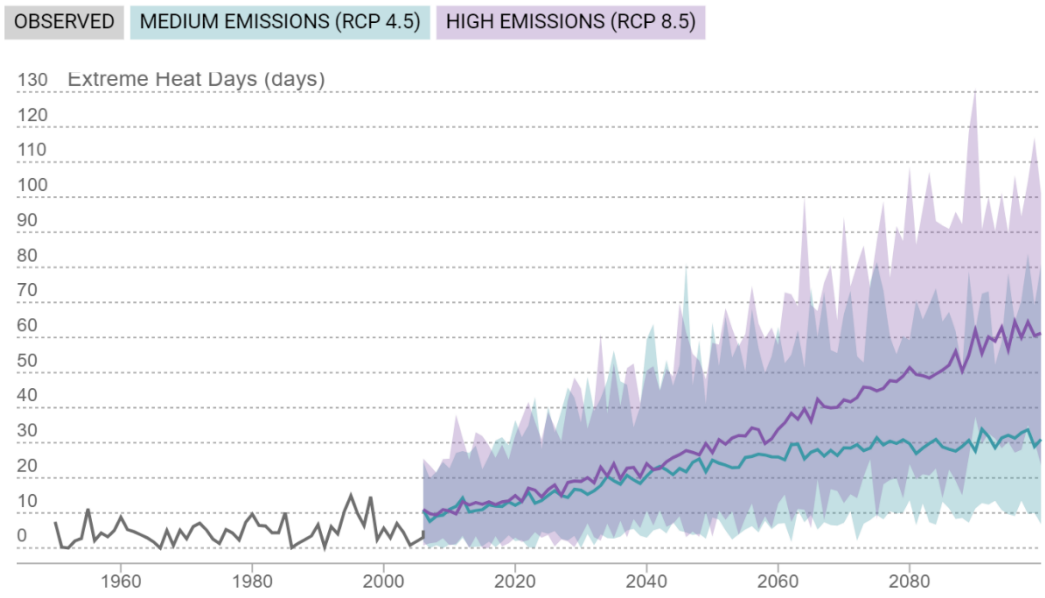
Under a scenario in which emissions peak around 2040, then decline, the average annual number of extreme heat days and warm nights in Lake Elsinore is projected to increase to 24 and 23 by 2064, and 30 and 30 by 2099. The timing of extreme heat days and warm nights is projected to expand from May to

[14] Ibid.
[15] Ibid.
[16] Ibid.

October (historical) to March to October. The average duration of extreme heat days is projected to be seven days by 2064 and eight days by 2099 under this scenario. The average annual heat wave frequency is projected to be three by 2064 and four by 2099.[17]

Under a scenario in which emissions continue to rise strongly through 2050 and plateau around 2100, the average annual number of extreme heat days and warm nights in Lake Elsinore is projected to increase to 31 and 32 by 2064, and 51 and 64 by 2099. The timing of extreme heat days and warm nights is projected to expand from May to October (historical) to February to November. The average duration of extreme heat days is projected to be nine days by 2064 and 25 days by 2099 under this scenario. The average annual heat wave frequency is projected to be four by 2064 and 11 by 2099.[18] Figure 3-3 shows the projected number of extreme heat days (i.e., the number of days in a year when daily maximum temperature is above a threshold temperature) in Lake Elsinore under medium and high emissions scenarios. The bold teal and purple lines in Figure 3-3 represent the most likely outcome and the less saturated teal and purple shading shows the range of future projections of extreme heat days.

FIGURE 3-3: PROJECTED EXTREME HEAT DAYS IN LAKE ELSINORE



Source: Cal-Adapt, Local Climate Change Snapshot for Lake Elsinore (2023)

[17] "Lake Elsinore Local Climate Change Snapshot," Cal-Adapt, accessed November 2023, https://cal-adapt.org/tools/local-climate-change-snapshot/.
[18] Ibid.

Flooding

Hazard Profile

A flood occurs when there is too much water on the ground to be held within local bodies of water, drain into soils, or to be carried away by rivers or urban drainage systems, causing the water to flow into normally dry areas. Watershed flooding is the primary form of flooding that impacts Lake Elsinore. Watershed flooding results from the runoff of severe or prolonged rainfall that overwhelms streams and drainages within the watershed. Major watershed floods are typically generated by rainstorms that include periods of high intensity rainfall.

LAKE ELSINORE FLOOD SOURCES

- Arroyo del Toro
- Channel H
- Elsinore Spillway Channel
- Lake Elsinore
- Leach canyon Channel
- Lime Street Channel
- McVicker Canyon
- Ortega Wash
- Ortega Channel
- Rice Canyon
- San Jacinto River
- Stovepipe Canyon Creek
- Temescal Walsh
- Wash G
- Wash I
- Murrieta Creek
- Wasson Canyon Creek
- Railroad Canyon Dam (if incidence of failure occurs)

Flooding can cause significant harm to people, buildings, infrastructure, and the natural environment. Floodwater can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Floodwater can cause significant erosion, which can lead to slope instability, severely damage transportation and utility infrastructure by undermining foundations, wash away pavement, or cause extensive damage to buildings and personal property. Flood events that develop very quickly, called flash floods, are especially dangerous because there may be little advance warning.

Large portions of Lake Elsinore are located within the Federal Emergency Management Agency (FEMA) mapped 100-year special flood hazard zones, see Figure 3-4. For this reason, flooding is a primary hazard of concern in Lake Elsinore.

Regional flood control is under the jurisdiction of the Riverside County Flood Control and Water Quality Management District. The District is also responsible for the maintenance and operation of flood control facilities, including debris dams, storm channels, and storm drains. The City of Lake Elsinore also owns and maintains flood control facilities that are part of the drainage plans for individual projects.

Disaster History

In the past decade, the City experienced flood damage from numerous winter storms that have overwhelmed the City's storm drainage system and created localized flood problems.[19] In February 2019, numerous areas of Lake Elsinore, especially areas adjacent to the 2018 Holy fire burn area, experienced flooding and mudflows from heavy rains. Lake Elsinore itself also has a history of flooding. In 1980, heavy rainstorms caused the Lake to flood, destroying nearby homes and businesses. To mitigate future flood damage, a new system was implemented to allow water to be released from Canyon Lake Dam and the

[19] Rick De Santiago, "Lake Elsinore Local Hazard Mitigation Plan" (Lake Elsinore: City of Lake Elsinore, June 2017).

Lake Elsinore Management Project was constructed from 1988-1994, consisting of an earthen levee, an operations island and causeway for well operations, drilling new wells, providing controlled overflow points into the Lake and creating new wetlands habitat areas.[20] All new development projects in Lake Elsinore are required to consider flooding and storm drainage effects. Limited encroachment into the 100-year floodplain fringe is allowed to permit development of properties within this area. However, encroachment shall maintain a focus on public facilities such as roads, parks, sewer and water improvements, and pedestrian routes. No development of the floodway is allowed.

Probability of Future Events

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. Although there are no specific flooding projections for Lake Elsinore and the broader region, multiple local and regional planning documents project that flood events are expected to become more frequent with the expected increase of extreme precipitation events linked to climate change.

[20] "About Lake Elsinore," Lake Elsinore and San Jacinto Watersheds Authority LESJWA, accessed November 2023, https://mywatersheds.com/about-us/about-lake-elsinore/.

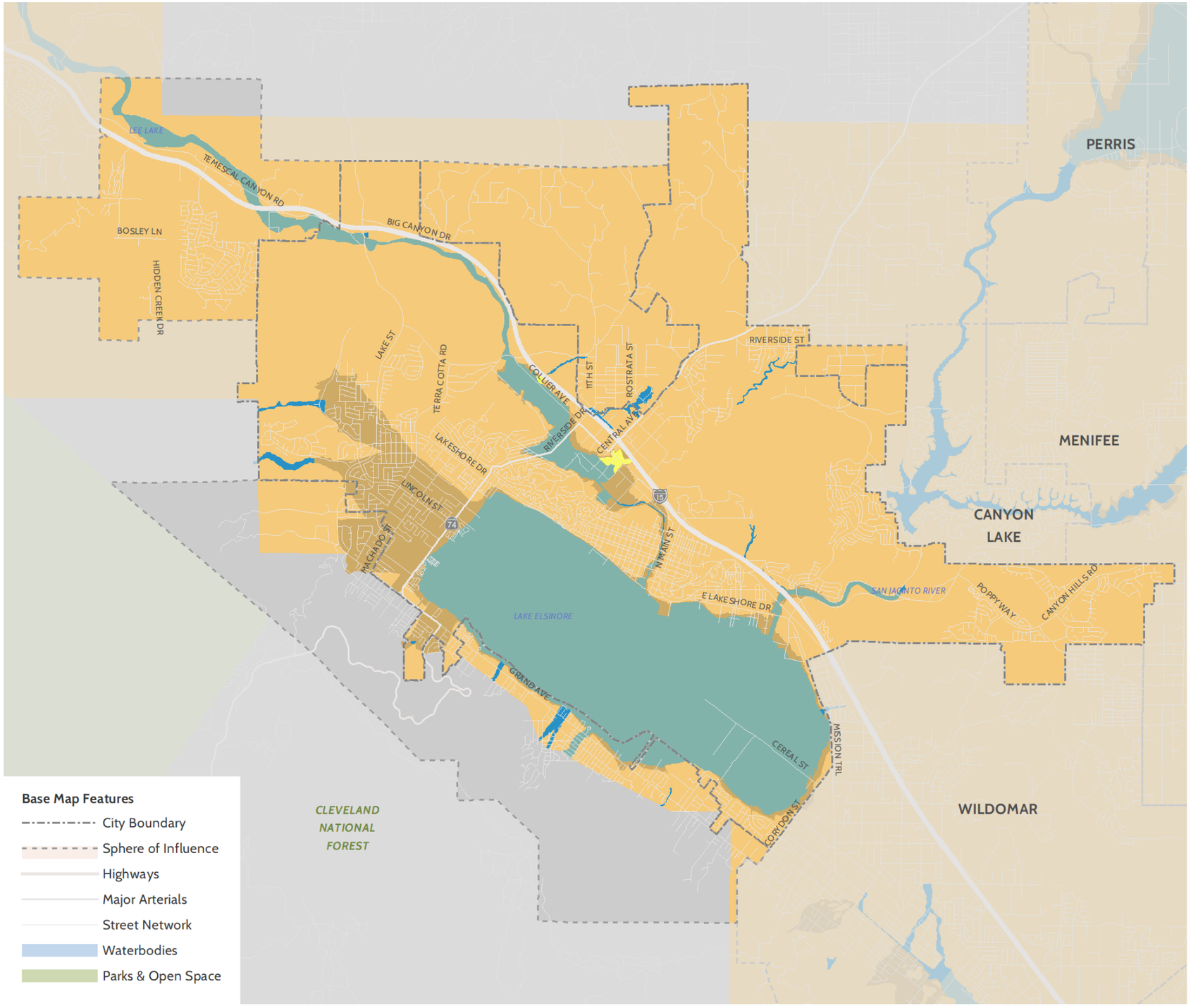


Figure 3-4

FLOOD HAZARDS

FEMA Flood Zones

- 1% Annual Chance of Flooding (100-Year Flood)
- Base Floodplain
- 1% Annual Chance of Shallow Flooding
- 1% Annual Chance of River or Stream Shallow Flooding
- Betwen 0.2% and 1% Annual Chance of Flooding (500-Year and 100-Year Flood)
- 0.2% Chance of Annual Flooding (500-Year Flood)
- Protected by Levee
- Undetermined Risk Areas

Prepared by MIG, October 2023.
Source: California Department of Water Resources, 2023

0 ¼ ½ 1 1½ 2 Miles

Landslides, Mudflows and Debris Flows

Hazard Profile

Landslides occur when a hillside becomes unstable, causing a mass of soil and rocks to slide downslope.[21] Hillsides, particularly steep slopes, tend to absorb water that can lead to slope failure and mudslides (a mixture of mud and water moving downslope) in extreme instances. Landslides and mudslides can move fast enough to damage or destroy buildings or other structures in their path, block roads or railways, and injure or kill people caught in them. Landslides and mudflows can be induced by numerous factors. Earthquakes are a common trigger of landslides, but this Vulnerability Assessment only looks at non-earthquake induced landslides. Common causes of non-earthquake induced landslides include extreme precipitation events, flooding, and slope destabilization caused by vegetation loss and soil composition change from wildfires.

Disaster History

The most recent mudslide and debris flow event occurred in February 2019 following heavy rains that impacted the unstable hillsides of the Holy Fire Burn Scar around Lake Elsinore.[22] Mandatory evacuation orders were issued for residential areas impacted by the Holy Fire, including 800 homes and approximately 2,800 residents. The heavy rains in combination with the unstable slopes caused by the Holy Fire caused thick mud and debris flows down multiple roads and canyons, damaging some houses and public infrastructure. Other landslides have occurred throughout Riverside County in the past few decades, although no other landslides of note have occurred in Lake Elsinore.[23]

LAKE ELSINORE MUD AND DEBRIS FLOW (2019)

Source: Riverside County Fire Department, 2019.

[21] "Western Riverside Adaptation and Resiliency Strategy: Part 1, Vulnerability Assessment" (Western Riverside Council of Governments , 2019).
[22] County of Riverside Emergency Management Department, April 2023.
[23] Ibid.

Probability of Future Events

The potential for landslide and mudflow events will likely increase as climate change progresses. Climate change is expected to cause an increase in extreme precipitation events, which can increase landslides and mudslides in Lake Elsinore. Expected increases in wildfire frequency and severity add to this risk due to slope destabilization potential from vegetation loss and soil disruptions, as seen in the 2019 mud and debris flow around the Holy Fire Burn Scar. Increasing drought conditions can destabilize hillsides even further due to vegetation loss. Figure 3-5 shows the topography of Lake Elsinore. Areas with steep slopes will likely face increased landslide susceptibility during extreme precipitation events, especially if the area has been impacted by wildfires.

Severe Weather

Hazard Profile

Severe weather is usually caused by intense storm systems that can cause atmospheric rivers, strong winds such as Santa Ana winds, hail, lightning, and thunderstorms. Atmospheric rivers, which are extreme topographic-induced precipitation events from high water vapor transport from the tropics to the Pacific Coast, can lead to flooding and landslides.[24] Between 1979-2013, atmospheric rivers impacted Southern California 2-3 times a year, though with significant interannual variability.[25] Santa Ana winds are characterized by strong northeasterly downslope and offshore flows of very dry air that typically occur between October and April in Southern California. Severe weather can cause injuries or deaths, damage to buildings and infrastructure, fallen trees, road and railway blockages by debris and cascading hazards such as flooding, landslides and fires sparked by strong winds and/or lighting.

Disaster History

Severe weather, particularly winter storms and associated flooding, is identified as the most prominent climate-induced hazard impacting Lake Elsinore by the City's 2017 LHMP. Between 2000 and 2017, six severe weather events impacted Lake Elsinore and caused an estimated $791,000 in damages from high winds and/or flooding.[26] Since then, numerous other strong winter storms have occurred resulting in flooding and landslides. The most notable event occurring in February 2018 as described in the Landslides, Mudflows and Debris Flows section above.

A review of the National Oceanic and Atmospheric Administration's National Climatic Data Center database reveals that 410 high wind events, 53 strong wind events, 154 thunderstorm wind events, 30 hail events, and 25 precipitation events occurred in Riverside County as whole between 1950 and 2022.[27]

[24] Hall, Berg, Reich, Los Angeles Summary Report, 2018.
[25] Ibid.
[26] Santiago, "Lake Elsinore Local Hazard Mitigation Plan", June 2017.
[27] County of Riverside Emergency Management Department, April 2023.

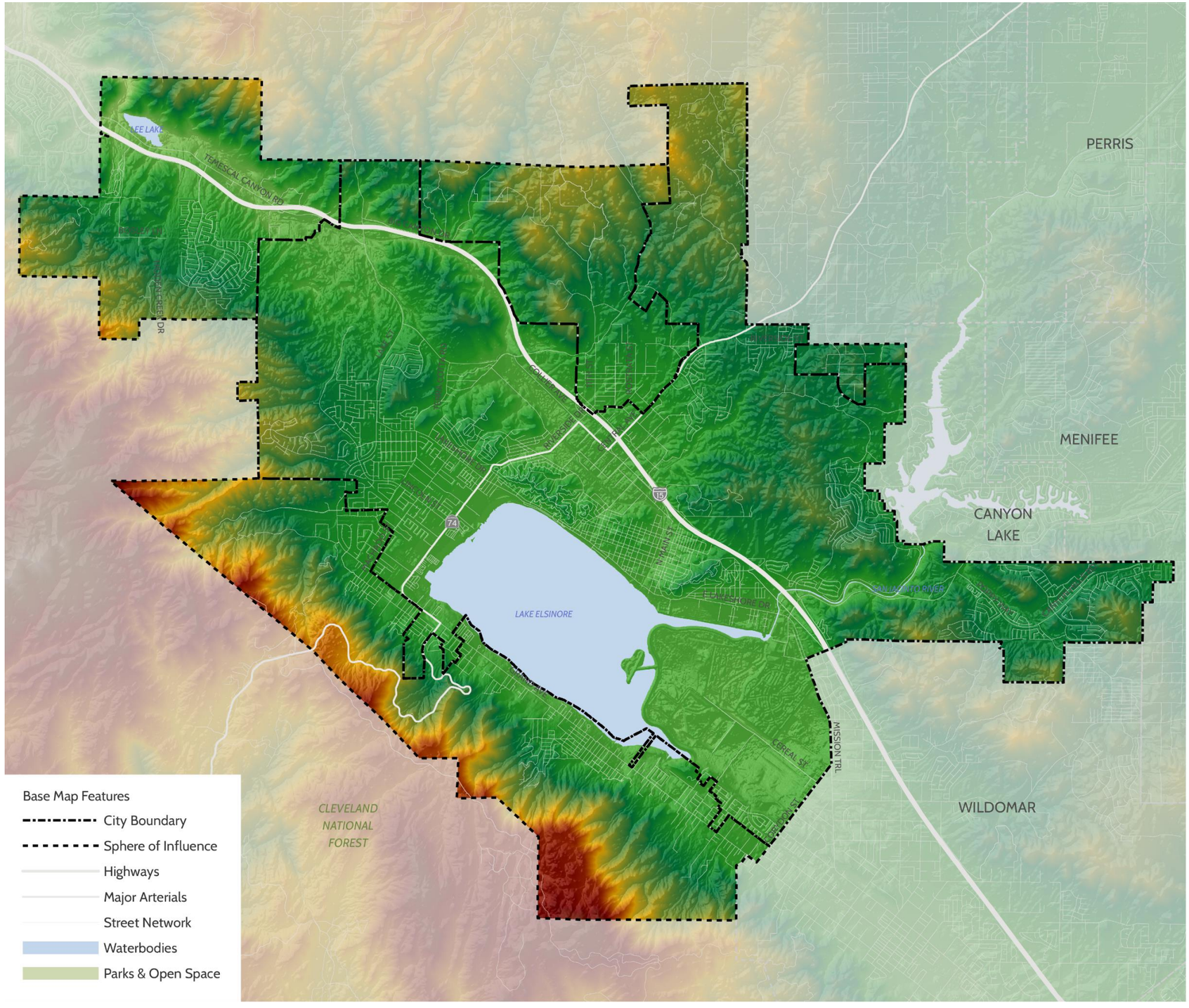


Figure 3-5
TOPOGRAPHY

Elevation (Meters)

High : 1,731

Low : -2.5

Prepared by MIG, October 2023.
Source: California Department of Water Resources, 2023

Miles
0 ¼ ½ 1 1½ 2

Probability of Future Events

Climate change is expected to increase severe weather in and around Lake Elsinore.[28] The Los Angeles Region Summary of California's Fourth Climate Change Assessment projects that extreme storms will increase in severity and frequency over an extended season. Atmospheric rivers will likely increase in frequency and severity and could extend the flood-hazard season in Southern California.[29] The probability of strong wind events is difficult to project but may be linked to climate variability patterns. Recent modeling also indicates that climate change-induced warming may lead to increased lighting, which in turn may increase the number of lightning-caused wildfires that occur throughout the State. The overall incidence of lightning across the continental United States could increase by 12 percent for every 1°C rise in global average air temperature by 50 percent by the end of the 21st century, though increases would vary by local climate.[30]

Wildfire

Hazard Profile

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can occur naturally, such as those ignited by lightning and Santa Ana winds, and are important to many ecosystem processes; however, most are started by human activity such as smoking, campfires, equipment use, and arson. Recently, wildfires in Riverside County have been started by arson and equipment use. The mix of weather, dry vegetation, complex topography, and land use and development patterns in and around Lake Elsinore are important contributors to the fire environment.

The topography in Lake Elsinore varies significantly with rolling hills, steep slopes, canyons, valleys, and ridges. This varied terrain can make fighting fires extremely difficult, especially when fueled by dry vegetation. Many of the City's rolling hills and steep slopes consist of undeveloped open space and natural areas with diverse vegetative communities including chaparral, oak woodland, sage scrub, and non-native grasslands (Figure 3-6). Warmer temperatures and drought conditions create more vegetative fuels for fires. Grass and shrub lands pose particularly high wildfire risk because they are easily ignited and will burn hot and fast, especially during high wind conditions.

CAL FIRE is required to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZ), influence how people construct buildings and protect property to reduce risk associated with wildland fires. Much of Lake Elsinore and the City's Sphere of Influence is designated a "Very High Fire Hazard Severity Zone" by Riverside County and CAL FIRE. Figure 3-7 shows the FHSZs in Lake Elsinore.

[28] "Western Riverside Adaptation and Resiliency Strategy: Part 1, Vulnerability Assessment", 2019.
[29] Ibid.
[30] Romps, Seeley, Vollaro, Molinari, Projected increase in lightning strikes in the United States due to global warming, 2014.

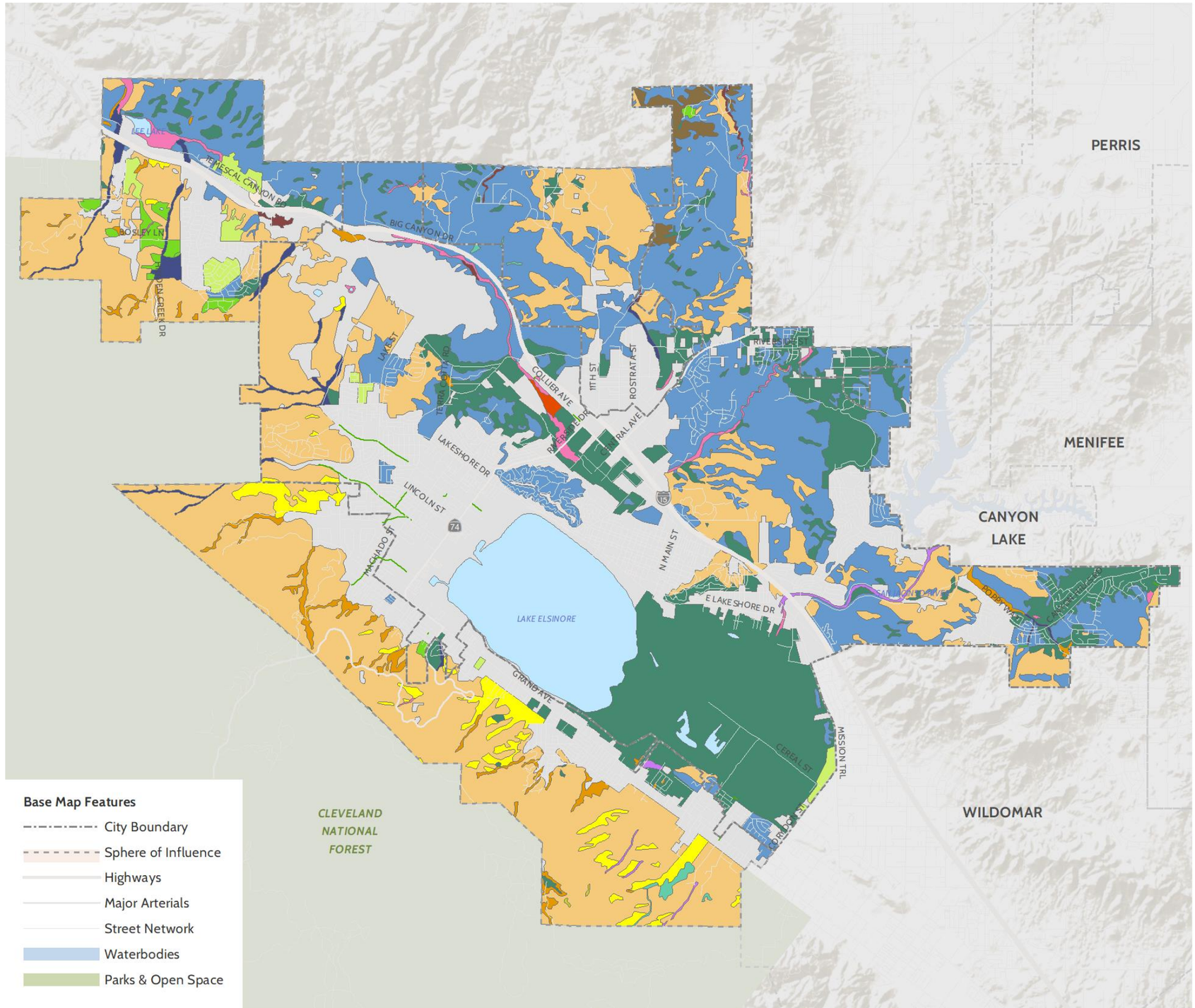


Figure 3-6
VEGETATIVE COMMUNITIES

Vegetative Communities

- Chamise Chaparral
- Chaparral
- Coast Live Oak Woodland
- Coastal and Valley Freshwater Marsh
- Dense Engelmann Oak Woodland
- Diegan Coastal Sage Scrub
- Field Croplands
- Grove/Orchard
- Non-native Grassland
- Oak Woodland
- Open Water/Reservoir/Pond
- Residential/Urban/Exotic
- Riparian Forest
- Riparian Scrub
- Riversidean Alluvial Fan Sage Scrub
- Riversidean Sage Scrub
- Southern Cottonwood/Willow Riparian
- Southern Willow Scrub

Prepared by MIG, October 2023.
Source: County of Riverside, 2023

0 ¼ ½ 1 1½ 2 Miles

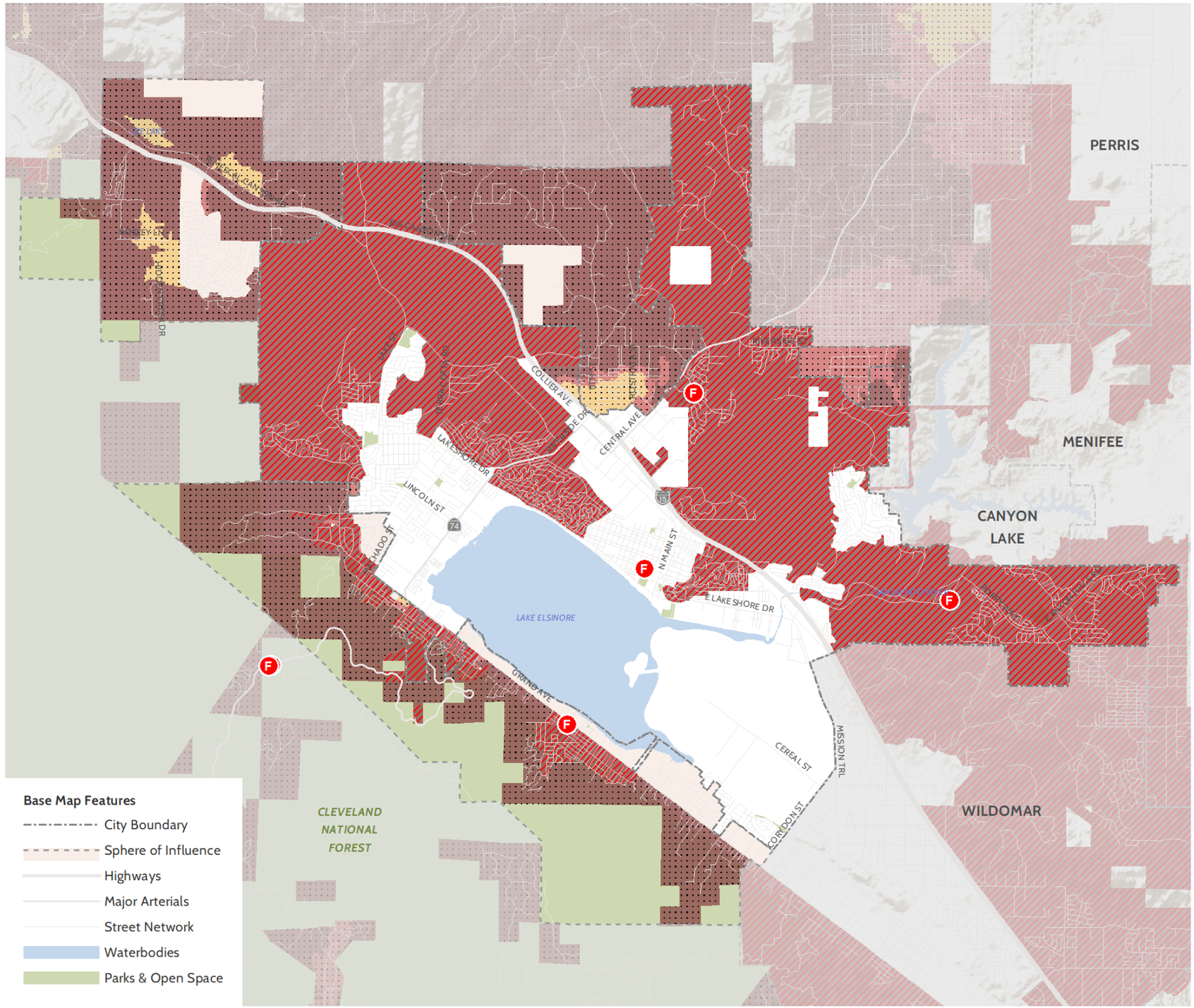


Figure 3-7

WILDFIRE HAZARDS

Fire Hazard Severity Zones

- Very High
- High
- Moderate
- Local Resposibility Area (LRA)
- State Responsibility Area (SRA)
- Fire Station

Prepared by MIG, October 2023.
Source: County of Riverside, 2023

0 ¼ ½ 1 1½ 2 Miles

Fire protection in California is the responsibility of either the federal, state, or local government. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, often in partnership with local grants and contracts. In state responsibility areas (SRA), which are defined according to land ownership, population density, and land use, CAL FIRE has a legal responsibility to provide fire protection. CAL FIRE is not responsible for densely populated areas, incorporated cities, agricultural lands, or federal lands. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands. In LRAs, fire protection is provided by city fire departments, fire protection districts, or counties, or by CAL FIRE under contract to local government. Figure 3-7 shows the SRA and LRA in and around Lake Elsinore.

Lake Elsinore contracts fire services with the Riverside County Fire Department and CAL FIRE, providing a full range of fire protection services including fire prevention, suppression, and emergency medical response. The Riverside County Fire Department provides firefighting services to Lake Elsinore's portion of the LRA while CAL FIRE is the primary emergency response agency responsible for lands within SRAs.

Wildfires are a continuous threat in Lake Elsinore and can lead to a wide range of significant primary and secondary hazards. Beyond direct physical threats to life and property, wildfire smoke can reduce air quality and create public health concerns, especially for certain at-risk populations. Cascading hazards include flash floods, heavy erosion, landslides, and mudflows because of vegetation loss and slope destabilization in burn zones.[31]

HOLY FIRE, LAKE ELSINORE (2018)

Source: Palm Springs Desert Sun, 2018.

Source: CBS, Patrick Record (2018)

Disaster History

There is a long history of wildfires in Lake Elsinore and Riverside County. The most recent major fire (greater than 500 acres) was the 2018 Holy Fire, which burned 92 square miles of the Cleveland National Forest to the northwest of the City. Approximately 23,025 acres and 160 buildings were burned in Lake Elsinore. According to California's Fourth Climate Change Assessment, nearly 80 percent of wildfires in the region occurred during the summer and fall, with a quarter of annual wildfires occurring during Santa Ana wind events.[32] Table 3-1 identifies other major fires in Lake Elsinore since 1950.

[31] County of Riverside Emergency Management Department, April 2023.
[32] Hall, Berg, Reich, Los Angeles Summary Report, 2018.

Figure 3-8 shows the perimeter of historic fires in Lake Elsinore for which records are available.

TABLE 3-1: MAJOR FIRES IN LAKE ELSINORE AND ITS SPHERE OF INFLUENCE (OVER 500 ACRES), 1950-2023

Fire Name	Alarm Date	Containment Date	Cause	Acreage
Morrell	8/5/1950	N/A	Unidentified	5,118
Jameson	8/30/1954	N/A	Unidentified	7,881
Cornwell	9/11/1956	N/A	Unidentified	3,173
Sandia	9/12/1956	N/A	Unidentified	2,053
Pederson	6/17/1957	N/A	Unidentified	1,979
Fiasco	6/18/1957	N/A	Unidentified	7,310
Morey	9/141958	N/A	Unidentified	2,662
Decker	8/8/1959	N/A	Unidentified	1,485
Cow	4/28/1968	N/A	Unidentified	536
Terrace Hill	5/2/1970	N/A	Unidentified	1,848
Boundary	9/6/1970	N/A	Miscellaneous	1,416
Estelle	7/21/1978	N/A	Unidentified	3,080
Lemon	8/23/1978	N/A	Unidentified	2,943
Turner	11/16/1980	N/A	Unidentified	31,447
Lake #2	11/16/1980	N/A	Unidentified	1,216
Indian	11/24/1980	N/A	Miscellaneous	28,940
Cottenwood	6/15/1981	N/A	Unidentified	1,279
Dawson	6/17/1981	N/A	Miscellaneous	8,000
Dexter	8/21/1981	N/A	Unidentified	1,350
Canyon	6/16/1983	N/A	Unidentified	1,231
Horse	7/11/1985	N/A	Unidentified	761
State 1587	10/3/1987	N/A	Equipment Use	3,276
Corona State #983	6/2/1988	N/A	Equipment Use	913
Rosa	9/5/1988	N/A	Campfire	632
State #2428	12/9/1988	N/A	Equipment Use	1,446

TABLE 3-1: MAJOR FIRES IN LAKE ELSINORE AND ITS SPHERE OF INFLUENCE (OVER 500 ACRES), 1950-2023

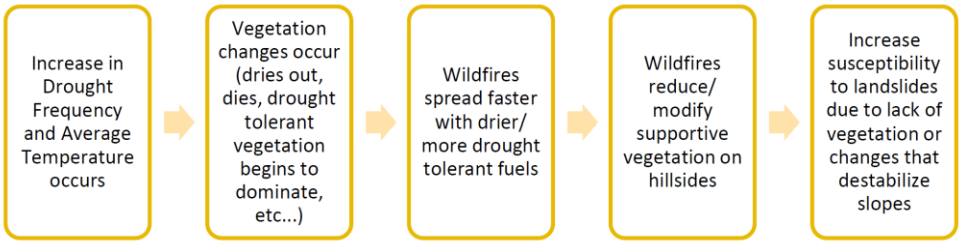
Fire Name	Alarm Date	Containment Date	Cause	Acreage
Ortega	6/27/1989	7/5/1989	Miscellaneous	7,880
Nichols	7/2/1995	N/A	Vehicle	1,264
Dawson	7/20/1995	N/A	Playing with Fire	4,718
Short	6/1/1996	N/A	Equipment Use	683
Cerrito	5/3/2004	5/7/2004	Playing with Fire	16,460
Falls	8/5/2013	8/14/2013	Miscellaneous	1,383
Holy	8/6/2018	10/17/2018	Miscellaneous	23,025

Source: CAL FIRE, Fire and Resource Assessment Program (FRAP).

Probability of Future Events

The Riverside County MJLHMP and the Lake Elsinore LHMP both identify wildfires as one of the natural hazards with the highest probability of occurring in the City and broader region. The combination of Southern California's Mediterranean climate, with its winter and spring rainfall and hot, dry summers, and the frequency of high wind velocity creates optimum conditions for wildfires. Recent research indicates that regional climate change will increase fire severity and frequency in Lake Elsinore. A warmer climate will bring drier winters with reduced snowpack, warmer springs with earlier snowmelts, and longer, drier summer fire seasons fueled by drier soils and vegetation from increasing drought frequency. With an increase in wildfire frequency and severity, susceptibility to secondary hazards such as flashfloods, landslides and mudflows will likely increase (Figure 3-9). According to the California Fourth Climate Change Assessment, overall burned area in the region is projected to increase over 60 percent from Santa Ana wind-induced fires and over 75 percent from non-Santa Ana wind-induced fires.[33] These models also suggest that the region will experience a significant increase in average annual acres burned over historic levels by mid-century, which will potentially decrease by the end of the century due to wildfire fuel reductions associated with increased drought and extreme heat conditions.[34]

FIGURE 3-9: CLIMATE CHANGE EFFECTS ON WILDFIRE AND RELATED HAZARDS



Source: Western Riverside Council of Governments Western Riverside County Vulnerability Assessment

[33] Hall, Berg, Reich, Los Angeles Summary Report, 2018.
[34] Ibid.

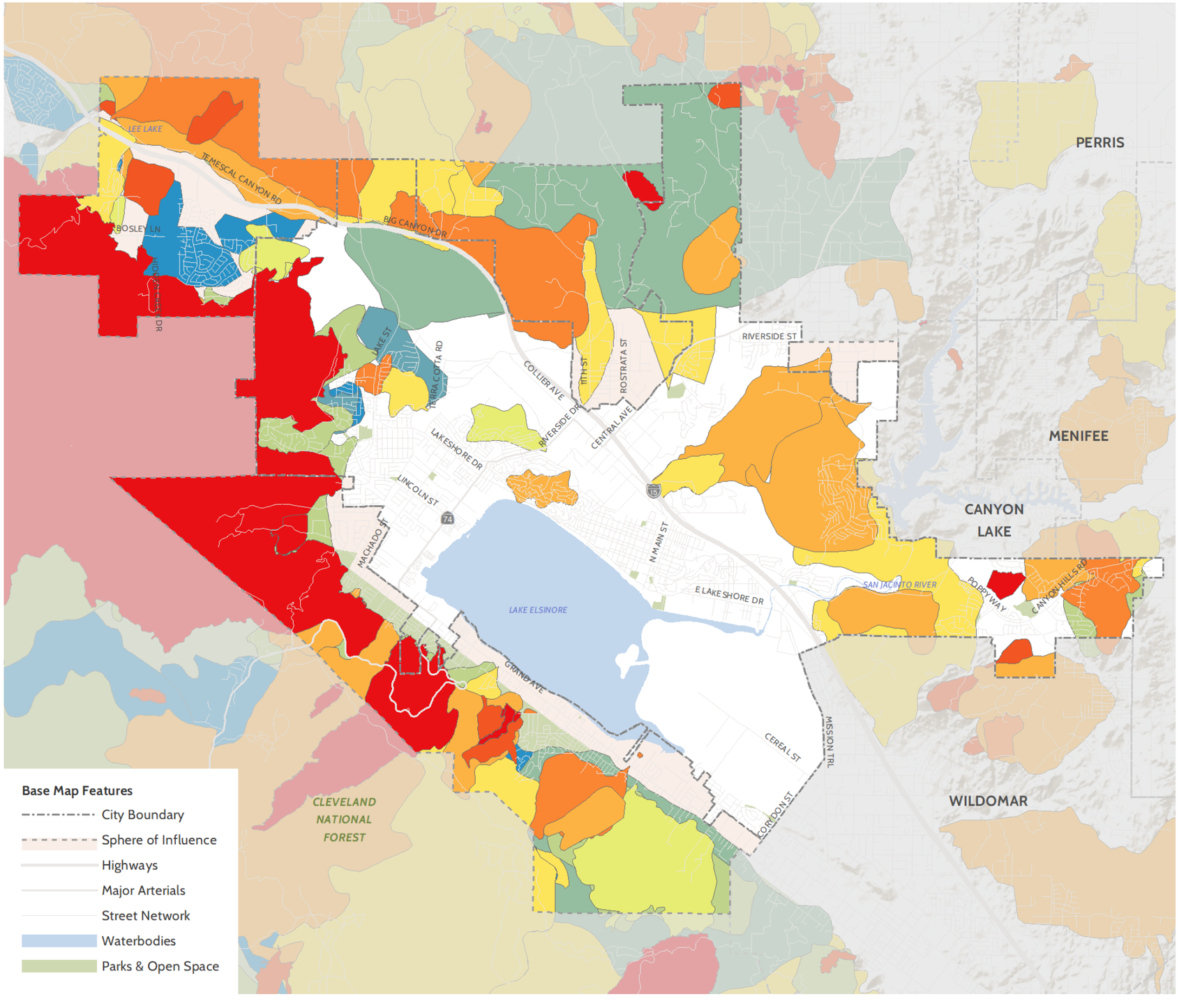


Figure 3-8

HISTORIC FIRE PERIMETER

Historic Fire Perimeters (By Year)

- 1913 - 1930
- 1931 - 1940
- 1941 - 1950
- 1951 - 1960
- 1961 - 1970
- 1971 - 1980
- 1981 - 1990
- 1991 - 2000
- 2001 - 2010
- 2011 - 2022

Prepared by MIG, October 2023.
Source: California Department of Forestry and Fire Protection, 2023

0 ¼ ½ 1 1½ 2 Miles

4. POPULATIONS AND ASSETS OF CONCERN

This section describes the potential impacts of climate change hazards on selected populations and physical assets. The California APG provides a general list of populations and assets, which the City refined to develop 15 distinct asset types and 17 distinct population types as shown in Table 4-1. The project team considered the following questions when deciding which populations and assets to include:

- Is the population or asset likely to face substantive harm from climate-related effects?
- Is the population or asset likely susceptible to climate-related effects in a unique way, different from most other populations or assets in the community?
- If the population or asset is substantially harmed, are there significant negative consequences to the community? Consider both direct and indirect consequences and remember that consequences may not be evident until well after the harm occurs.
- Is the population or asset key to achieving overarching resiliency goals?

WHAT IS A PHYSICAL ASSET?

An asset is any feature of a community that is not a person or group of people. Assets include the natural environment as well as the built environment, such as buildings and infrastructure systems.

SOURCE: 2020 APG 2.0

TABLE 4-1: VULNERBAILITY ASSESSMENT POPULATIONS AND ASSETS

CATEGORY		*POPULATION OR ASSET*
Populations	Financially Constrained Households	Low-income Households Households in Poverty Cost-Burdened Households Severely Overcrowded Households Renters
	Physically or Socially Isolated Communities	Mobile Homes Persons without Access to Transportation or Telecommunications Linguistically Isolated Communities
	Persons with High Outdoor or Hazard Exposure	Outdoor Workers Healthcare Workers, First Responders, and Protective Service Occupations Houseless Population
	Low-Resourced Racial or Ethnic Minorities	Low-Resourced Racial or Ethnic Minorities
	Persons with Limited Mobility, Chronic Health Conditions, or Who May Be Dependent on Individuals or Services	Children Persons with Disabilities Persons with Chronic Health Problems Seniors

TABLE 4-1: VULNERBAILITY ASSESSMENT POPULATIONS AND ASSETS

CATEGORY		*POPULATION OR ASSET*
		Persons Living Alone
Assets	Transportation Services and Infrastructure	Major Roads and Highways Airports Transit Routes Freight
	Energy Infrastructure	Electrical Transmission and Distribution Lines Electrical Substations
	Water and Wastewater Infrastructure	Water and Wastewater Infrastructure Flood Control Infrastructure
	Key Services	Emergency Services Communication Services
	Buildings	Areas of Concentrated Residential Development Government Buildings and Sites Key Employment or Commercial Centers Schools
	Natural and Managed Resources	Natural and Managed Resources

Selected Populations

The Vulnerability Assessment evaluated 17 populations that may be disproportionately harmed by climate hazards. The list of selected populations is based on the guidance of APG 2.0 and the 2018 Integrated Climate Adaptation and Resiliency Program guide "Defining Vulnerable Communities in the Context of Climate Adaption". Selected populations are grouped together under a broader category based on similar climate impacts and characteristics, although different categories may face similar impacts.

APG 2.0 provides direction on how to decide which groups of people to evaluate for climate-related susceptibility. The APG 2.0 directs that vulnerability analyses focus on populations who are likely to face the most harm from climate change. These persons are sometimes said to be "socially vulnerable" or to have "social vulnerability."[35] This does not mean that they lack resilient qualities. Many socially vulnerable people have historically faced, and continue to face, systemic social, economic, and political marginalization and injustice. By identifying groups that are socially vulnerable, communities acknowledge the systemic discrimination that many such persons have faced and seek to correct these wrongs and build resiliency in a manner that is equitable and just.

[35] "California Adaptation Planning Guide" (Cal OES, June 2020).

This Vulnerability Assessment follows the APG 2.0 guidance and identifies and discusses climate change impacts to socially vulnerable populations in Lake Elsinore. The statistics presented below are from the US Census Bureau.

Financially Constrained Households

Low-Income Households

Households with an income below $70,400 for a household of four in Riverside County based on the State Income Limit from Department of Housing and Community Development.[36] There are an estimated 8,776 households in Lake Elsinore with an income below $70,400 or 50.3 percent of all occupied housing units.[37]

Households in Poverty

Households with an income below the 2022 federal poverty level, which is $27,750 for a household of four.[38] There are approximately 2,323 households with an income below the federal poverty level or 13.3 percent of all occupied housing units.

Cost-Burdened Households

Households paying over 30 percent of their income towards housing-related expenses, including mortgage and rental payments, real estate taxes, homeowner's insurance, and utilities. There are approximately 6,845 cost-burdened households in Lake Elsinore or 39.2 percent of all households.[39]

Severely Overcrowded Households

Persons living in households with more than one person per room (including all rooms except bathrooms) are considered overcrowded. Persons living in households with more than 1.5 persons per room are considered severely overcrowded. There are approximately 541 severely overcrowded households or 3.1 percent of all households.[40]

Renters

Persons who do not own the household in which they reside. Approximately 31 percent of occupied housing units in Lake Elsinore are rented.

Physically or Socially Isolated Communities

Mobile Homes

Households living in prefabricated structures, built in a factory before being transported to the site. There are 781 mobile homes in Lake Elsinore or 3.6 percent of all housing units.[41]

Persons Without Access to Transportation or Telecommunications

Persons without access to a car, transit, or communication systems (internet and telephone services). In Lake Elsinore, 574 occupied housing units do not have access to a vehicle, making up 3.3 percent of the

[36] 2022 State Income Limit California Department of Housing and Community Development
[37] 2020 ACS 5-Year Estimates Detailed Tables, S2503: Financial Characteristics
[38] 2022 Poverty Guidelines Office of the Assistant Secretary for Planning and Evaluation
[39] HUD CHAS data, 2016-2020.
[40] 2020 ACS 5-Year Estimates Detailed Tables, B25014: Tenure by Occupants Per Room
[41] 2023 California Department of Finance E-5 Population and Housing Estimates

City's households.[42] An estimated 1,209 households in Lake Elsinore do not have internet access or 6.9 percent of all households.[43]

Linguistically Isolated Communities

A "limited English-speaking household" is one in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well." In other words, all members 14 years old and over have at least some difficulty with English. In Lake Elsinore, 886 households have limited English proficiency, which accounts for approximately 5.41 percent of households in the City.[44]

Persons with High Outdoor or Hazard Exposure

Outdoor Workers

Persons in industries that require them to be outdoors, such as agriculture, outdoor recreation, construction, and landscaping. Approximately 18 percent of Lake Elsinore workers are outdoor workers, which is higher than the state average of 9 percent. Most of Lake Elsinore's outdoor workers are employed in construction rather than agriculture, forestry, fishing and hunting, and mining.

Healthcare Workers, First Responders, and Protective Service Occupations

This category includes healthcare practitioners, health technologists and technicians, healthcare support occupations, firefighting and prevention and other protective service workers including supervisors, and law enforcement workers including supervisors. An estimated 13 percent of workers in Lake Elsinore fall into these categories.[45]

Houseless Population

Persons experiencing homelessness are individuals with a primary nighttime residence that is in a public or private space not designed for use as a regular sleeping accommodation for human beings. The County of Riverside conducts an annual Point-in-Time (PIT) Count and serves as the primary source of population data collected countywide on individuals and families who live in places that are not meant for human habitation (e.g., on the streets or in vehicles). In 2020, an estimated 50 unsheltered individuals lived in Lake Elsinore, which is 2.3 percent of the total number of unsheltered individuals in Riverside County.[46]

Low-Resourced Racial or Ethnic Minorities

Low-Resourced Racial or Ethnic Minorities

Persons identifying as a member of a racial and/or ethnic minority facing limited access to financial, social, healthcare, or educational resources. Individuals in this category may lack access to a car, may be uninsured, or below the poverty level. Lake Elsinore has an estimated 43,590 individuals or 68 percent of the City's population that identify as a member of a racial and/or ethnic minority.[47] Of this population,

[42] 2020 ACS 5-Year Estimates Detailed Tables, B25044: Tenure by Vehicles Available
[43] 2020 ACS 5-Year Estimates Detailed Tables, B28011: Internet Subscriptions in Household
[44] 2020 ACS 5-Year Estimates Detailed Tables, S1602: Limited English Speaking Households
[45] 2020 ACS 5-Year Estimates Detailed Tables, S2401: Occupation for Employed Population
[46] Lake Elsinore 6th Cycle Housing Element
[47] 2020 ACS 5-Year Estimates Detailed Tables, B03002: Origin By Race

several of the characteristics listed in Table 4-2 increase the vulnerability of individuals in this community.

TABLE 4-2: ADDITIONAL POPULATION CHARACTERISTICS FOR LOW RESOURCED ETHNIC MINORITIES

Population Characteristics	Number of Individuals	Percent of Population
Person with a Disability	2,821	6.5%
Persons Below Poverty	7,273	16.6%

Source: U.S. Census Bureau, American Community Survey (2016-2020: 5-Year estimates)

Persons with Limited Mobility, Chronic Health Conditions, or Who May Be Dependent on Individuals or Services

Children

Persons 14 years of age or younger. Lake Elsinore has 16,174 individuals aged 14 or younger, making up 25.2 percent of the City's total population.[48]

Persons with Disabilities

Persons with a physical condition that limits their movements, senses, or activities, including those with access and functional needs; and persons with psychological conditions, including mental, behavioral, cognitive, and developmental disabilities. An estimated 5,482 individuals in Lake Elsinore have one or more disabilities, making up 8.6 percent of the population.[49]

Persons with Chronic Health Problems

Persons with a persistent or long-lasting illness or disease, including those with compromised immune systems. Table 4-3 summarizes the prevalence of chronic conditions, such as asthma, diabetes, heart disease, and serious psychological distress, in Lake Elsinore residents.

TABLE 4-3: CHRONIC HEALTH CONDITIONS

Health Conditions (2020) for Population Age 18 and Older in Past 12 months	Percent of Population
Ever diagnosed with asthma	12.8%
Ever diagnosed with diabetes	12.8%
Ever diagnosed with heart disease	5.2%
Serious psychological distress	12.1%

Source: AskCHIS Neighborhood Edition, California Health Interview Survey (CHIS), UCLA, 2020.

Seniors

Persons 65 years of age or older. In Lake Elsinore, 5,704 individuals or 8.9 percent are age 65 or older.

[48] 2020 ACS 5-Year Estimates Detailed Tables, S0101: Age and Sex
[49] 2020 ACS 5-Year Estimates Detailed Tables, S1810: Disability Characteristics

Persons Living Alone
Individuals aged 18 and older living by themselves. Lake Elsinore has 2,570 individuals living alone, 26.4 percent of which are seniors living alone.[50]

Population Impacts

Table 4-4 summarizes the anticipated climate change impacts on the 19 selected populations discussed above. The table groups each population under a broader category, identifies the climate hazards a population category is exposed to, identifies non-climate stressors, and describes the overall climate impact.

Impact scores to each population are included in Appendix A.

[50] 2020 ACS 5-Year Estimates Detailed Tables, DP02: Selected Social Characteristics in the United States

TABLE 4-4: IMPACTS TO SELECTED POPULATIONS

Population Category	Populations	Non-Climate Stressors	Climate Exposures	Impact Description
Financially Constrained Households	• Low-Income Households • Households in Poverty • Cost-Burdened Households • Overcrowded Households • Renters	• Financial instability • Lack of affordable or quality housing • Lack of air conditioning or heating • Lack of insurance	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Flooding and severe weather can damage homes or cause mold to grow, which can create unhealthy living conditions. Extreme heat can cause indoor air temperatures to skyrocket, causing dehydration and other heat-related illnesses for those inhabiting the structures. Drought and extreme weather can increase utility prices and property maintenance. Smoke from wildfires can infiltrate homes and be especially hazardous in homes without air filtration systems. Financially constrained households may have limited capacity to retrofit, maintain, or rebuild homes to resist impacts from hazards or recover from hazard damages due to financial capacity or home ownership. Financial assistance programs may be available to help with upgrades or repairs to homes, but households may be unaware or unable to participate.
Physically or Socially Isolated Communities	• Mobile Homes • Persons Without Access to Transportation or Telecommunications • Linguistically Isolated Communities	• Remote location or limited access to housing • Lack of access to communication • Lack of access to transportation • Language barriers • Lack of insurance	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Persons belonging to physically or socially isolated communities can be highly impacted by climate hazards as they can easily be cut off from the rest of the City and from receiving vital communications, goods, and services. Water or energy supply may be limited for these communities and can be damaged by drought, flooding, landslides, severe weather, and wildfire, leaving people without water or electricity. These

TABLE 4-4: IMPACTS TO SELECTED POPULATIONS

Population Category	Populations	Non-Climate Stressors	Climate Exposures	Impact Description
				populations may face difficulties during emergencies that require evacuations, because potentially lower levels of social capital and language barriers may prevent adequate preparation and warnings for evacuations.
Persons with High Outdoor or Hazard Exposure	• Outdoor Workers • Healthcare Workers, First Responders, and Protective Service Occupations • Houseless Population	• Lack of air conditioning or heating • Often inflexible occupational demands	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Individuals with high outdoor or hazard exposure are more like to be exposed to climate hazards because they do not work in sheltered locations, often have physically intensive work, or may be responding to a hazard or have unavoidable work duties despite the hazard. The houseless population is continually exposed to weather conditions and may not be able to relocate to a safe area without assistance. Persons with high outdoor exposure may be unable to seek adequate shelter, evacuate, or be aware that hazardous conditions are occurring due to occupation or working conditions. Outdoor workers can easily face economic hardship if work is halted or delayed. Extreme heat can cause individuals to overheat and cause dehydration and heat stroke, and smoke and ash can irritate the respiratory system and create difficulty breathing with extended exposure. Programs such as cooling centers, homeless shelters, and adult education programs are available in some areas of the City and/or county. However, these

TABLE 4-4: IMPACTS TO SELECTED POPULATIONS

Population Category	Populations	Non-Climate Stressors	Climate Exposures	Impact Description
				populations can be difficult to reach during emergencies.
Persons with Limited or Constrained Resources	Low-Resourced Racial and Ethnic Minorities	• Financial Instability • Lack of affordable or quality housing • Lack of access to healthcare or • communication • Lack of insurance	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Disparities in living conditions and institutional biases may cause difficulty for persons with limited resources to prepare for or recover from hazardous events. Language barriers or lower levels of social capital may also prevent individuals from receiving evacuation and other emergency notifications, decreasing their ability to adequately prepare for and respond to hazardous events. These populations may have limited capacity to retrofit, maintain, or rebuild homes to resist damage from hazards or recover from hazard damage due to financial capacity or home ownership.
Persons with Limited Mobility, Chronic Health Conditions, or Who May be Dependent on Individuals or Services	• Children • Seniors • Persons Living Alone • Persons with Disabilities • Persons with Chronic Health Problems	• Mobility and/or health issues • Lack of access to healthcare, transportation, or communication • Lack of insurance	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Seniors, particularly those living alone, are vulnerable to several different climate change hazards due to health and mobility factors. Seniors are usually more susceptible to heat- or smoke-related illnesses because they are more likely to have medical conditions that can worsen with extreme heat, and often take medicine that makes it harder for them to stay cool. Seniors and persons with chronic health problems are more susceptible to poor air quality associated with wildfires, and seniors and persons with disabilities may have a decreased awareness of impending fire events. Additionally, they may have reduced

TABLE 4-4: IMPACTS TO SELECTED POPULATIONS

Population Category	Populations	Non-Climate Stressors	Climate Exposures	Impact Description
				mobility which makes it difficult to quickly evacuate in hazardous conditions. Children often have a lower level of awareness about heat-related illnesses and may not have access to air-conditioned spaces. Persons with limited mobility or chronic illnesses may have difficulty evacuating due to medicine or equipment needs and may not be able to drive themselves. They may also experience equipment issues if there are interruptions to electricity, water, or wastewater supply. Extreme heat or smoke-filled air can worsen existing medical conditions. Existing chronic illnesses can also make new illnesses from climate change hazards more difficult to treat. Individuals in this category may depend on others for assistance during a hazard event to evacuate or shelter safely.

Selected Assets

A total of 15 types of assets are considered in this Vulnerability Assessment. Information in this section is largely sourced from the 2011 Lake Elsinore General Plan, 2017 Lake Elsinore LHMP, or other online data sources.

Transportation Services and Infrastructure

Major Roads and Highways

Lake Elsinore's major roads and highways connect individual communities to others in the region and beyond. Major highways include Interstate 15, running north to south, and State Route 74 running east to west. Major roads include Lake Street, Lakeshore Drive, Riverside Drive, and Railroad Canyon Road. Roads and highways in Lake Elsinore are shown in Figure 4-1.

Airports

Lake Elsinore has one privately owned airport within its boundaries. It is mostly used for recreational purposes, such as gliding and skydiving activities.

Transit Routes

The Riverside Transit Agency (RTA) provides local and regional transportation options. The agency currently operates three routes: Routes 8, 9, and 205/206. Dial-a-Ride services are also provided by the RTA, which provides curb-to-curb reservation-based transportation services to seniors and people with disabilities.

Freight

Designated truck routes help facilitate the movement of goods throughout the City. Truck routes are found along Interstate 15, State Route 74, Lakeshore Drive/Lake Street, Corydon Street, and Railroad Canyon Road.

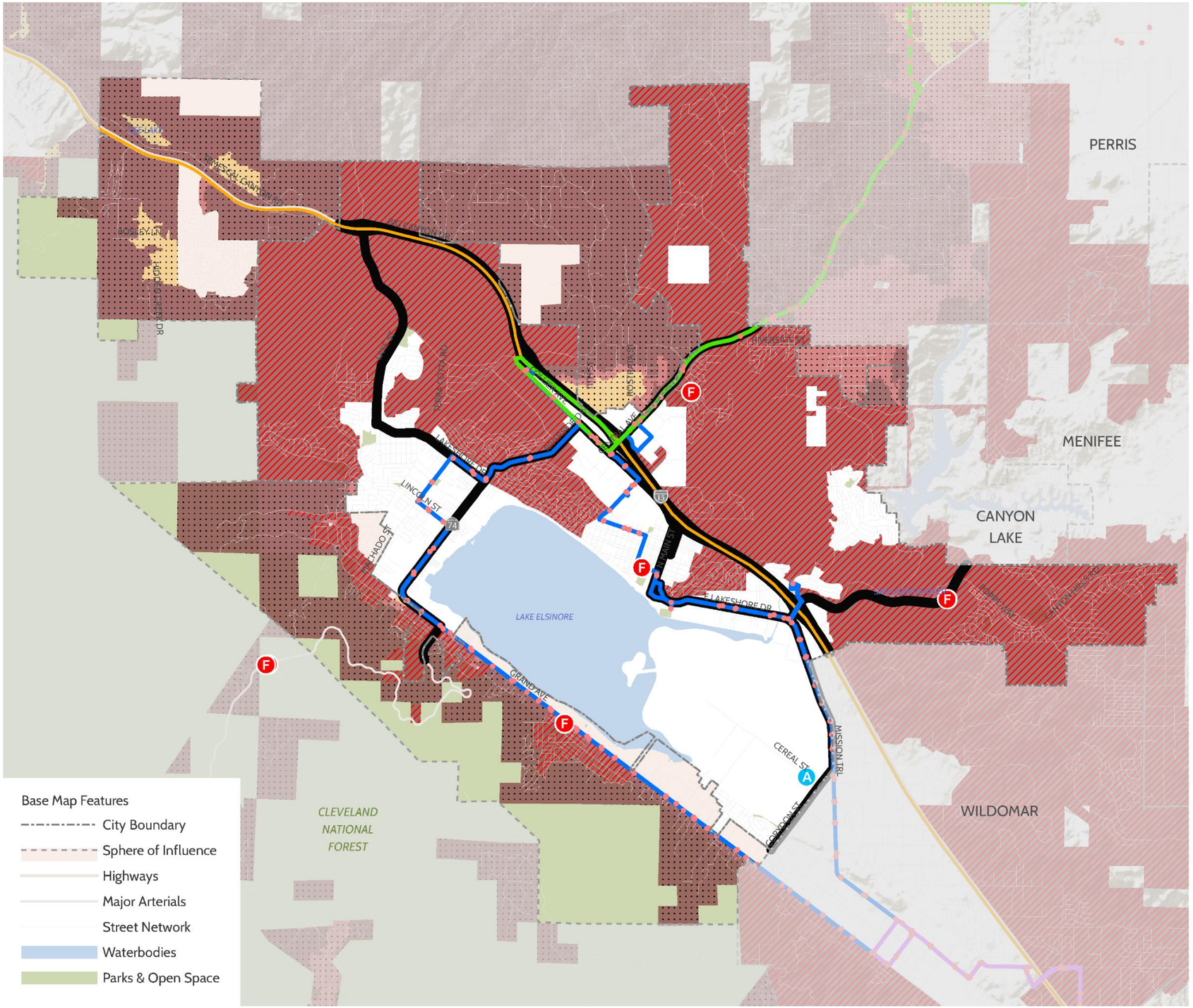


Figure 4-1

WILDFIRE HAZARD ASSET IMPACTS - TRANSPORTATION

Fire Hazard Severity Zones
- Very High
- High
- Moderate
- Local Resposibility Area (LRA)
- State Responsibility Area (SRA)
- Fire Station

Transportation Assets
- Truck Routes
- Bus Routes and Stops
- Airport

Prepared by MIG, October 2023.
Source: County of Riverside, 2023

0 ¼ ½ 1 1½ 2 Miles

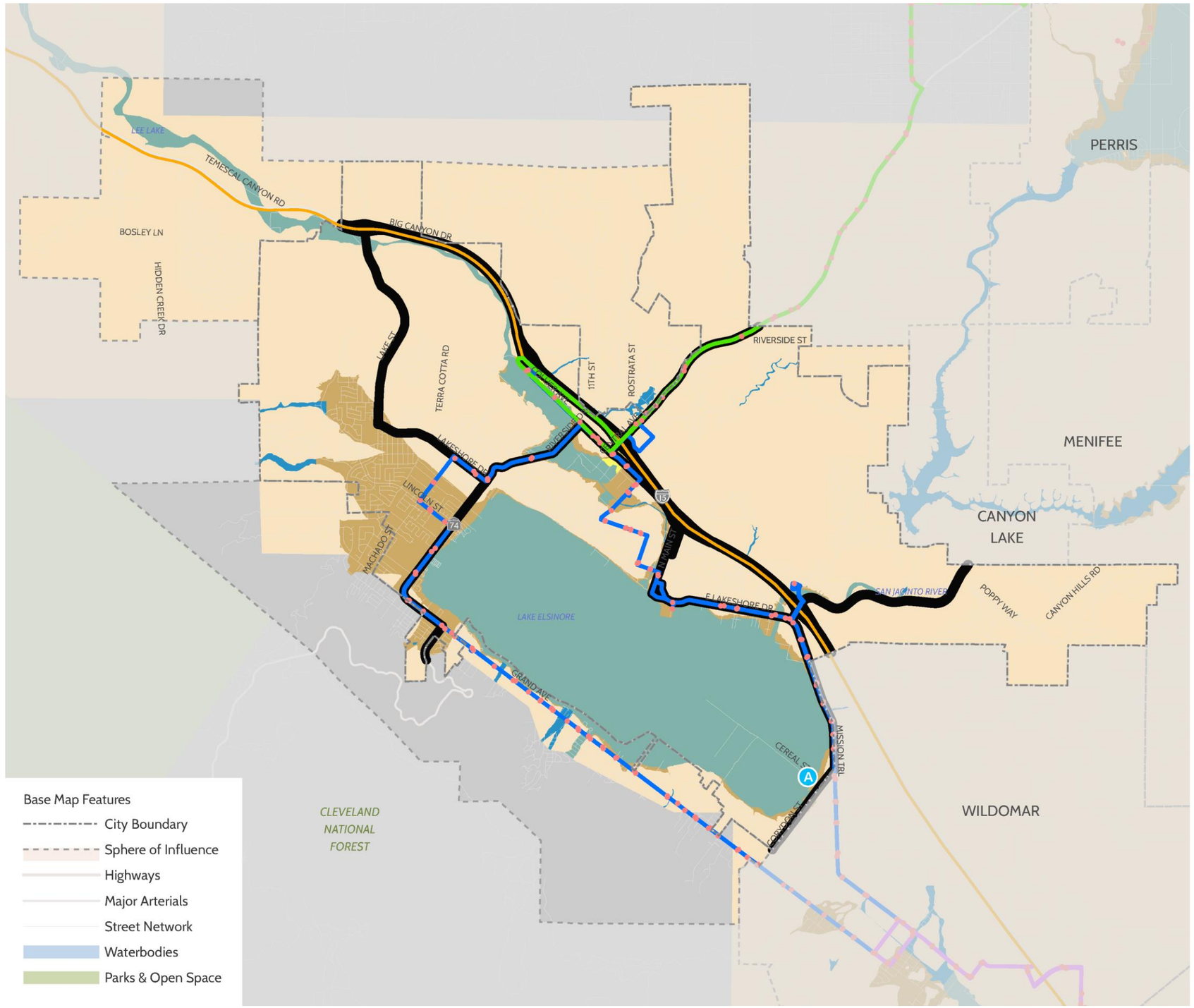


Figure 4-2

FLOOD HAZARD ASSET IMPACTS - TRANSPORTATION

FEMA Flood

- 1% Annual Chance of Flooding (100-Year Flood)
- Base
- 1% Annual Chance of Shallow
- 1% Annual Chance of River or Stream Shallow Flooding
- Betwen 0.2% and 1% Annual Chance of Flooding (500-Year and 100-Year Flood)
- 0.2% Chance of Annual Flooding (500-Year Flood)
- Protected by
- Undetermined Risk

Transportation Assets

- Truck Routes
- Bus Routes and Stops
- A Airport

Prepared by MIG, October 2023.
Source: California Department of Water Resources, 2023

0 ¼ ½ 1 1½ 2 Miles

Energy Infrastructure

Electrical Transmission and Distribution Lines

Electrical transmission lines are power lines that carry high-voltage electricity long distances between power plants and electrical customers. Electrical distribution lines transport lower voltage electricity over shorter distances. Electrical transmission and distribution lines are operated by Southern California Edison and are located adjacent to Interstate 15 (Figure 4-3 and 4-4).

Electrical Substations

Electrical substations are facilities that convert electricity from one voltage to another, making it suitable for long-distance transmission or for use by homes, businesses, and other electrical customers.

Water and Wastewater Infrastructure

Water and Wastewater Facilities

These facilities provide potable water for public use and treat wastewater so it can be safely discharged into the environment. They include surface storage reservoirs, potable water distribution systems (pipelines and pumps), water treatment facilities, and wastewater treatment facilities.

The Elsinore Valley Municipal Water District (EVMWD) encompasses approximately 100 square miles and supplies water to over 160,000 residents in southwestern Riverside County and eastern Orange County. The Elsinore and Temescal Divisions make up EVMWD's service area, which cover the cities of Lake Elsinore and Canyon Lake, portions of Wildomar and Murrieta, and unincorporated portions of Riverside County and Orange County. The Elsinore Division is the largest, with approximately 43,849 active connections and encompassing about 96 percent of the District's total service area.

Flood Control Infrastructure

The Riverside County Flood Control District manages the region's flood protection and drainage. The District oversees several flood control facilities such as debris dams, storm channels, and storm drains that are referred to as the "backbone" system of flood control for the region. The City of Lake Elsinore also owns and maintains multiple flood control facilities that are generally constructed as part of the drainage plans for individual projects. Naturally occurring flood protection, such as natural channelization, allows water to percolate into local groundwater basins. Two dams operated by the EVMWD impact the Planning Area. The Canyon Lake Dam (also referred to as the Railroad Canyon Dam), located at Canyon Lake northeast of the Planning Area, maintains the level of Canyon Lake Reservoir and regulates flows from the San Jacinto River watershed to Lake Elsinore. The Elsinore Valley Dam (also referred to as the Lee Lake Dam), located at Corona Lake in the northwest corner of the Planning Area, regulates a man-made storage reservoir for non-drinking water that was previously used for agricultural irrigation and recreation but dried up almost completely during the five-year drought.

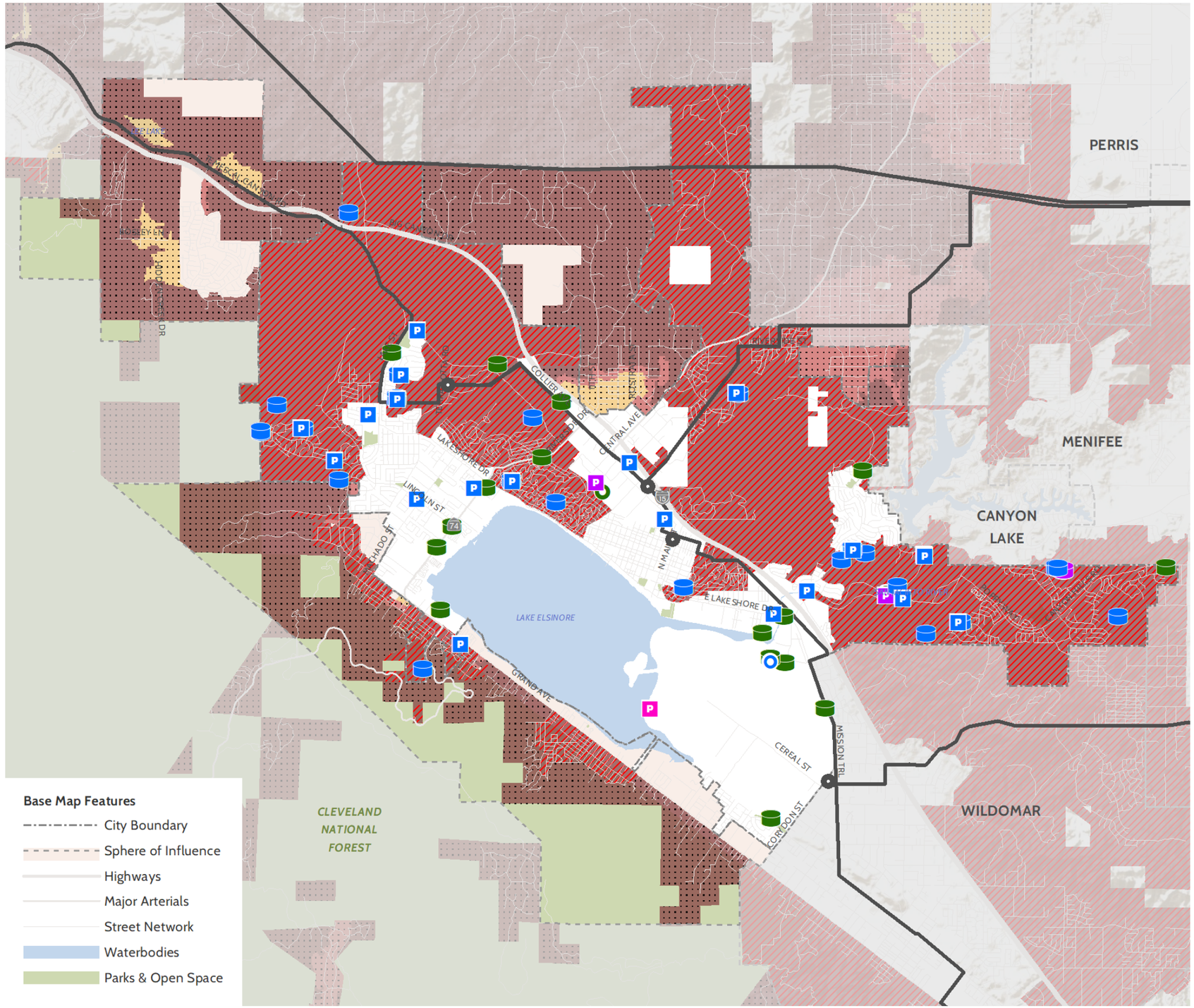


Figure 4-3

WILDFIRE HAZARD ASSET IMPACTS - ENERGY, WATER, AND WASTEWATER

Fire Hazard Severity Zones

- Very High
- High
- Moderate
- Local Resposibility Area (LRA)
- State Responsibility Area (SRA)

Energy Infrastructure

- Substations
- Power Transmission Lines

Water Infrastructure

- EVMWD Water Pump Station
- EVMWD Water Reservoir
- EVMWD Water Treatment Plant
- EVMWD Non-Potable Pump Station
- EVMWD Recycled Water Pump Station
- EVMWD Recycled Water Reservoir

Wastewater Infrastructure

- EVMWD Wastewater Lift Station
- EVMWD Wastewater Treatment Plant

Prepared by MIG, October 2023.
Source: County of Riverside, 2023, City of Lake Elsinore, 2023, EVMWD, 2023.

0 ¼ ½ 1 1½ 2 Miles

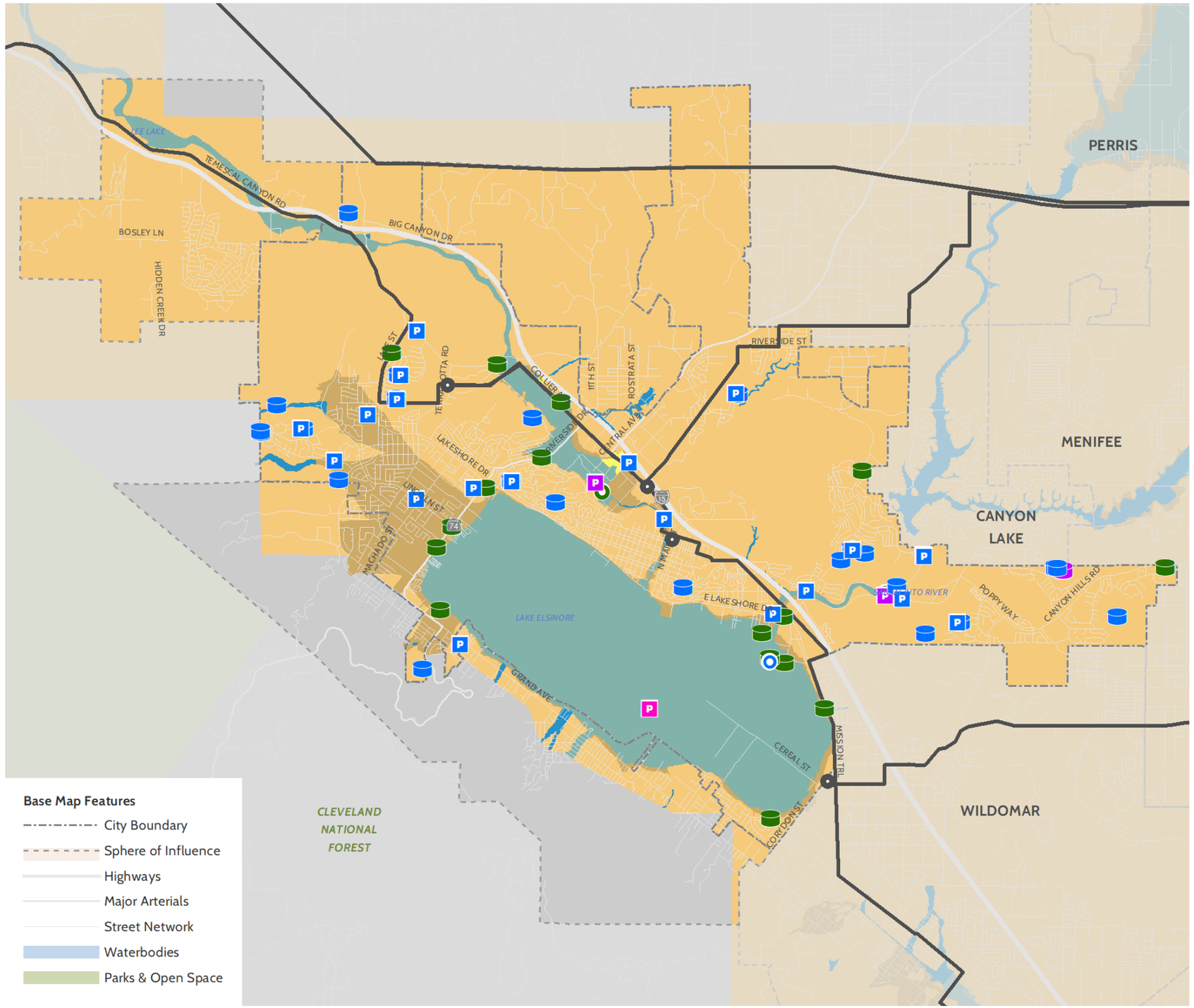


Figure 4-4

FLOOD HAZARD ASSET IMPACTS - ENERGY, WATER, AND WASTEWATER

FEMA Flood Zones

- 1% Annual Chance of Flooding (100-Year Flood)
- Base Floodplain
- 1% Annual Chance of Shallow Flooding
- 1% Annual Chance of River or Stream Shallow Flooding
- Betwen 0.2% and 1% Annual Chance of Flooding (500-Year and 100-Year Flood)
- 0.2% Chance of Annual Flooding (500-Year Flood)
- Protected by Levee
- Undetermined Risk Areas

Energy Infrastructure

- Substations
- Power Transmission Lines

Water Infrastructure

- EVMWD Water Pump Station
- EVMWD Water Reservoir
- EVMWD Water Treatment Plant
- EVMWD Water Well
- EVMWD Non-Potable Pump Station
- EVMWD Non-Potable Well
- EVMWD Recycled Water Pump Station
- EVMWD Recycled Water Reservoir

Wastewater Infrastructure

- EVMWD Wastewater Lift Station
- EVMWD Wastewater Treatment Plant

Prepared by MIG, October 2023.
Source: County of Riverside, 2023, City of Lake Elsinore, 2023, EVMWD, 2023.

0 ¼ ½ 1 1½ 2 Miles

Key Services

Emergency Services (law enforcement, hospitals, and fire department)

Emergency medical response services are usually ambulances but may also be fire or police respondents if ambulances are not available. In remote areas away from roads, emergency medical responses may arrive by helicopter. These services are critical in providing rapid and urgent medical care.

The Riverside County Fire Department and CAL FIRE provide Lake Elsinore with fire prevention, suppression, and emergency medical services. There are four fire stations located within the city limits.

Local law enforcement services, provided by Riverside County Sheriff's Department, are located in Lake Elsinore's downtown. The Lake Elsinore Sheriff's Station serves an area of 241 square miles, including the City of Lake Elsinore, City of Wildomar, and the unincorporated communities of Alberhill, El Cariso, Glen Eden Hot Springs, Glen Ivy Hot Springs, Good Hope, Lakeland Village, Quail Valley, and Sedco Hills.

Communication Services

Communication services include radio, television, cellular and landline phone, and Internet. These services can be delivered via wires or wirelessly, and most are delivered by private companies. Communication services are often used for entertainment but are also for vital information sharing and remaining connected. Most wireless communications facilities are located near Interstate 15.

Buildings

Areas of Concentrated Residential Development

Many of the City's neighborhoods primarily consist of single-family residences. Residential developments in the City's five Sphere Districts and outermost city Districts (Lake Elsinore Hills, Alberhill and North Peak) have low-density lots and a more rural feel than more urbanized parts of the City due to higher amounts of vacant land and open space. Multi-family residences are mostly located in the areas surrounding the Lake.

Government Buildings and Sites

Government facilities could act as operations hubs for emergency services and emergency public works projects during disasters. These include Lake Elsinore City Hall, community centers, libraries, post offices, and district offices.

Key Employment or Commercial Centers

Major employers, banks, and commercial establishments such as grocery stores, hardware stores, and gas stations. Key commercial areas are mostly located in the Downtown and Business Districts.

Schools

Lake Elsinore Unified School District (LEUSD) operates 12 elementary schools, four middle schools, three comprehensive high schools, two K-through-8 schools, and four alternative education schools. LEUSD boundaries stretch over 144 square miles through Southwest Riverside County, serving families in Lake Elsinore, Canyon Lake, and Wildomar, and several unincorporated Riverside County communities, including Lakeland Village and Horsethief Canyon.

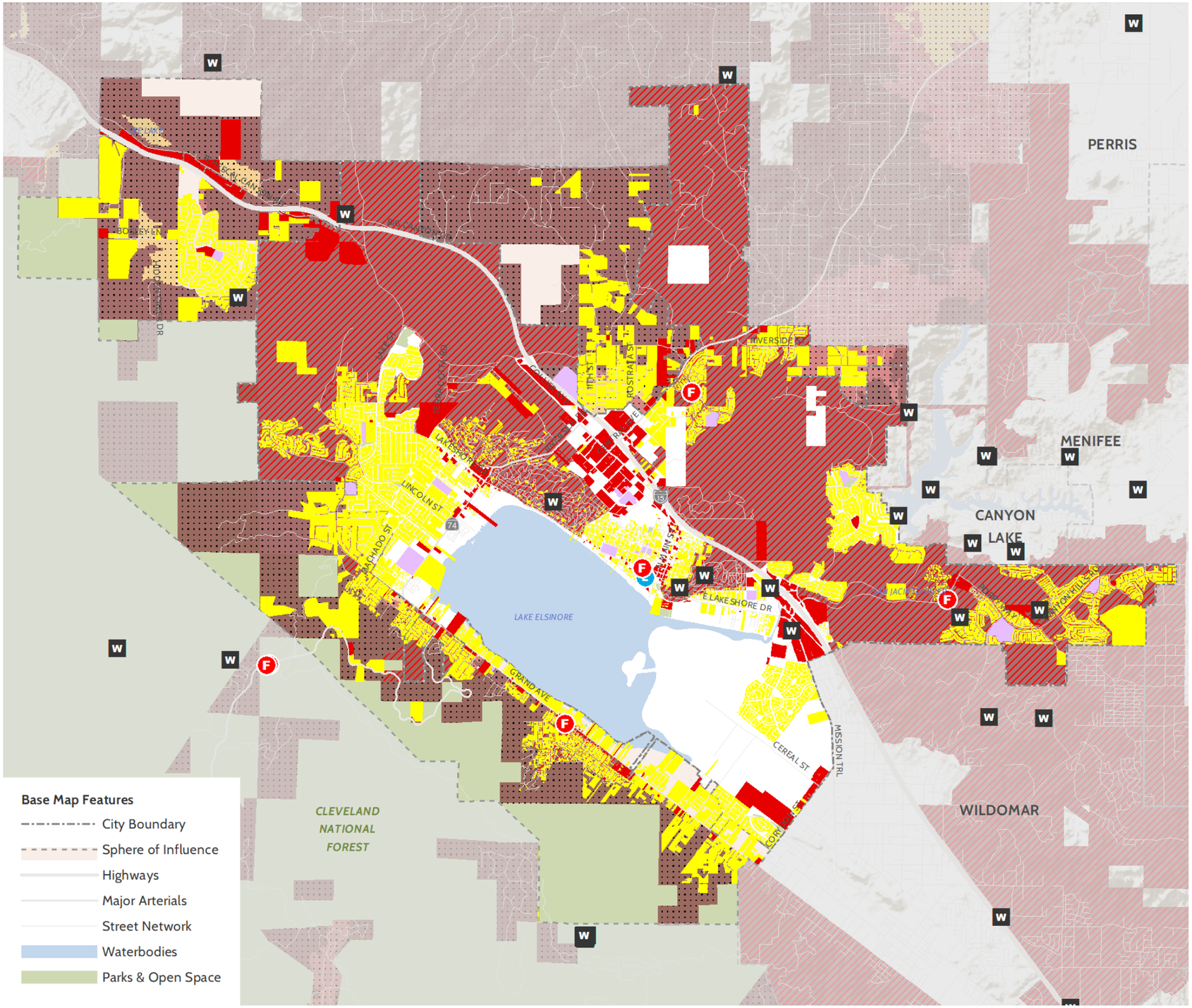


Figure 4-5

WILDFIRE HAZARD ASSET IMPACTS - KEY SERVICES AND BUILDINGS

Fire Hazard Severity Zones

- Very High
- High
- Moderate
- Local Resposibility Area (LRA)
- State Responsibility Area (SRA)

Key Services

- Fire Station
- Law Enforcement
- Wireless Comunication Facilities

Buildings

- Residential
- Employment
- Schools

Prepared by MIG, October 2023.
Source: County of Riverside, 2023, Homeland Infrastructure Foundation-Level Data, 2023, Urban Footprint, 2023.

0 ¼ ½ 1 1½ 2 Miles

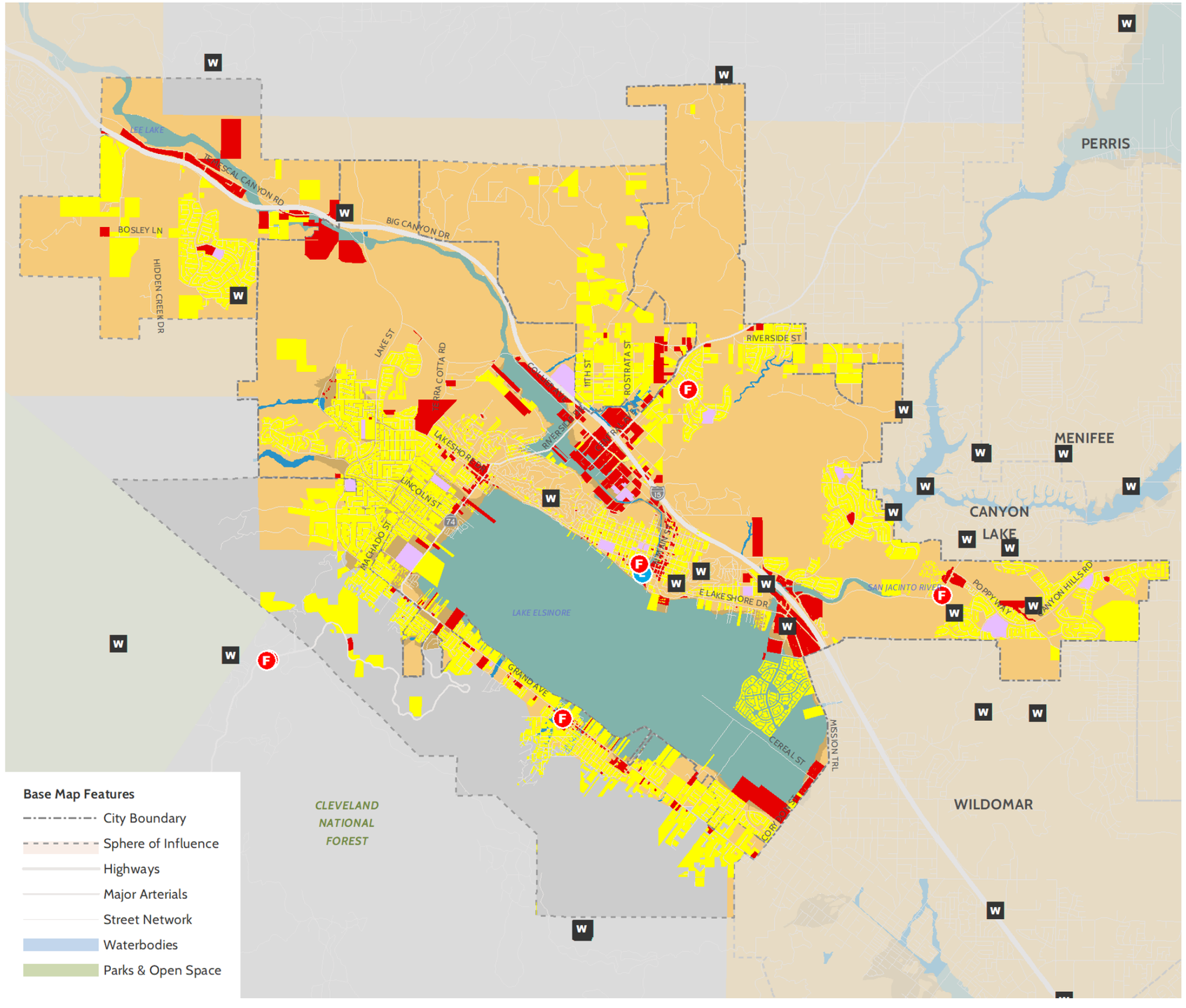


Figure 4-6

FLOOD HAZARD ASSET IMPACTS - KEY SERVICES AND BUILDINGS

FEMA Flood Zones

- 1% Annual Chance of Flooding (100-Year Flood)
- Base Floodplain
- 1% Annual Chance of Shallow Flooding
- 1% Annual Chance of River or Stream Shallow Flooding
- Betwen 0.2% and 1% Annual Chance of Flooding (500-Year and 100-Year Flood)
- 0.2% Chance of Annual Flooding (500-Year Flood)
- Protected by Levee
- Undetermined Risk Areas

Key Services

- Fire Station
- Law Enforcement
- Wireless Comunication Facilities

Buildings

- Residential
- Employment
- Schools

Prepared by MIG, October 2023.
Source: County of Riverside, 2023, Homeland Infrastructure Foundation-Level Data, 2023, Urban Footprint, 2023.

0 ¼ ½ 1 1½ 2 Miles

Natural and Managed Resources

Wildlands and Open Spaces

Open space and natural areas in Lake Elsinore consist of local parks, mountains, rugged hillsides, and the lake. The Cleveland National Forest, located to the west of Lake Elsinore, encompasses most of the Santa Ana Mountains. Much of the City's natural areas fall under the Western Riverside County Multiple Species Habitat Conservation Plan, which is a multi-jurisdictional species and habitat conservation effort. Mineral resources, such as sand, gravel, and clay, are also found in the Alberhill, Rice Canyon, Temescal Wash, and Cottonwood Hills areas.

Asset Impacts

Table 4-5 summarizes the climate impacts on the 15 selected assets. The table groups each asset under a broader category, identifies the climate hazards an asset category is exposed to, identifies non-climate stressors, and describes the overall climate impact.

In addition to the data sources used to identify, determine, and define assets, the impact descriptions rely upon information contained in California's Fourth Climate Assessment and the Safeguarding California Plan which provide background information and evidence of regional climate change impacts as well as strategies to reduce impacts.

Impact scores for each asset are included in Appendix A.

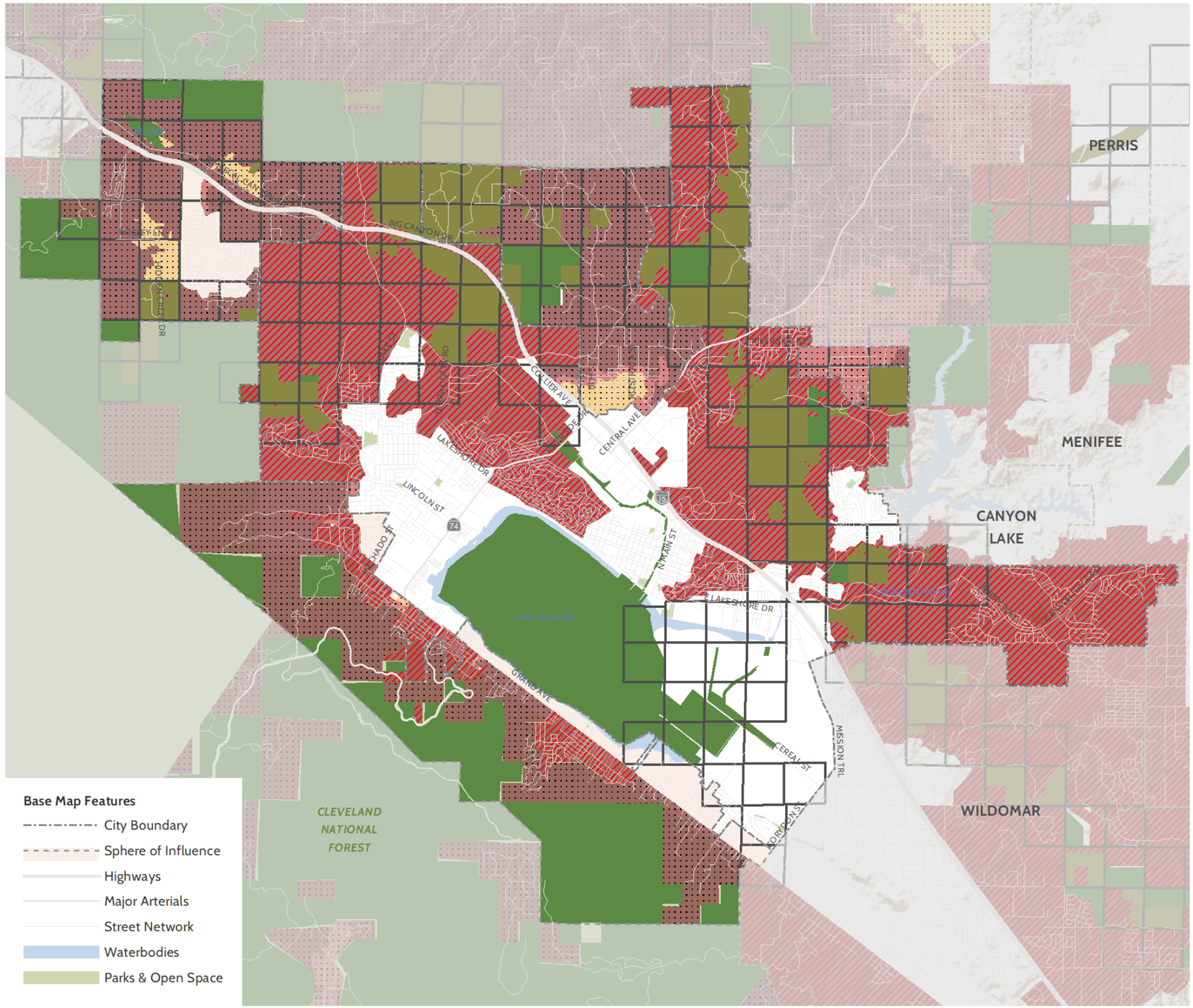


Figure 4-7

WILDFIRE HAZARD ASSET IMPACTS - NATURAL & MANAGED RESOURCES

Fire Hazard Severity Zones

- Very High
- High
- Moderate
- Local Resposibility Area (LRA)
- State Responsibility Area (SRA)

MSHCP Conservation Areas

- Criteria Cells
- RCA MSHCP Conserved Lands / Easments
- Public / Quasi-Public Conserved Lands

Public / Quasi-Public Conserved Lands: Properties owned, managed, or maintained by public agencies for the purposes of conservation.

RCA MSHCP Conserved / Easements: Additional reserve lands that contribute toward MSHCP conservation goals.

Criteria Cells / Area: A roughly 160-acre rectangle overlaid onto parcels within the MSHCP Plan Area and that has areas described for conservation.

Prepared by MIG, October 2023.
Source: County of Riverside, 2023

0 ¼ ½ 1 1½ 2 Miles

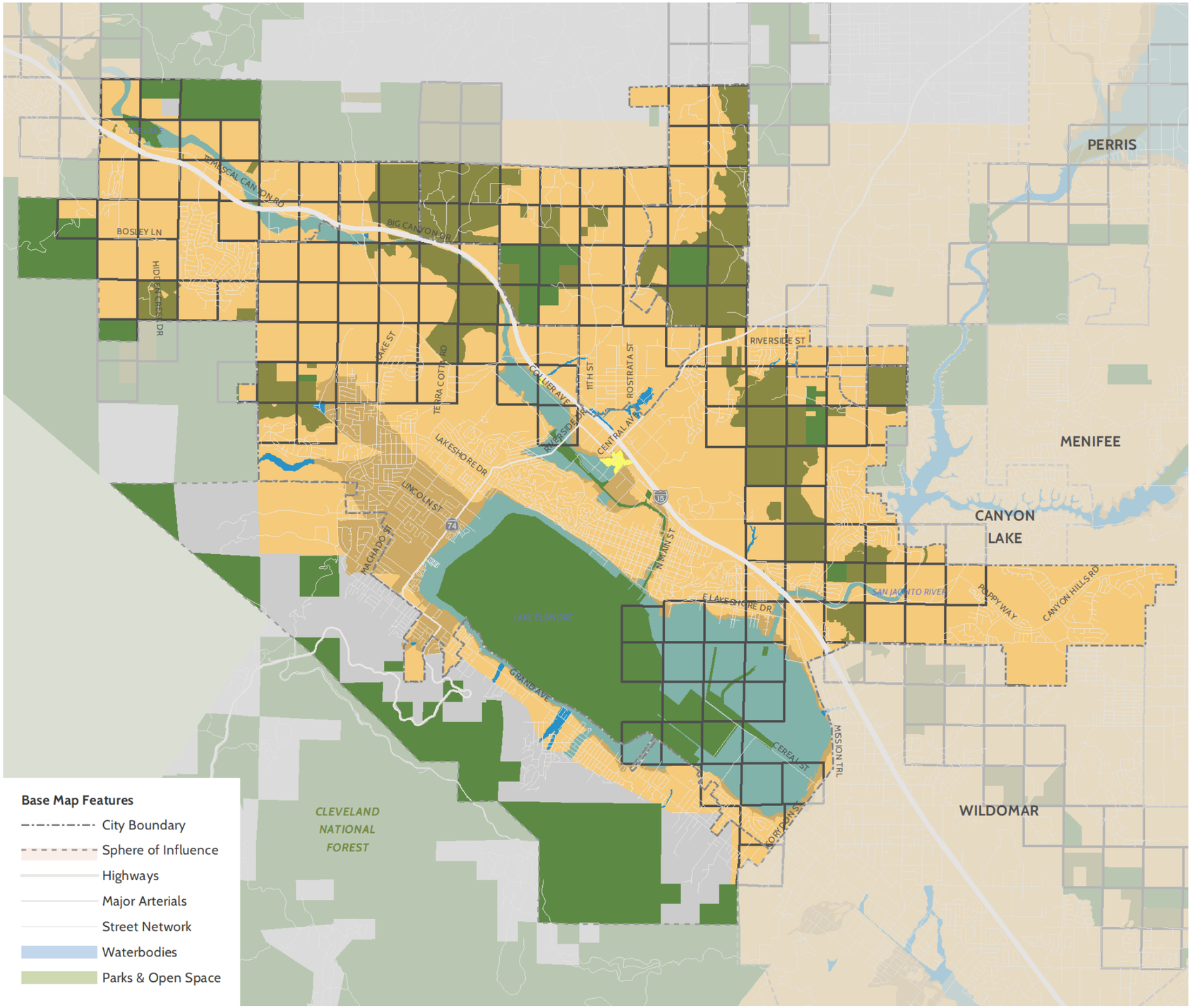


Figure 4-8

FLOOD HAZARD ASSET IMPACTS - NATURAL & MANAGED RESOURCES

FEMA Flood Zones

- 1% Annual Chance of Flooding (100-Year Flood)
- Base Floodplain
- 1% Annual Chance of Shallow Flooding
- 1% Annual Chance of River or Stream Shallow Flooding
- Betwen 0.2% and 1% Annual Chance of Flooding (500-Year and 100-Year Flood)
- 0.2% Chance of Annual Flooding (500-Year Flood)
- Protected by Levee
- Undetermined Risk Areas

MSHCP Conservation Areas

- Criteria Cells
- RCA MSHCP Conserved Lands / Easments
- Public / Quasi-Public Conserved Lands

Base Map Features

- City Boundary
- Sphere of Influence
- Highways
- Major Arterials
- Street Network
- Waterbodies
- Parks & Open Space

Public / Quasi-Public Conserved Lands: Properties owned, managed, or maintained by public agencies for the purposes of conservation.

RCA MSHCP Conserved / Easements: Additional reserve lands that contribute toward MSHCP conservation goals.

Criteria Cells / Area: A roughly 160-acre rectangle overlaid onto parcels within the MSHCP Plan Area and that has areas described for conservation.

Prepared by MIG, October 2023.
Source: County of Riverside, 2023

0 ¼ ½ 1 1½ 2 Miles

TABLE 4-5: IMPACTS TO SELECTED ASSETS

Asset Category	Assets	Non-Climate Stressors	Climate Exposures	Impact Description
Transportation Services and Infrastructure	• Major Roads and Highways • Airports • Transit Routes • Freight	• Age of facility • Undersized or overused • Not routinely maintained • Poorly designed for current needs	• Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Low-lying roads in the City can be susceptible to flooding during storm events. Fire service agencies may need to close stretches of major roads and highways during wildfires to reduce threats to the public, which would result in disruptions to regular commuting. Wildfires may also make roads dangerous or unpassable if trees overhang the road or roads have been burned. When a road network is compromised, communities are extremely vulnerable to reduced goods movement and limited access to supplies essential for daily living. Emergency and other public services could be interrupted and commuting, and tourism capacity could be reduced.
Energy Infrastructure	• Electrical Transmission and Distribution Lines • Electrical Substations • Water and Wastewater Infrastructure	• Lack of funding and staff capacity for retrofits, repairs, and/or upgrades • Lack of alternatives or redundancy	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Electricity infrastructure can be damaged or destroyed by climate change hazards, preventing electricity from traveling to residents and businesses in the City. Extreme heat conditions increase use of air conditioning which can stress and overload the grid, causing power outages and potential damage to electricity transmission lines and substations. During severe wind events, electrical transmission lines can be damaged or turned off by the service provider, causing widespread power outages and hardships for City residents. Electrical system infrastructure is often not designed to withstand prolonged

TABLE 4-5: IMPACTS TO SELECTED ASSETS

Asset Category	Assets	Non-Climate Stressors	Climate Exposures	Impact Description
				extreme heat and may shut down or be damaged under extreme heat conditions. Electrical substations and individual power poles are vulnerable to post-fire debris-flows. Transmission and distribution lines can be brought down by strong winds and wildfire and can be impacted by flooding wherever transmission lines are located near flood zones.
Water and Wastewater Infrastructure	• Water and Wastewater Facilities • Flood Control Infrastructure	• Lack of funding and staff capacity for retrofits, repairs, and/or upgrades • Difficulty relocating	• Flooding • Severe Weather	Drought can prevent water infrastructure from functioning properly because of very low reservoir levels. Water and wastewater infrastructure can become overwhelmed by stormwater runoff and debris from flooding, causing them to malfunction and become damaged. The extreme heat of wildfires may also burn and damage the water supply distribution system such as pump stations. Flood control infrastructure can become overwhelmed by water and debris from severe weather, causing it to malfunction and become damaged. Flood waters may overtop flood control infrastructure during high storm surge events.
Key Services	• Police, fire, and ambulance stations • Communication Services	• Aging infrastructure and technology • Staff capacity • Reduced funding • Disruption of services from the	• Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Emergency services are highly dependent on transportation and energy infrastructure to deliver services and therefore can be disrupted by flooding, landslides and debris flows, and wildfire. Extreme heat events could fatigue emergency responders and frontline

TABLE 4-5: IMPACTS TO SELECTED ASSETS

Asset Category	Assets	Non-Climate Stressors	Climate Exposures	Impact Description
		failure of buildings or infrastructure during repairs		healthcare workers. Wildfires require all emergency services to be activated in dangerous conditions and impact the ability of emergency responders to reach and transport residents. Cascading and compounding effects of climate change impacts will increase the frequency and amount of emergency services needed to address hazards, straining staffing, and resources, interrupting staff time dedicated to nonresponse activities, projects, and programs. Communication facilities located in flood-prone areas could be damaged by water or the footings of cell towers could be compromised by erosion from flood waters. Communication services are highly vulnerable to landslides, severe weather, and wildfires. Communication systems, such as phone poles or cell towers, in landslide prone areas of the City can be damaged when landslides and debris flows undermine the foundations supporting these systems. Severe winds on these steep slopes can also damage communication facilities. These hazards can damage communication facilities or cut off the power to them, preventing communities from receiving or relaying emergency notifications and other essential communications.

TABLE 4-5: IMPACTS TO SELECTED ASSETS

Asset Category	Assets	Non-Climate Stressors	Climate Exposures	Impact Description
Buildings	• Areas of concentrated residential development • Government Buildings and Sites • Key Employment or Commercial Centers • Schools	• Lack of funding for retrofits, repairs, and/or upgrades • Lack of alternative sites • Aging buildings	• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	Older residential buildings may have greater heating/cooling needs or be more susceptible to damage from severe weather, flooding, and wildfire. On the steeper slopes in the City, building foundations can be undermined by landslides, post-fire landslides and debris flows caused by heavy rain events. Fire stations, post offices, libraries, and other government facilities in fire hazard areas are vulnerable to wildfire and may be vulnerable to post-fire debris flows. Damage to these facilities could cause them to become unusable to the community until repaired or rebuilt. Commercial buildings could be vulnerable to flooding from severe weather events. The destruction of commercial centers reduces opportunities for residents to access daily necessities, including food and medical supplies. School buildings could be damaged or destroyed by flooding from severe weather events and wildfire impacts. If not destroyed, these buildings may have mold and mildew growth because of being flooded or smoke damage that makes them unusable until they are repaired. These facilities may also not have adequate heating, ventilation, and air

TABLE 4-5: IMPACTS TO SELECTED ASSETS

Asset Category	Assets	Non-Climate Stressors	Climate Exposures	Impact Description
				conditioning systems to maintain healthy air temperatures during extreme heat events.
Natural and Managed Resources	• Wildlands and open spaces		• Drought • Extreme Heat • Flooding • Landslides, Debris Flows, and Post-Fire Debris Flows • Severe Weather • Wildfire	The health of wildlands and protected open spaces may be severely impacted by climate change impacts, particularly drought and wildfires, but also extreme heat, flooding, and landslides.

5. ADAPTIVE CAPACITY

The City and regional agencies have developed policies, plans, and programs to moderate the potential damage caused by climate change and/or natural hazards. The following sections summarize documents that outline existing efforts to manage climate impacts.

Existing Resiliency Planning Efforts

Lake Elsinore General Plan (updated 2011)

The Lake Elsinore General Plan, most recently updated in 2011, serves as the City's comprehensive long-range general plan that guides long-term growth and promotes the Lake Elsinore community's fundamental values and vision for future development. The Plan serves as the basis for most City regulatory documents and addresses a range of mandated elements including land use, circulation, housing, open space, conservation, noise, and safety. Sustainability is a central focus of the 2011 document with goals and policies relating to sustainable development spread throughout the plan. The Safety Element, most recently updated in 2023, also incorporates numerous goals and policies focused on addressing climate change adaptation and resilience.

The Plan can be found here: Lake Elsinore General Plan

Lake Elsinore Local Hazard Mitigation Plan (updated 2018)

The Lake Elsinore LHMP focuses on eight hazards: flood, wildfire, earthquake, severe weather, hazardous materials, air quality, dam failure, and drought. Each hazard has a profile that provides brief background information on extent, potential impacts, and vulnerability. Mitigation actions and strategy programs were developed for hazards of concern. The Lake Elsinore LHMP also includes a list of hazard mitigation capital improvement projects and project cost estimates.

The Plan can be found here: Lake Elsinore Hazard Mitigation Plan

Lake Elsinore Climate Action Plan (updated 2011)

The Lake Elsinore Climate Action Plan (CAP) serves as the City's long-range plan to reduce community wide GHG emissions. Although the CAP is primarily focused on strategies and measures to achieve greenhouse gases (GHG) reduction targets, identified actions also support the City's overall ability to plan for, mitigate, and adapt to climate change.

The Plan can be found here: Lake Elsinore Climate Action Plan

Riverside County Multi-Jurisdictional Local Hazard Mitigation Plan (updated 2023)

The Riverside County MJLHMP focuses on 28 hazards, including seven climate related hazards: wildland fire, flood, drought, extreme weather (extreme heat and severe cold), and landslides. Each hazard has a profile which includes hazard definition, probability of future events, extent (magnitude/severity), impacts and vulnerability. For hazards which the County was found to be vulnerable to, prioritized mitigation actions were developed. The MJLHMP also includes community profiles for all cities within its jurisdiction, including Lake Elsinore.

The Plan can be found here: Riverside County Multi-Jurisdictional Local Hazard Mitigation Plan

Riverside County Climate Action Plan (updated 2019)

The Riverside County Climate Action Plan Update (CAP Update) serves as the County's long-range plan to reduce county-wide greenhouse gas (GHG) emissions. The CAP Update summarizes various State and

local policies that will help the County plan sustainably, achieve GHG reduction targets, and address climate change.

The Plan can be found here: Riverside County Climate Action Plan Update

Western Riverside Council of Governments Western Riverside County Vulnerability Assessment (updated 2019)

The Western Riverside County Vulnerability Assessment was completed as part of the Resilient IE, a collaborative effort between the Western Riverside Council of Governments (WRCOG) and San Bernardino County Transportation Authority (SBCTA) with funding from Caltrans. Resilient IE aims to support regional and local efforts to prepare for and mitigate risks associated with climate change through five project components, including subregional vulnerability assessments. The Western Riverside County Vulnerability Assessment identifies nine subregional climate change hazards of concern including: agricultural pests and diseases, air quality, drought, extreme heat, human health hazards, landslides, severe weather, and wildfire. In conjunction with the Vulnerability Assessment, WRCOG identified nine priority adaptation issues and strategies to address each issue and increase climate resilience in the subregion.

The Assessment can be found here: Western Riverside County Vulnerability Assessment

The Adaptation Strategies can be found here: Western Riverside County Adaptation Strategies

Current Planning Efforts Adaptive Capacity Summary

Table 5-1 evaluates how each plan and report discussed above addresses Lake Elsinore's climate change hazards of concern through targeted policies and adaptation measures. As shown in the table, multiple planning documents include some policies or programs to address the climate change-related impacts that are expected to impact the City. Mitigation and adaptation measures for existing hazards including extreme heat, flooding, severe weather, and wildfires are well documented in these plans and reports. The goals and policies developed for the Lake Elsinore Safety Element will aim to fill the gaps that have not been addressed in other City or regional planning efforts.

TABLE 5-1: ADAPTIVE CAPACITY IN LOCAL AND REGIONAL EXISTING PLANS AND REPORTS

Document	Drought	Extreme Heat	Flooding	Landslides and Mudflows	Severe Weather	Wildfire
Lake Elsinore General Plan	-[1]	X	X	-[2]	X	X
Lake Elsinore Local Hazard Mitigation Plan	-[1]	X	X	-[2]	X	X
Lake Elsinore Climate Action Plan[2]						
Riverside County Multi-Jurisdictional Local Hazard Mitigation Plan	X[4]	X	X	X	X	X

TABLE 5-1: ADAPTIVE CAPACITY IN LOCAL AND REGIONAL EXISTING PLANS AND REPORTS

Document	Drought	Extreme Heat	Flooding	Landslides and Mudflows	Severe Weather	Wildfire
Riverside County Climate Action Plan[2]						
Western Riverside Council of Governments Western Riverside County Vulnerability Assessment and Adaptation Strategies	X	X	X	X	X	X

[1] While the Plan's explore how drought will affect Lake Elsinore's populations and assets, they do not contain drought-specific policies and adaptation measures.

[2] Includes policies and adaptation measures relating to earthquake-induced landslides, but not climate-induced landslides.

[3] The Climate Action Plans do not identify hazard specific policies and adaptation measures, although GHG reduction policies and measures could reduce the future probability and severity of climate-induced hazards.

[4] Identifies California water mitigation efforts as of 2022.

Adaptive Capacity Summary

This section presents a summary description of the existing adaptive capacity of the City's vulnerable populations and assets based on the description of climate change exposure described in Section 3, the description of vulnerable populations and assets presented in Section 4, and the existing adopted planning documents described above. The tables below are organized by the populations and assets described in Section 4 and present a high-level overview of their adaptive capacity. The City's vulnerability to each identified climate change exposure is assessed based on the magnitude of risk posed to populations and assets, and any existing measures in place to mitigate these impacts. When combined with a population or assets impact score, adaptive capacity scores ultimately feed into determining each population and assets' vulnerability to climate change hazards.

Based on the results of the adaptive capacity assessment, each population or asset was ranked on a three-point scale (1-3) ranging from Low Capacity to High Capacity. Adaptive capacity scoring for each population and asset is included in Appendix A.

TABLE 5-2: ADAPTIVE CAPACITY OF POPULATIONS

Population Category	Populations	Adaptive Capacity Description
Financially Constrained Households	• Low-Income Households • Households in Poverty • Cost-Burdened Households • Overcrowded Households • Renters	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, Wildfire* Financially constrained households throughout the City are exposed to all climate change hazards addressed in this Vulnerability Assessment. Lacking financial resources, these households generally have limited ability to respond to the climate change hazards and their adaptive capacity is considered low. Financially constrained households likely have limited capacity to evacuate for an extended period, or to retrofit homes to resist damage or recover from hazard damage. Retrofitting construction work is expensive and not financially feasible for many of these populations. There are assistance programs that can help retrofit homes or recover from climate events, however these communities may be unaware of these programs and how to participate or may not be able to qualify and the assistance programs are unlikely to pay the entire cost of retro fit/repair. Financially constrained households that rent are subject to the maintenance practices of the landlord who may not invest in protecting the home against climate change impacts. Communities that are financially constrained may not have health insurance or access to healthcare to treat illnesses or conditions created or worsened by climate change impacts.
Physically or Socially Isolated Communities	• Mobile Homes • Persons Without Access to Transportation or Telecommunications • Linguistically Isolated Communities	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, Wildfire* Depending on their location, isolated and rural communities could be exposed to all climate change hazards addressed in this Vulnerability Assessment. Because of the remote locations these populations live in and the difficulties in preparing for and responding to climate hazards these populations may have limited adaptive capacity to certain hazards. Persons living in remote areas with limited access can prepare themselves through retrofitting buildings and infrastructure, creating emergency preparedness kits, and working with others in their community on emergency evacuations and operations. While vegetation management and

TABLE 5-2: ADAPTIVE CAPACITY OF POPULATIONS

Population Category	Populations	Adaptive Capacity Description
		prescribed burns may increase adaptive capacity regarding wildfire, actions or programs may not extend over multiple properties due to different ownership or management. These communities may be unable to receive emergency notifications because of lack of cell phone service or may not have access to alternative roadways to evacuate, or utilities may not be available to provide or quickly restore services to the area. Language barriers or lower levels of social capital may also impact emergency preparedness or evacuation.
Persons with High Outdoor or Hazard Exposure	• Outdoor Workers • Healthcare Workers, First Responders, and Protective Service Occupations • Houseless Population	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, Wildfire* Persons with high outdoor exposure may be unable to seek adequate shelter or evacuate during hazardous conditions or be aware that hazardous conditions are occurring due to age, working conditions, or living conditions. Programs such as cooling centers, homeless shelters, and adult education programs are available in some areas of the City and/or county. However, these populations can be difficult to reach during emergencies. Outdoor work sites can make water, shelter, and protective gear available, although not all sites may do so even when required to. Persons working outdoors are often aware of the warning signs of heat-related illnesses, although access to medical care may be more limited in remote outdoor work sites.
Persons with Limited or Constrained Resources	Low-Resourced Racial and Ethnic Minorities	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, Wildfire* Disparities in living conditions and institutional biases may hinder persons with limited resources in preparing for or recovering from hazardous events. Due to citizenship status or language barriers, these persons may be afraid to seek help, qualify for, or connect with disaster relief services during, or after a disaster. Language barriers may also prevent this group from receiving evacuation and other emergency notifications, decreasing their ability to adequately prepare for and respond to hazardous events.

TABLE 5-2: ADAPTIVE CAPACITY OF POPULATIONS

Population Category	Populations	Adaptive Capacity Description
Persons with Limited Mobility, Chronic Health Conditions, or Who May be Dependent on Individuals or Services	• Children • Seniors • Persons Living Alone • Persons with Disabilities • Persons with Chronic Health Problems	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, Wildfire* Persons with chronic health problems have existing conditions that make it difficult to adapt to climate change hazards. These persons may find it difficult to adapt to increases in extreme heat and smoke from wildfires, or to effectively evacuate during flooding or wildfire events. These persons may also rely on life supporting equipment or treatment machines, such as dialysis or breathing equipment, which requires electricity, which can be turned off or lost during severe weather conditions. Agencies or groups may maintain evacuation assistance lists to locate vulnerable populations and help them evacuate safely. However, communities may be unaware of these services.

TABLE 5-3: ADAPTIVE CAPACITY OF ASSETS

Asset Category	Assets	Adaptive Capacity Description
Transportation Services and Infrastructure	• Major Roads and Highways • Airports • Transit Routes • Freight	*Climate Exposures: Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather and Wildfire* Highways, major roads, freight routes, and road infrastructure, can be protected from flooding, retrofitted to resist landslides, and repaired when damaged, and cleared of vegetation to protect it during wildfire events. However, major roads and highways are the primary method of travel in the City for residents, visitors and freight routes, and therefore any disruptions could harm the economy and quality of life. The infrastructure may not be usable for days or weeks if it is damaged by climate change hazards and requires repairs.

TABLE 5-3: ADAPTIVE CAPACITY OF ASSETS

Asset Category	Assets	Adaptive Capacity Description
		Airports can be protected from flooding with levees and other flood control improvements and hardened against certain severe weather impacts. However, airports experience temporary closures during severe storm events. An airport in a wildfire zone can be protected with vegetation management and firefighting capabilities.
Energy Infrastructure	• Electrical Transmission and Distribution Lines • Electrical Substations • Water and Wastewater Infrastructure	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, Wildfire* Electrical infrastructure can be protected from environmental hazards but depending on the specific hazard, the infrastructure may still suffer damage such as being inundated during a flooding, covered in landslide, impacted by severe wind, or wildfire. Pieces of the energy infrastructure may be undergrounded to avoid certain hazards such as severe weather and wildfire. However, this can be expensive and could take years to complete. Electric vehicle charging stations and fuel pumps may be able to install backup battery systems to ensure that people can still use the charging infrastructure during power outages. To prevent secondary damage, electricity infrastructure can be turned off; however, this causes secondary affects to those relying on the electricity for critical services.
Water and Wastewater Infrastructure	• Water and Wastewater Facilities • Flood Control Infrastructure	*Climate Exposures: Flooding, Severe Weather* Water and wastewater infrastructure can be protected from environmental hazards but depending on the specific hazard, the infrastructure may still suffer damage such as from being inundated during a flooding, covered or dislocated in a landslide, or impacted by wildfire. Pipeline alignments are underground and thus would avoid certain hazards such as impacts from severe weather or wildfire. Water and wastewater infrastructure is highly regulated and protection from climate change hazards will eventually be required. However, this infrastructure is very difficult and expensive to move or place outside of a hazard prone area. Additional pumping or pipeline systems may have to be installed to keep this infrastructure functioning

TABLE 5-3: ADAPTIVE CAPACITY OF ASSETS

Asset Category	Assets	Adaptive Capacity Description
		properly. Water conservation measures, use of more recycled water, and more extensive filtering equipment can protect the water services throughout the City. Wastewater services may have a more difficult time adapting due to the expensive nature of moving wastewater infrastructure. Flood control infrastructure is highly regulated and can be hardened to prevent damage from climate change hazards. However, this infrastructure is very difficult and expensive to move or raise outside of a hazard prone area.
Key Services	• Police, fire, and ambulance stations • Communication Services	*Climate Exposures: Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather and Wildfire* The ability to provide emergency and communication services can be impacted by many of the climate change hazards discussed in this Vulnerability Assessment. Emergency service and communication service providers can plan for climate change hazards and the disruptions to service that may occur. Service providers can provide additional training in how to avoid service disruptions during an event, they can provide additional equipment, establish command centers and shelters outside of all known hazard areas, have repair crews on standby, and plan for such events as power outages. Local and regional medical centers and providers can strengthen medical supply chains and prepare emergency contingency plans for if/when hazards increase in frequency and intensity. However, this may take time and require extensive coordination and redundancy within the emergency service system. Communication systems can also be retrofitted to prevent damage and keep communication capabilities working during hazard events.
Buildings	• Areas of concentrated residential development • Government Buildings and Sites	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, and Wildfire* Buildings can be partially protected against flooding, landslides, severe weather, and damage from wildfires by building hardening and retrofitting and creating defensible space. However,

TABLE 5-3: ADAPTIVE CAPACITY OF ASSETS

Asset Category	Assets	Adaptive Capacity Description
	• Key Employment or Commercial Centers • Schools	these adaptive options can be expensive and do not always provide complete protection. It is extremely difficult to protect or repair individual buildings from large scale hazards like flooding and wildfire. Although steps to harden specific buildings can be taken, more complete protection from these hazards is best approached on a local or regional scale. Chronic climate change hazards could cause buildings to become permanently uninhabitable and/or unusable.
Natural and Managed Resources	• Wildlands and open spaces	*Climate Exposures: Drought, Extreme Heat, Flooding, Landslides, Debris Flows, and Post-Fire Debris Flows, Severe Weather, and Wildfire* The health of natural and managed resources may be severely impacted by climate change impacts, particularly drought and wildfires, but also extreme heat, flooding, and landslides. Extreme heat can raise water temperatures in aquatic systems, increasing dissolved oxygen content, decreasing overall water quality, and potentially contribute to algal blooms, which fish and plant populations may not be able to fully recover from.

6. VULNERABILITY ASSESSMENT RESULTS

The vulnerability assessment evaluates the impact and adaptive capacity of each population and asset for each relevant exposure and assigns a final vulnerability score on a scale of 1 to 5 (adjusted for risk and onset of the exposure). The vulnerability score reflects how susceptible the population or asset is to the harm posed by the exposure. For the purposes of this vulnerability assessment, a score of V4 or V5 is considered significant. Populations and assets that score at least a V4 for one or more exposures are considered substantially vulnerable.

TABLE 6-1: VULNERABILITY SCORING MATRIX

		Impact Score		
		Low Impact	*Medium Impact*	*High Impact*
Adaptive Capacity Score	*Low Capacity*	V3	V4	V5
	Some Capacity	V2	V3	V4
	High Capacity	V1	V2	V3

In total, this vulnerability assessment assigns vulnerability scores to 159 different pairings of populations and assets and the hazards they are exposed. Although there are 192 potential scores, many populations or assets were not given a score because the exposure is not applicable to the population or asset. For example, no score was given to drought hazards to buildings or infrastructure because drought does not pose a hazard to certain infrastructure or buildings.

While the summaries in this chapter focus on scores of at least V4, lower scores should not be ignored, and Lake Elsinore will include adaptation strategies in the Safety Element to improve resilience for populations and assets that scored a V3 or below for certain exposures.

This chapter discusses the significant vulnerabilities within Lake Elsinore's populations and assets. Blank squares in the tables mean that a climate hazard exposure is not applicable to the population or asset, and gray squares indicate that the hazard is applicable, but the score is less than V4 (highly vulnerable). For a complete listing of the vulnerability scores for all sensitivities and exposures for each population and asset, see Table A-3 in Appendix A.

Vulnerable Populations

Exposure to extreme heat, flooding, landslides, and wildfire leaves many populations highly or severely vulnerable due to the high impacts of exposure and lower levels of adaptive capacity (Figure 6-2). Adaptation to these hazards may not be possible or financially feasible for some populations.

People who have limited financial resources or who do not own their home are more limited in their emergency response capacity and therefore vulnerable to climate hazards. Households in poverty (2,323 households) have a higher vulnerability to climate hazards than low-income households (8,776 households) because of the differences in financial resources between the two household categories (low-income households having more assets than households in poverty).

Lower levels of social capital, or the network of relationships an individual or population has, can increase vulnerability. Many communities in Lake Elsinore may be unable to receive emergency notifications, may not be able to evacuate, or evacuate quickly due to financial, social, or infrastructure limitations.

People with disabilities, populations over 65, and others with mobility challenges may face challenges in evacuating and thus are considered highly vulnerable to climate hazards which may require evacuation. Additionally, persons with disabilities, chronic illnesses, or seniors may rely on medical equipment that cannot be transported easily.

Lake Elsinore's health care workers, first responders and protective service occupations (13 percent of workers), outdoor workers (18 percent of workers) and houseless populations (an estimated 50 individuals) are highly vulnerable to many different climate hazards due to their high outdoor exposure and lack of alternative options that would reduce impacts of climate hazards.

Some policies, plans, and programs exist in Lake Elsinore and the broader region to increase the climate resilience and social capacity of highly and severly vulnerable populations, although additional measures are needed to build on these strategies and strengthen their ability to manage present and potential future climate impacts. Many existing and planned strategies applicable to the most highly and severely vulnerable populations are implemented at the regional scale, especially within the Western Riverside Council of Governments Western Riverside County Vulnerability Assessment and Adaptation Strategies. Strategies identified within this analysis should be integrated into Lake Elsinore plans and documents to supplement existing local strategies and increase the local resilience and adaptability of the City's most vulnerable populations.

FIGURE 6-2: HIGHLY AND SEVERELY VULNERABLE POPULATIONS

	Drought	Extreme Heat	Flooding	Landslides and Mudflows	Severe Weather	Wildfire
Populations						
Low-Income Households	_	V4	V5	V5	V4	V4
Households in Poverty	_	V5	V5	V5	V5	V5
Cost-Burdened Households	_					
Severely Overcrowded Households	_					
Renters	_		V4	V4	V4	
Mobile Homes	_				V4	V4
Persons Without Access to Transportation or Telecommunications	_		V5	V5	V5	V5
Linguistically Isolated Communities	_					V4
Low-Resourced Racial or Ethnic Minorities	_		V4	V4	V4	V4
Outdoor Workers	V5	V4	V4	V4	V4	V4
Healthcare Workers, First Responders, and Protective Service Occupations	V5	V4	V4	V4	V4	V4
Houseless Population	V5	V4	V5	V4	V4	V4
Children (under 14 years of age)	_	V5				V5
Persons with Disabilities	_	V4	V4	V4		V5
Persons with Chronic Health Problems	_	V5				V5
Seniors (65+)	_	V4				V5
Persons Living Alone	_					

Vulnerable Assets

Many of the key infrastructure networks (roads, freight routes, water systems, wastewater systems, electricity grid) in Lake Elsinore are vulnerable to climate change hazards due to their expensive and complex nature (integration within the system), high exposure to hazards, and the coordination and cost necessary to redesign or relocate the infrastructure. For example, major roads and highways throughout Lake Elsinore are vulnerable to numerous hazards, which can cause them to close or become impassable, isolating residents and business owners from key services and potentially creating severe health and safety risks. Local and/or regional policies and plans exist to mitigate the impact of climate hazards on key infrastructure and encourage climate-smart locations of future infrastructure projects.

Emergency and communication services are key services vulnerable to climate change hazards due to their active role in responding to climate events and local emergencies. Climate-smart emergency management activities will require an increased commitment of staff time and expertise, materials and equipment, and other resources. Multi-jurisdictional emergency management efforts allow communities to effectively share resources but ensure a sufficient supply if all participating communities are simultaneously affected by a major disaster. Existing multi-jurisdictional and local emergency response and communication strategies exist but will likely need to increase as climate hazards worsen, especially relating to emergency services.

Buildings can be retrofitted, upgraded, or raised to prevent damage from climate hazards, but these solutions can be expensive or infeasible for property owners to complete and are not always effective in protecting the building from certain hazards. Areas of concentrated residential development are highly or severely vulnerable to several hazards. However, some homeowners, especially low-income or cost-burdened households, may not have the appropriate disaster insurance or the ability to pay to fix structure damage. Chronic climate change hazards could cause buildings to become permanently uninhabitable. Regional and local policies, plans, and programs can increase building's climate resilience, including specific programs for low-income and vulnerable communities, and develop additional resilience hubs in Lake Elsinore and the broader region.

Lake Elsinore's wildlands and open spaces are highly susceptible to damage from drought, landslides, and wildfire. Drought can lower water levels and water quality, thus, stressing vegetative communities and wildlife. Higher temperatures and lack of water related to drought can stress the vegetative communities and make them more susceptible pest infestations and wildfire damage. Drought and wildfires can also lead to increased slope instability and landslide susceptibility across the Lake Elsinore's many steep slopes. Local and regional level policies and plans can manage vegetation and reduce the impact of climate hazards (especially wildfires) on wildlands and open spaces, although additional strategies are needed to manage vulnerability against drought and landslides.

FIGURE 6-3: HIGHLY AND SEVERELY VULNERABLE ASSETS

	Drought	Extreme Heat	Flooding	Landslides and Mudflows	Severe Weather	Wildfire
Infrastructure						
Airports	_	_		_		
Transit Routes	_	_		_		
Major Roads and Highways	_	_	V4	V4	V4	V4
Freight	_	_	V4	V4	V4	V4
Electrical Substations	_	V4			V4	V4
Electrical Transmission and Distribution Lines	_	V4			V4	V4
Water and Wastewater Infrastructure			V4		V4	
Flood Control Infrastructure	V4	_	V4		V4	
Key Services						
Emergency Services	_	V4	V4	V4	V4	V4
Communication Services	_			V5		V5
Buildings						
Areas of Concentrated Residential Development	_		V5	V5		V4
Government Buildings and Sites	_					
Key Employment or Commercial Centers	_					
Schools	_					
Natural and Managed Resources						
Wildlands and open spaces	V4			V4		

Next Steps

Moving forward, the City will develop Safety Element goals and policies to address these issues and improve community resilience. Future community engagement is recommended to confirm the impact and adaptive capacity and of existing populations and assets and to identify future opportunities to increase community-wide climate resilience, especially of highly and severely vulnerable populations and assets.