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VULNERABILITY ASSESSMENT REPORT FOR THE GENERAL PLAN UPDATE

City of Santa Ana

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1. Introduction

The City of Santa Ana (City) prepared this Vulnerability Assessment Report in conformance with State of California requirements to assess climate change vulnerability and address climate change adaptation and resilience as part of a General Plan Update, with the goal of enabling the community to prepare for, respond to, withstand, and recover from disruptions created or caused by climate change. California Government Code Section 65302(f)(4) requires communities to prepare a vulnerability assessment to analyze how climate change may harm the community, and to then prepare and implement General Plan goals, policies, and implementation strategies to increase resiliency in Santa Ana. This report discusses the regulatory framework and method for adding adaptation and resilience into City policies, the climate change hazards affecting the resilience of Santa Ana, specific populations and assets included in the assessment, and a summary of the vulnerability assessment results.

1.1 REGULATORY FRAMEWORK

In 2015, California adopted Senate Bill (SB) 379, which amended Section 65302(g) of the California Government Code to require the Safety Element of the General Plan to include more information about wildfire hazards, flooding risks, and other short-term and long-term threats posed by climate change. To address climate change adaptation, the safety element must include a vulnerability assessment identifying the risks that climate change poses to local jurisdictions; a set of goals, polices, and objectives based on a vulnerability assessment for the protection of the community; and a set of feasible implementation measures to carry out the goals, policies, and objectives of the City. SB 379 also states that safety elements must be reviewed and revised with each revision of the housing element or local hazard mitigation plan, but no less than once every eight years, to address climate adaptation and resiliency and identify new information relating to flood and fire hazards.

The State of California prepared a guidance document, the *California Adaptation Planning Guide*, to assist communities in addressing climate adaptation and resilience. This guide presents a step-by-step process for gathering the best available climate change science, completing a climate change vulnerability assessment, creating adaptation strategies, and integrating those strategies into general plans and other policy documents. The City's vulnerability assessment is consistent with the guidance and recommended methods provided in the *California Adaptation Planning Guide*.

1.2 CLIMATE SCIENCE OVERVIEW

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. These effects can lead to an increase in frequency and intensity of climate change

hazards. According to the *California Adaptation Planning Guide*, climate change hazards have the potential to cause fatalities, injuries, property and infrastructure damage, interruption of business, and other types of harm or loss. These hazards can include flooding, severe weather, wildfires, landslides, and drought conditions, among others. This Vulnerability Assessment Report evaluates the impacts created by these hazards and the ability of Santa Ana's populations and community to resist these hazards, to assess which aspects of the community are most vulnerable to climate change.

1.3 METHOD

The Vulnerability Assessment analyzes how a changing climate may harm the City of Santa Ana, and which aspects of the community – including people, buildings and facilities, economic drivers, and many other assets – are most vulnerable to its effects. The vulnerability assessment primarily follows the recommended process published in the *California Adaptation Planning Guide* in 2020 by the California Office of Emergency Services. This includes a four-step process: (1) characterizing the City's exposure to current and projected climate hazards; (2) identifying potential sensitivities and potential impacts to City populations and assets; (3) evaluating the current ability of the community to cope with climate impacts, also referred to as its adaptive capacity; and (4) identifying priority vulnerabilities based on systematic scoring. These steps are shown in Figure 1.

Figure 1. California Adaptation Planning Guide Recommended Method

Step 1: Identify Exposure. The goal of this step is to characterize the community's exposure to current and projected climate change hazards. Many projections of climate change hazards rely on multiple scenarios that reflect different levels of how global GHG emissions and atmospheric GHG concentrations may change over time. 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. 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.

The Cal-Adapt database, which provides California-specific climate change hazard projections, uses RCP 4.5 for a low emissions scenario and RCP 8.5 for a high emissions scenario. The Governor's Office of Planning

and Research *Planning and Investing for a Resilient California* recommends using RCP 8.5 for analyses considering impacts through 2050, as there are minimal differences between emission scenarios for the first half of the century. This guide also recommends using RCP 8.5 for late-century projections, for a more conservative and risk-adverse approach. The recently updated *California Adaptation Planning Guide* follows these recommendations. The City used the RCP 8.5 GHG emission scenario to input into global climate models on the Cal-Adapt database and other resources.

This first step of a vulnerability assessment is to confirm which of the hazards are expected to take place at the local level in Santa Ana. The City of Santa Ana identified six climate change hazards for this assessment, listed here and discussed in more detail in Section 2.

1. Air Quality
2. Drought
3. Extreme Heat
4. Flooding
5. Human Health Hazards
6. Severe Weather

The climate change hazard data was derived from up-to-date information, including the state Cal-Adapt database, the *California Adaptation Planning Guide*, and the *California 4th Climate Change Assessment*.

Step 2. Identify Sensitivities and Potential Impacts. This step includes evaluating past and potential future climate change impacts to community populations and assets. The City first identified a list of populations and assets to include in the assessment with the following five categories:

1. Populations: People that experience a heightened risk and increased sensitivity to climate change and have less capacity and fewer resources to adapt to or recover from climate impacts.
2. Infrastructure: Structures that provide various services to Santa Ana community members.
3. Buildings: Homes, nonresidential buildings, and other building types.
4. Economic Assets: Properties and activities that make significant contributions to the Santa Ana economy.
5. Key Community Services: Important functions to community members provided by government agencies and private companies.

Once this list was confirmed, the City evaluated potential impacts to these populations and community assets. To identify how great the impacts of each relevant hazard are on the populations and community assets, the City considered a number of different questions that helped ensure the assessment broadly covered a range of potential harm. Examples of these questions include:

» Could the hazards cause 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 harmed both directly and indirectly?

» How long would the impacts persist?

Based on the results of the impact assessment (IM), the City ranked each sensitivity on a five-point scale (0 – 4) for each relevant exposure. IM0 is the lowest score (lowest impact), and IM4 is the highest score (highest impact). Impact is a negative quality, so a lower impact score is better. The City accounted for the risk levels and onset of hazardous conditions in each of the impact scores. Table 1 provides more detail about what each score means.

Table 1. Rubric for Impact Scoring

Impact Score	Meaning (People and Ecosystems)	Meaning (Buildings, Infrastructure, Services, and Economic Drivers)
IM0. Minimal Impact	Community members may not notice any change.	Damage, interruption in service, or impact on the local economy is small or intermittent enough to mostly go unnoticed.
IM1. Low Impact	Community members notice minor effects. Daily life may experience mild, occasional disruptions.	There are minor but noticeable interruptions in service, damage, or negative effects on the economy.
IM2. Moderate Impact	There is a marked impact to the community. Quality of life may decline. Impacts may be chronic, and at times substantial.	Damage, service interruptions, and other impacts are clearly evident. Impacts may be chronic and occasionally substantial.
IM3. Significant Impact	The well-being of the community declines significantly. The community's current lifestyle and behavior may no longer be possible.	Impacts are chronic. Buildings, infrastructure, and services may be often or always unable to meet community demand. Large sections of the economy experience major hardships.
IM4. Severe Impact	There is a severe risk of widespread injury or death to people, or of significant or total ecosystem loss.	Buildings, infrastructure, and services cannot function as intended or needed. Economic activities are not viable.

Step 3. Assess Adaptive Capacity. Adaptive capacity is the ability of populations and community assets to cope with and adapt to the impacts of climate change. Each population and assets were evaluated for adaptive capacity by considering the following questions:

» 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 the City/jurisdiction that community members can use?

Based on the results of the adaptive capacity (AC) assessment, the City ranked each sensitivity on a five-point scale (0–4) ranging from AC0 (the lowest adaptive capacity) to AC4 (the highest adaptive capacity). Adaptive capacity is a positive quality, so a higher adaptive capacity score is better. As recommended by the APG, the City adjusted the adaptive capacity scores to ensure that they reflect risk levels and onset periods. Table 2 provides more detail about what each score means.

Table 2. Rubric for Adaptive Capacity Scoring

Adaptive Capacity Score	Meaning
AC0. No Adaptive Capacity	Currently, there are no feasible means of adapting.
AC1. Low Adaptive Capacity	Adaptive solutions are available, but they are expensive, technologically difficult, and/or politically unpopular. Alternatives may not exist that can provide similar services.
AC2. Some Adaptive 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.
AC3. High Adaptive 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.
AC4. Outstanding Adaptive Capacity	Sensitivities can adapt with little or no effort. Quality of life is unchanged or may improve.

Step 4. Prioritize Vulnerability Scoring. The City used the impact and adaptive capacity scores for each population or asset, and relevant hazard, to determine a vulnerability score. The vulnerability (V) score reflects how susceptible the sensitivity is to harm from a particular 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

Figure 2 shows how different impact and adaptive capacity scores translate to a vulnerability score.

Figure 2. Vulnerability Scoring Matrix

		IMPACT SCORE				
		IM0	**IM1**	**IM2**	**IM3**	**IM4**
ADAPTIVE CAPACITY SCORE	**AC0**	V3	V4	V5	V5	V5
	AC1	V2	V3	V4	V5	V5
	AC2	V1	V2	V3	V4	V5
	AC3	V1	V1	V2	V3	V4
	AC4	V1	V1	V1	V2	V3

2. Climate Change Hazards

As described in the *California Adaptation Planning Guide*, hazards are events or physical conditions that have the potential to cause fatalities, injuries, property and infrastructure damage, interruption of business, and other types of harm or loss. Some natural hazards are not climate change related, such as seismic hazards and earthquakes, which do not have a known connection with climate change. Climate change-related hazards focus on natural hazards that can change in frequency and intensity due to climate change. The Climate Change Vulnerability Assessment assessed the climate change related hazards that are most relevant to the City of Santa Ana, as stated above. This section discusses the climate change-related hazards based on projections provided by Cal-Adapt, the *California Fourth Climate Change Assessment*, the Federal Emergency Management Agency (FEMA), and scholarly research.

2.1 AIR QUALITY

The dominant sources of air pollution in the City of Santa Ana are ozone pollution from vehicle exhaust, fine particulate matter from industry, and diesel particulate matter from diesel trucks, as well as smoke from wildfires in the region. Higher future temperatures may increase the production of ground-level ozone, and concentrations are expected to increase in most places already experiencing high levels of this pollutant. Ground-level ozone is associated with a variety of negative health outcomes, including reduced lung function, pneumonia, asthma, cardiovascular diseases, and premature death.

2.2 DROUGHT

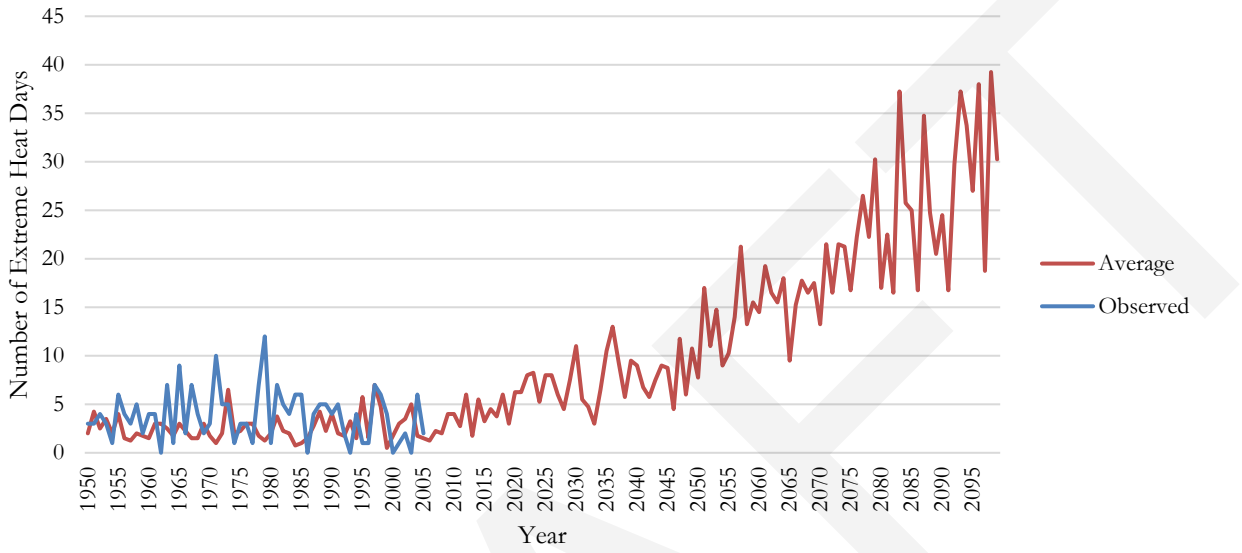
A drought occurs when conditions are drier than normal for an extended period of time, making less water available for people and ecosystems. Droughts are a regular occurrence in California; however, scientists expect that climate change will lead to more frequent and more intense droughts statewide. Nearly 30 percent of Santa Ana's water supply comes from the Metropolitan Water District of Southern California via the State Water Project and Colorado River, which may experience a reduction in water supply during drought conditions. This could cause water shortages during drought conditions and heavier reliance on groundwater supplies to meet the needs of Santa Ana's residents and businesses. The price of water could also increase during drought periods, increasing the economic instability of low-income residents.

2.3 EXTREME HEAT

Extreme heat occurs when temperatures rise significantly above normal levels. In Santa Ana, an extreme heat day occurs when temperatures reach above 96.3 degrees Fahrenheit. As shown in Figure 3, the projected number of extreme heat days in Santa Ana is projected to increase to an average of 11 extreme heat days per year by mid-century and an average of 25 extreme heat days per year by end of century.

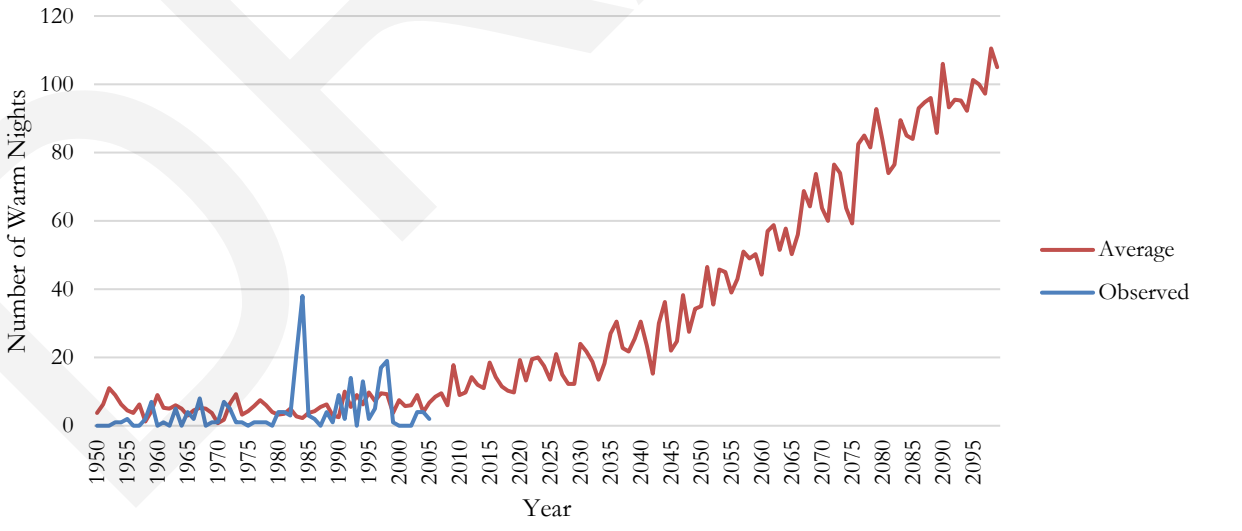
2. Climate Change Hazards

Figure 3. Projected Extreme Heat Days in Santa Ana



Extreme heat can also occur in the form of warmer nights, as temperatures do not cool down overnight and provide relief from the heat. In Santa Ana, a warm night occurs when the temperature remains above 68.3 degrees Fahrenheit. As shown in Figure 4, the projected number of warm nights in Santa Ana is projected to increase to an average of 39 warm nights per year by mid-century and an average of 87 warm nights per year by the end of the century.

Figure 4. Projected Warm Nights in Santa Ana



Extreme heat can cause heat-related illnesses, such as heat cramps, heat exhaustion, and heat stroke, in addition to exacerbating respiratory and cardiovascular conditions. Approximately 30 percent of homes in Santa Ana

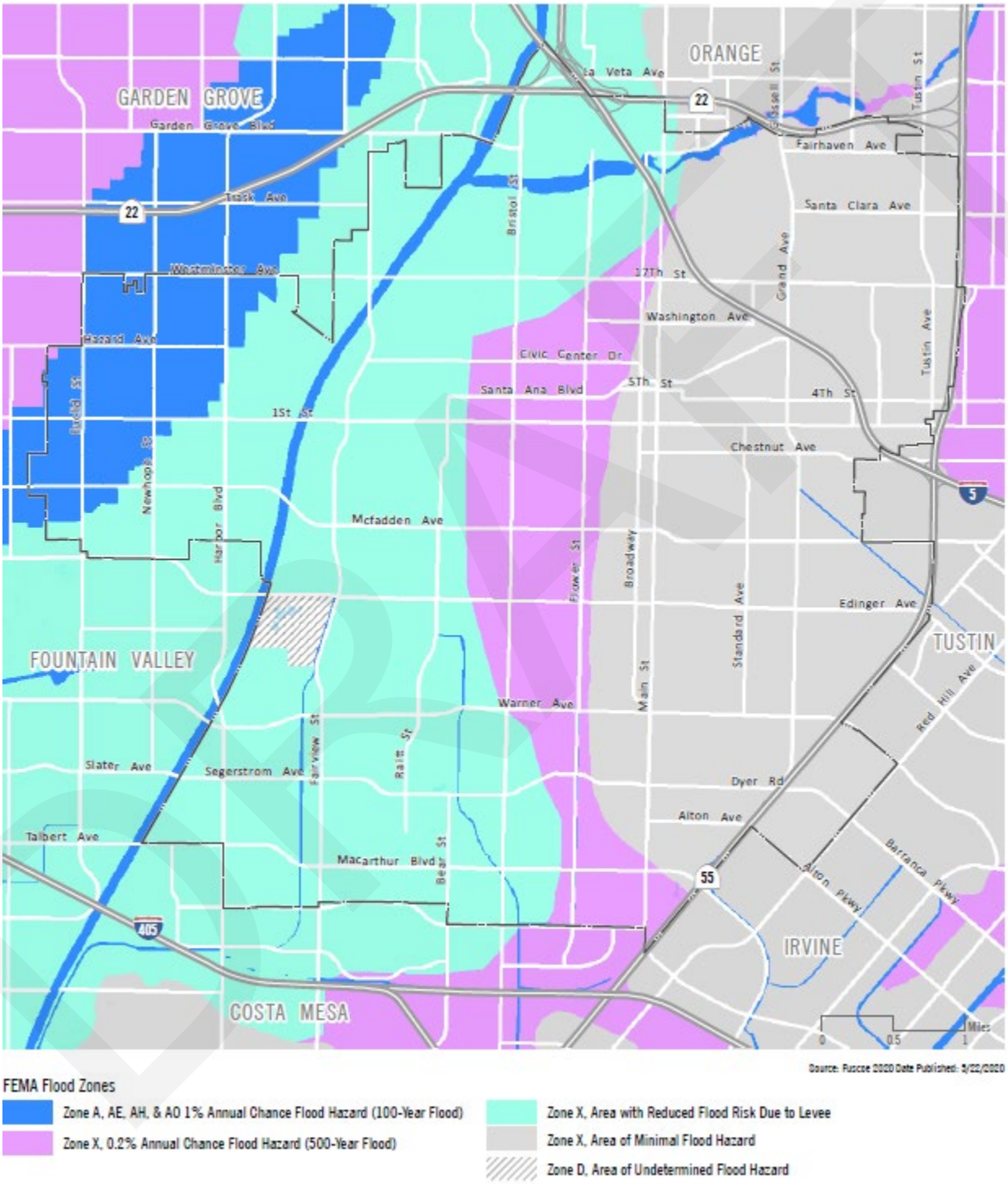
may lack air conditioning, and as a result people living in these homes may be more susceptible to harm from extreme heat events. If homes have air conditioning, residents may find increased use cost prohibitive. Some types of infrastructure, including power lines and roadways, face greater stresses during high temperatures that make failure more likely.

2.4 FLOODING

Flooding can cause significant harm to buildings, people, and infrastructure. Floodwater can be deep enough to drown people and may move fast enough to carry people or heavy objects (such as cars) away. Flooding can be caused by heavy rainfall or long periods of moderate rainfall, or clogged drains during periods of rainfall. In rare instances, a break in a dam, water pipe, or water tank can also cause flooding. Additionally, heavy periods of rainfall can stress levee systems, and overtopping can lead to catastrophic flooding. Persons experiencing homelessness and others who may be outdoors in the path of a flood can face particularly high risks from these events. Storm drainage systems throughout the city collect stormwater runoff and convey water to prevent flooding, although these systems are typically designed based on winter storms recorded in the past and may not be designed to accommodate more intense storms. The levee system along the Santa Ana River is designed for a 190-year flood and may also not be able to accommodate a more intense storm or heavy rainfall over a short period of time. Scientists project that climate change will increase the frequency and intensity of floods within Santa Ana, although total annual precipitation levels are not expected to change very much. Figure 5 shows FEMA-designated flood hazard areas within Santa Ana.

2. Climate Change Hazards

Figure 5. FEMA Flood Hazard Zones



2.5 HUMAN HEALTH HAZARDS

There are several diseases, such as hantavirus pulmonary syndrome, Lyme disease, West Nile virus, and influenza, that are linked to climate change and can be debilitating or fatal for some of the population. These diseases are carried by pests, such as mice, rats, ticks, and mosquitos. Climate change can increase the rates of infections because many of the animals that carry diseases are more active during warmer weather and may expand in population size due to higher levels of rainfall during storm events and stagnant water after flooding, increasing the time for diseases to be transmitted. Some diseases and illnesses have the potential to become epidemics or pandemics if they spread within communities, regions, or over multiple countries. Additionally, following natural disasters, such as flooding or severe weather events, mental health and stress-related disorders increase. Health hazards from air pollutants are evaluated as part of the air quality hazard discussion.

2.6 SEVERE WEATHER

Severe weather can include strong winds, hail, and lightning, which is usually caused by intense storm systems, although types of strong winds can occur without a storm. As described in the *Los Angeles Summary Report* from the *California Fourth Climate Change Assessment*, the connection between climate change and severe storms is not as well established as other exposures, but new evidence suggests that these forms of severe weather may occur more often than in the past. Severe winds, such as the Santa Ana winds, tend to be most frequent during October to April and can have average speeds of 40 miles per hour. These winds can destroy buildings, knock over trees, damage power lines and electrical equipment, and fan small sparks into large wildfires in the region. Hail can damage buildings and plants, and lightning can spark fires, injure people, or cause fatalities.

2. Climate Change Hazards

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3. Populations and Assets

Populations and assets are the people, infrastructure, and services in the City of Santa Ana that can be affected by climate change. The vulnerability assessment looks at how each population and community asset may be affected by each of the climate change hazards discussed in Section 2. The *California Adaptation Planning Guide* provides a general list of populations and assets, which the City of Santa Ana refined and used to develop five distinct asset categories: (1) populations, (2) infrastructure, (3) buildings, (4) economic assets, and (5) key community services. In total, Santa Ana identified 55 distinct populations and assets, as shown in Table 3. Figure 6 shows the location of key community facilities for the vulnerability assessment.

Table 3. Populations and Assets Included in the Vulnerability Assessment

Category	Population or Asset
Populations	Children (Under 10 years of age)
	Cost-burdened households
	Households in poverty
	Immigrants and refugees
	Outdoor workers
	Persons experiencing homelessness
	Person in overcrowded households
	Persons with chronic health problems
	Persons with disabilities
	Persons with limited English proficiency
	Persons without access to lifelines
	Renters
	Senior citizens (65 years of age or over)
	Senior citizens living alone
	Undocumented persons
Infrastructure	Bicycling facilities
	Bridges
	Communication facilities

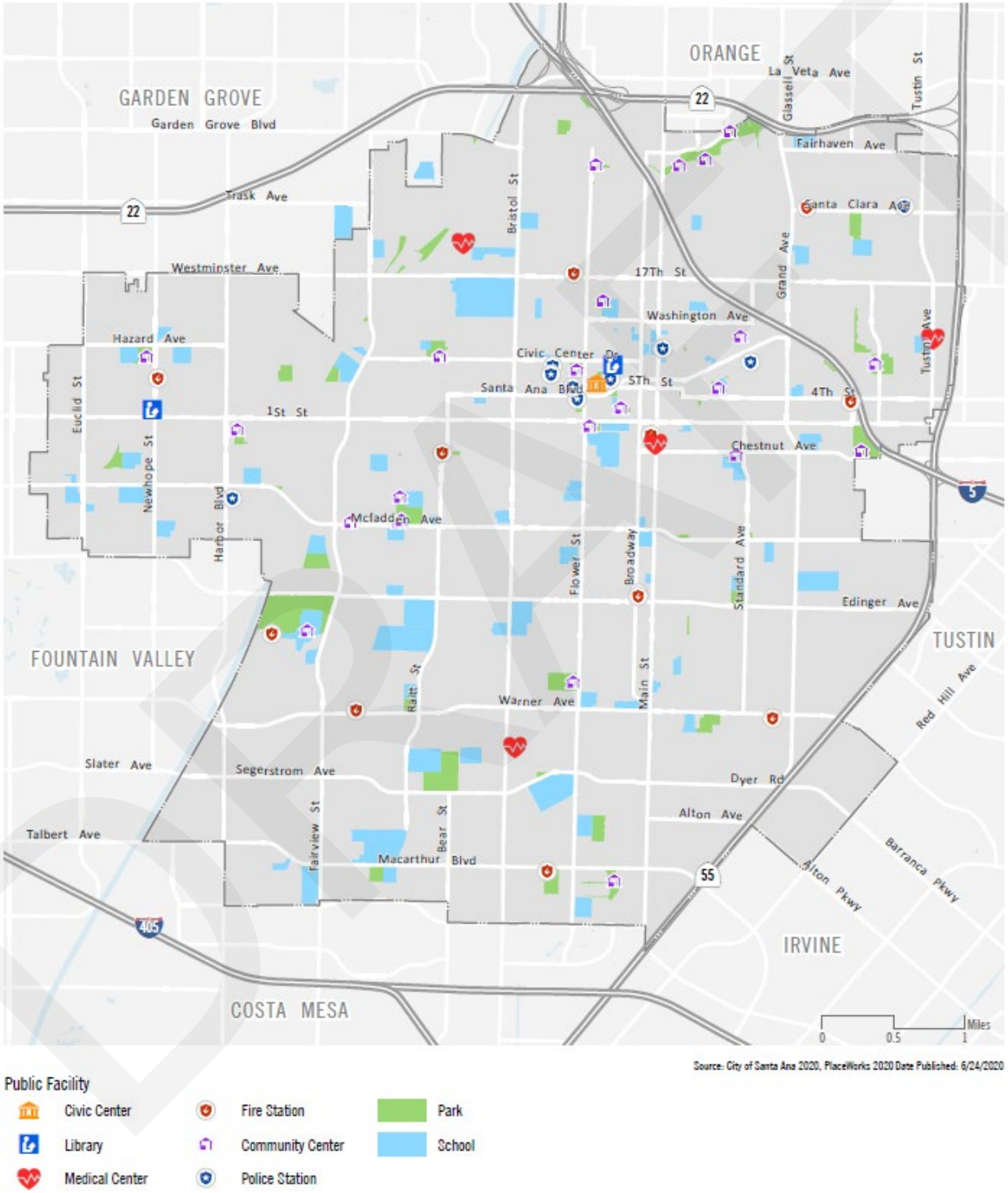
3. Populations and Assets

Category	Population or Asset
	Electrical transmission and distribution lines
	Electrical substations
	Flood control infrastructure
	Major roads and highways
	Parks and open space
	Railroads
	Transit stops
	Waste transfer stations
	Water and wastewater infrastructure
Buildings	Commercial buildings
	Community centers
	Government buildings
	Homes
	Industrial buildings
	Libraries
	Medical and care facilities
	Public safety buildings
	Schools
	Transit centers
Economic Assets	Airports
	Industrial/manufacturing centers
	Major employers
	Outdoor recreation
	Retail
	Administrative support and waste management
	Health care and social assistance
	Accommodation and food services
	Professional, scientific, and technical services
	Communication services

Category	Population or Asset
Key Community Services	Emergency medical response
	Energy delivery
	Government administration and city services
	Public health
	Public safety response
	Public transit access
	Solid waste removal
	Water and wastewater

3. Populations and Assets

Figure 6. Key Facilities for Vulnerability Assessment



4. Vulnerability Assessment Results

The vulnerability assessment evaluates the impact and adaptive capacity of each population and asset for each relevant hazard. Vulnerability scores were assigned on a scale of 1 to 5 to reflect how susceptible the population or asset is to harm posed by the hazard. In total, 221 different pairings were assessed for vulnerability. This section provides a summary of the key vulnerabilities within the City of Santa Ana. For a complete list of vulnerability scores for all populations and assets, see Appendix A.

4.1 POPULATIONS

Of the 15 populations evaluated in the vulnerability assessment, 11 scored V4 or V5 for at least one hazard type. Populations are most vulnerable to air quality, extreme heat, flooding, and human health hazards. The most vulnerable populations include households in poverty, immigrants (including undocumented persons), populations that spend a disproportionally amount of time outdoors (outdoor workers and persons experiencing homelessness), and persons with existing health conditions or that have limited mobility.

Households in poverty and other households with financial instability are severely vulnerable to all hazards, except drought, as these households may live in poor housing conditions, neighborhoods that have little vegetation, and lack the financial means to recover from property damage or illnesses caused by climate change hazards.

Similarly, **persons experiencing homelessness** are severely vulnerable to the same five climate change hazards as they lack permanent, and often temporary, shelter. This can leave them directly exposed to high temperatures, air pollution, flooding, vector-borne diseases, and severe weather. Homeless encampments and services are also located within close proximity to the Santa Ana River and Santiago Creek, and persons experiencing homelessness may have a difficult time recovering if flooding events damage or destroy temporary shelters and personal property.

Outdoor workers are also severely vulnerable to air quality and extreme heat because their occupations often involve physically intense work that can include the risk of individuals suffering from medical complications. Outdoor work can be halted during hazardous conditions; however, outdoor workers may face economic hardships if work is stopped, further hindering adequate recovery.

Immigrants and refugees, especially undocumented persons, are highly or severely vulnerable to multiple hazards due to their citizenship or immigrant status. A majority of these populations may be hesitant to seek help or may not qualify for financial assistance programs that can help them prepare and recover from a disaster.

Persons with existing health conditions or those that have limited mobility, such as persons with chronic health problems or seniors living alone, are highly vulnerable, as these individuals may have a compromised immune system that make it more difficult for health professionals to treat new illnesses and they may have

difficulty evacuating during emergencies caused by flooding or severe weather. Power outages can also isolate these persons and potentially cause life-support systems to fail.

4.2 BUILT SYSTEM

The built system includes vulnerabilities to infrastructure, buildings, and the community services that the City of Santa Ana provides. The built systems are most vulnerable to flooding, with high winds creating several vulnerabilities under the severe weather hazard. Of the 22 infrastructure and building assets included in the assessment, nine scored V4 or V5 for at least one hazard.

The most vulnerable assets are electricity transmission and distribution lines, as extreme heat and severe weather can overload or damage the electrical grid, causing power outages that would impact Santa Ana residents and businesses. If electricity lines are intentionally shut off to reduce damage, critical facilities may not be able to function properly if they do not have backup power supplies.

As shown in Figure 5, the northern, southern, and western portions of Santa Ana are within the 100-year or 500-year flood zone, or an area with reduced flood risk due to a levee. The portion of Santa Ana east of Broadway is outside of the flood zone. Due to a projected increase in frequency and intensity of rainstorms, flooding could occur more frequently, leaving major roadways and highways, bridges, and railroads highly vulnerable to damage. While parks and open space can absorb stormwater, park facilities such as restrooms and pedestrian paths can be damaged by floodwaters, rendering the parks unusable. Homes and residential structures are more vulnerable than other building assets. Homes and residential buildings are most vulnerable to flooding and severe weather because water damage can cause mold and mildew to grow, causing these structures to become uninhabitable. Some homeowners, especially low-income or cost-burdened households may not have flood insurance or the ability to pay for restoration of their home. Other buildings east of Main Street are also vulnerable to flooding, including commercial buildings in Downtown Santa Ana, industrial buildings in western Santa Ana near the Santa Ana River, and over half of school buildings, including the Santa Ana Community College.

Of the nine community service assets assessed, four scored V4 or V5 for at least one hazard. The most vulnerable community service is energy delivery. As described above, electricity transmission and distribution lines can be damaged by extreme heat and severe weather, and therefore the regionwide energy delivery system is also vulnerable to these hazards. Southern California Edison and the City of Santa Ana can work together to insulate power lines, place them underground, or install solar panels and battery storage facilities; however, this process can be expensive and may disrupt other community services.

Many of the community services are also highly vulnerable to flooding, such as wastewater services that can back up due to an increase in wet weather flow and roadways that can become impassable from flood waters, disrupting public transit services, emergency medical response, and public safety response. Disruption of these services could be detrimental to both residents and businesses. Community services, such as emergency medical response, are highly vulnerable to human health hazards, such as vector-borne diseases, that can overwhelm and create shortages of facilities, equipment, pharmaceuticals, and personnel if health care workers become sick or if supply chains are disrupted.

4.3 ECONOMIC SYSTEM

Of the nine economic assets evaluated in the vulnerability assessment, two economic assets scored V4 or V5 for at least one hazard. Industrial and manufacturing centers and outdoor recreation are the most vulnerable economic assets in Santa Ana.

Industrial and manufacturing centers located in western Santa Ana near the Santa Ana River are highly vulnerable to flood and severe weather, which can damage the buildings that house this industry. Damage to these buildings may not only cause economic hardship, but also has the potential to release hazardous materials into the air, water, and soil in the surrounding areas. Severe weather can also prevent workers from traveling to industrial centers and working remotely may not be an option for these companies.

Outdoor recreation is also highly vulnerable to air quality and extreme heat because these hazards can prevent residents and visitors from participating in activities at the City's four golf courses or parks if poor air quality or high temperatures create negative health outcomes. Some outdoor recreation activities can be postponed or temporarily moved indoors, avoiding harm to participants; however, such alternatives within the City may not be viable for all activities.

4. Vulnerability Assessment Results

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5. Implications for the General Plan Update

5.1 EQUITY AND UNCERTAINTY

When addressing vulnerability and adaptation through general plan policies and the associated implementation plan, two factors should also be considered: equity and uncertainty.

Equity means that all people are justly and fairly included in society, and that everyone is able to participate, prosper, and achieve their full potential. Neighborhoods and residents on the eastern and western edges of Santa Ana already experience a disproportionate burden of the effects of climate change, environmental pollution, and historical socio-economic disparities. Equitable climate adaptation planning involves identifying persons who are most vulnerable to climate change hazards, and ensuring that the planning process, distribution of resources, and efforts to address systematic wrongs are all conducted in an equitable manner. This vulnerability assessment identifies 15 vulnerable populations and assesses climate change impacts and the ability of these populations to prepare for, respond to, and recover from climate change hazards (see list in Section 2).

Uncertainty is the second component to consider when determining how hazardous conditions may affect Santa Ana. Climate change is driven by the concentration of GHGs in the atmosphere, which is affected by the adoption of and implementation of local, state, federal, and international GHG-reduction measures. This is where the uncertainty arises, as the more action taken to reduce GHG emissions, the less severe the effects of climate change are expected to be. Climate change models consider the concentrations of atmospheric GHG emissions and the changes in these levels over time to project future extent or intensity of hazardous events. Even with the extensive modeling, potential impacts are projections of more likely future conditions and are not certain. Similarly, there is also substantial uncertainty about the future state of technology, socioeconomic conditions, and other factors. According to recent studies, the best approach to uncertainty is to prepare and adapt by monitoring how the future evolves and allow for adjustments over time as new climate data and studies are completed.

5.2 OPPORTUNITIES

Santa Ana currently experiences a wide range of climate change hazards that are projected to increase in frequency and intensity in the future. While GHG reduction measures in the Santa Ana Climate Action Plan will help reduce the amount of carbon dioxide in the atmosphere, adaptation strategies will be needed to increase the resilience of residents and businesses in Santa Ana. The general plan and associated implementation plan should integrate adaptation measures into the update process that will help the community prepare for, respond to, and recover from climate change-related hazards.

5. Implications for the General Plan Update

Safety. Due to the recent update of the California Government Code Section 653029(g) with the approval of SB 379, Safety Elements are required to address climate adaptation and resilience strategies. The Safety Element's goals and policies and implementation actions can provide resilience strategies that support both reduced impacts and improved adaptive capacity of the community to climate-change related hazards, along with policies on required hazards such as floods and geologic hazards. Policies within this element can ensure that health and safety concerns of the community are met, even with an increase in frequency and intensity of climate change hazards. Examples of specific implementation actions could include:

- Partner with social care organizations and local homeless shelters to distribute insect repellant, masks, sanitizer, and other basic hygienic necessities to persons experiencing homelessness.

- Coordinate with City and regional transit providers to identify alternative routes and stops if normal infrastructure is damaged or closed as a result of extreme events.

- Annually distribute flood protection safety pamphlets to educate community members about safety during flood conditions, including the dangers of driving on flooded roads.

» **Public Services.** The Public Services Element already includes policies for the location and programming of public facilities and utility infrastructure. Buildings and utility infrastructure are included in the previous key vulnerability discussion, and therefore resilience strategies for these systems would be appropriate to add to the Public Services Element's goals and policies and implementation actions. Potential policies and implementation actions may include efforts to underground electrical lines, retrofit and protect public facilities, and install sustainable back-up power supplies. Strategies can also look at the promotion of low-impact development and green infrastructure that can help convey stormwater and reduce flooding.

The Urban Sustainability Network's *Resilience Hub White Paper* provides another key resilience strategy for public facilities, the integration of physical and virtual resilience hubs. These can serve as centralized locations for resources about climate change, opportunities to reduce emissions, and techniques to increase resilience, showcases for sustainability, energy efficiency, and low carbon building, and to help residents obtain essential resources and information during and after a disaster. Examples of specific implementation actions could include:

- Identify existing facilities to serve as resilience hubs and cooling centers that open during emergencies or specific temperature triggers for residents to go to seek refuge from extreme heat days or emergency shelter.

- Coordinate with emergency management services to establish backup power, preferably from renewable energy sources, and water resources at emergency shelters, resilience hubs, and cooling centers in case of power outages.

» **Economic Prosperity.** The focus of the Economic Prosperity Element is on job creation, diversifying the economic base, and economic development strategies. This element and associated implementation actions can provide additional policies to ensure small and large businesses can prepare for, respond to, and recover from climate change hazards, which helps to promote a resilient community. Such policies and actions can ultimately reduce economic hardships that can be caused by hazardous events. These policies and actions can emphasize strategies for facilities that are most vulnerable to climate change, including industrial and manufacturing assets and outdoor recreation.

» **Open Space.** The Open Space Element includes public health and safety by promoting recreation opportunities and protected green space within the City, which is essential to ensuring that vulnerable populations can adapt to an increase in frequency and intensity of hazards. Open space areas can help reduce air pollution, decrease ambient air temperatures and provide shade during hot days, and act as buffers to slow down and absorb floodwaters, among other benefits. This element and implementation plan can include policies and actions that increase the urban tree canopy to reduce the heat island effect and clean the air.

Conservation. The Conservation Element emphasizes a sustainable environment, which can include policies and associated implementation actions to increase the health and safety of homes through energy retrofit programs that also protect residents from extreme heat, poor air quality, and severe weather. Examples of resilience policies and actions could include installing solar energy and energy storage systems at public facilities, promoting use of sustainability and low-carbon building materials, or establishing a rebate program to remove lawns and install drought-tolerant landscaping. Examples of specific implementation actions could include:

- Expand participation of PACE programs and other support services that provide funding resources for economically disadvantaged households and businesses.

» **Environmental Justice.** Although not a discrete element, environmental justice issues will be integrated throughout the General Plan. Environmental justice focuses on reducing unique or compounded health risks in disadvantaged communities identified within Santa Ana. Policies can include reducing air pollution, increasing public facilities and food access, and promoting safe homes and physical activity to directly address the needs of disadvantaged communities. Environmental justice policies and implementation actions can increase resiliency of vulnerable populations and ensure that these populations have opportunities to participate in the public decision-making process. Specific adaptation measures can include providing affordable healthy foods in schools and other public spaces; assist in the repair, rehabilitation, and improvement of residential structures; and demolish and replace structures that are dilapidated and beyond repair.

5.3 RESILIENCE IN OTHER PLANNING MECHANISMS

Resilience cannot only be integrated into the General Plan but can also be incorporated into other City plans, codes, projects, and implementation programs. Addressing climate change hazard events in the General Plan can support other essential safety documents, such as Santa Ana's Hazard Mitigation Plan (currently under development) and the Orange County Regional Water and Wastewater Hazard Mitigation Plan. Development standards such as residential building codes for buildings in the flood zones and development of adequate evacuation routes can be integrated into the Santa Ana Municipal Code. Policies that focus on emergency response to hazards can be included in an evacuation plan or an emergency operations plan. Adaptation measures that also reduce GHG emissions can be integrated into the City's Climate Action Plan and may support an Active Transportation Plan. Policies related to drought and flooding may be integrated into the Urban Water Management Plan and the Sewer System Master Plan. Furthermore, programs such as the Santa Ana Municipal Code and Capital Improvement Program can help implement the resilience policies developed in the General Plan through specific projects, development codes, and budgeting.

5. Implications for the General Plan Update

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Appendix A: Vulnerability Assessment Results

Populations and Assets	Air Quality	Drought	Extreme Heat	Flooding	Human Health Hazards	Severe Weather
Populations						
Children (Under 10)	V4	-	V4	V4	V3	V3
Cost-burdened households	V3	V2	V3	V3	V2	V2
Households in poverty	V5	V3	V5	V5	V5	V5
Immigrants and refugees	V4	-	V4	V4	V5	V4
Outdoor workers	V5	-	V5	-	V4	V4
Persons experiencing homelessness	V5	-	V5	V5	V5	V5
Persons in overcrowded households	V3	V2	V3	V3	V3	V2
Person with chronic health problems	V4	-	V4	V4	V5	V4
Persons with disabilities	V3	-	V3	V3	V3	V3
Persons with limited English proficiency	V4	-	V3	V3	V4	V3
Persons with access to lifelines	V3	-	V3	V4	V3	V3
Renters	V2	-	V3	V3	V2	V2
Senior citizens: individuals 65 or older	V4	-	V4	V3	V4	V3
Senior citizens living alone	V5	-	V5	V4	V5	V4
Undocumented persons	V5	-	V4	V5	V5	V4
Infrastructure						
Bicycling facilities	-	-	V2	V2	-	V1
Bridges	-	-	-	V4	-	V3
Communication facilities	-	-	V2	V2	-	V2
Electrical transmission and distribution lines	-	-	V4	V1	-	V5
Electrical substations	-	-	V3	V3	-	V3
Flood control infrastructure	-	-	-	V3	-	V2
Major roads and highways	-	-	V3	V5	-	V3
Parks and open space	-	V3	V1	V4	-	V2
Railroads	-	-	V3	V4	-	V3

Appendix A: Vulnerability Assessment Results

Populations and Assets	Air Quality	Drought	Extreme Heat	Flooding	Human Health Hazards	Severe Weather
Transit stops	-	-	-	V3	-	V2
Waste transfer stations	-	-	-	V3	-	V2
Water and wastewater infrastructure	-	-	-	V2	-	V2
Buildings						
Commercial buildings	-	-	V2	V4	-	V3
Community centers	-	-	V2	V3	-	V1
Government buildings	-	-	V2	V3	-	V1
Homes	-	-	V3	V4	-	V4
Industrial buildings	-	-	V3	V4	-	V3
Libraries	-	-	V2	V3	-	V1
Medical and care facilities	-	-	V2	V3	-	V3
Public safety buildings	-	-	V1	V3	-	V2
Schools	-	-	V3	V4	-	V3
Transit Centers	-	-	V2	V2	-	V2
Economic Assets						
Airports: John Wayne Airport	V2	-	V2	V1	V2	V2
Industrial/manufacturing centers	V3	-	-	V4	V3	V4
Major employers	V3	-	-	V3	V3	V3
Outdoor recreation	V4	V2	V4	V3	V2	V3
Retail	V3	-	V2	V3	V3	V3
Administrative support and waste management	V1	-	V1	V3	V2	V1
Health care and social assistance	V3	-	V3	V2	V3	V2
Accommodation and food services	V2	-	-	V3	V3	V3
Professional, scientific and technical services	V1	-	-	V2	V2	V2

Appendix A: Vulnerability Assessment Results

Populations and Assets	Air Quality	Drought	Extreme Heat	Flooding	Human Health Hazards	Severe Weather
Key Community Services						
Communication services	-	-	V2	V1	-	V3
Emergency medical response	V1	-	V3	V3	V4	V3
Energy delivery	-	V2	V4	V3	-	V5
Government administration: City services	V1	-	V1	V2	V1	V1
Public health	V2	-	V2	V2	V3	V1
Public safety response	-	-	V3	V3	V3	V3
Public transit access	V3	-	V3	V4	V2	V4
Solid waste removal	V3	-	V2	V3	V1	V3
Water and wastewater	-	V3	V3	V5	-	V2

Appendix A: Vulnerability Assessment Results

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