CITY OF CARSON, CALIFORNIA

2024 HAZARD MITIGATION PLAN

EXECUTIVE SUMMARY

Hazard mitigation is often described as sustained actions taken to reduce or eliminate impacts of natural or human-made hazards including preventing loss of life and damage to property. It is a process that identifies, and profiles hazards, analyzes people and facilities at risk because of these hazards, and develops mitigation actions to reduce or eliminate hazard risk and create a stronger, more resilient community.

The 2024 City of Carson Hazard Mitigation Plan is designed to function as a roadmap for the coordination and execution of hazard mitigation policies and initiatives for the City of Carson. It describes the characteristics of hazards which threaten the community, as well as mitigation goals, strategies, and associated actions to aid the city and its community in reducing risks and minimizing damages by taking proactive steps before disaster strikes. This not only decreases risk to lives and properties but also reduces the social, economic, and environmental aftereffects which often follow hazardous events.

It is necessary to understand the characteristics of both current and emerging hazards. To achieve this, a significant portion of time was allocated to researching past occurrences of hazards, both natural and human-made, that have impacted the City of Carson. In order to have an in-depth understanding of the hazards that pose a risk to the community and their impacts, the team parsed through a robust set of databases from government agencies and academic sources. Further information was obtained from other federal, state, and local resources, when available.

There are 17 unique hazards detailed in this plan. Through a review of the available resources, a picture of previous hazard occurrences within the City of Carson was formed. This illustrates how the City of Carson responded to previous events and also provides insight into trends and future conditions. The findings for each of the 17 hazards are presented in separate, dedicated sections within the Hazard Identification and Risk Assessment. Within these sections, the location and extent, range of magnitude, past occurrences, possible future occurrences, impacts due to climate change, and vulnerability assessment of each hazard is laid out. The vulnerability assessments specifically examine the consequences for people, systems, and natural, cultural, and historic assets.

Hazard mitigation is most effective when it serves the needs of the whole community. To achieve this, our planning process cast a wide net and engaged many participants and the public through a comprehensive virtual and in-person outreach process. The actions and strategies which emerged are representative of the comprehensive and strategic improvements that the county is already targeting, as well as thoughtfully tailored actions from each of the engaged participants and stakeholders that call the City of Carson home.

Individual capability and strategy meetings were held with the City of Carson hazard mitigation planning team members who work in various departments across the city. Through these calls the planning team was able to speak with community officials and discuss their individual concerns. These conversations provided insight into the local circumstances which likely would not have been attainable through other means. Although these communities are all within the same city, they often have different hazard exposure levels, needs, and response capabilities, and a mitigation strategy which works for one community may not be actionable for all.

After outlining the mitigation goals, objectives, and approaches, the 2024 City of Carson Hazard Mitigation Plan delves into a comprehensive assessment of the capabilities of Carson. This section begins with a review of administrative and technical capacities, such as the presence of in-house engineers, the utilization of geographic information systems (GIS). It then transitions to a review of financial strengths, followed by an evaluation of policy-driven and programmatic capabilities. The section wraps up with a synthesis of the capabilities for Carson which is accompanied by a consequence analysis.

Once approved by the FEMA Region IX and adopted by the city, plan implementation will occur over the next five years as City departments begin to implement the actions identified in this plan. Full implementation of the recommendations of this plan will require time and resources. The measure of the plan's success will be its ability to adapt to changing conditions. The City of Carson assumes responsibility for adopting the recommendations of this plan and committing resources toward implementation. A plan maintenance strategy was developed to include annual progress reporting, a strategy for continued public involvement, a commitment to plan integration with other relevant plans and programs, and continued oversight from the hazard mitigation planning team.

TABLE OF CONTENTS

1) INTRODUCTION

The City of Carson Hazard Mitigation Plan is dedicated to enhancing public safety and environmental protection against natural, human-caused, and technological hazards. Its core aim is to educate the public, outline resources for reducing risks and losses, and direct the city towards a more resilient future. This plan sets clear, actionable goals as milestones towards mitigating hazard risks:

1. **Enhanced Protection**: Strengthen the resilience of homes, businesses, infrastructure, and other properties against natural hazards.
2. **Loss Reduction**: Minimize recurring damages from frequent hazards and advocate for insurance against major disasters.
3. **Informed Development**: Refine hazard assessments to discourage new construction in high-risk zones and promote preventive measures in existing vulnerable areas.
4. **Sustainable Planning**: Harmonize natural resource management with hazard mitigation, safeguarding life, property, and the environment.
5. **Natural System Preservation**: Maintain and improve natural systems for their role in hazard mitigation.
6. **Collaborative Engagement**: Foster communication and cooperation across public agencies, citizens, businesses, and non-profits to encourage active implementation.
7. **Leadership Empowerment**: Motivate public and private sectors to prioritize and execute local and regional hazard mitigation.
8. **Policy Establishment**: Formulate policies guaranteeing mitigation projects for essential facilities and services.
9. **Emergency Operations** Enhancement: Boost coordination and collaboration in emergency responses across various sectors.
10. **Integrated Activities**: Align mitigation efforts with emergency plans and procedures where feasible.

The Plan Maintenance Section outlines the continuous updating and relevance of the plan, emphasizing annual reviews, five-year revisions, public involvement, and integration with city planning efforts such as the General Plan and Building Codes.

Adoption by the City Council is crucial for the plan's success. The Council, as the governing body, is charged with enforcing policies that address hazard risks and periodically updating the plan to reflect changing conditions.

A) EXISTING AUTHORITIES, POLICIES, PROGRAMS, AND RESOURCES

All mitigation is the responsibility of the local jurisdiction. Development and implementation of risk reduction strategies and policies lies with each local jurisdiction; however, mitigation is a joint effort with the support of various stakeholders, partners, and the public. Partners and resources exist at the regional, state, and federal levels. Numerous California state agencies have a role in hazards and hazard mitigation. Several of the key agencies include:

- **The California Emergency Management Agency (Cal EMA**) is responsible for disaster mitigation, preparedness, response, recovery, and the administration of federal funds after a major disaster declaration.
- **The Southern California Earthquake Center (SCEC)** gathers information about earthquakes, integrates this information on earthquake phenomena, and communicates this to end-users and the public to increase earthquake awareness, reduce economic losses, and save lives.
- **The California Department of Forestry and Fire Prevention (CAL FIRE)** is responsible for all aspects of wildland fire protection on private and state properties, and administers forest practices regulations, including landslide mitigation, on non-federal lands.
- **The California Division of Mines and Geology (DMG)** is responsible for geologic hazard characterization, public education, the development of partnerships aimed at reducing risk, and exceptions (based on science-based refinement of tsunami inundation zone delineation) to state mandated tsunami zone restrictions; and
- **The California Division of Water Resources (DWR)** plans, designs, constructs, operates, and maintains the State Water Project; regulates dams; provides flood protection and assists in emergency management. It also educates the public and serves local water needs by providing technical assistance.

2) PLANNING PROCESS

An update to the 2018 City of Carson Natural Hazard Mitigation Plan was completed in 2024 after nearly a decade. An update was not only required by the Disaster Mitigation Act of 2000 to become eligible for hazard mitigation grant opportunities, but to have a clearer understanding of the hazards that pose a risk to the jurisdiction to make better informed decisions regarding hazard mitigation.

The City of Carson Natural Hazards Mitigation Plan includes resources and information to assist City residents, public and private sector organizations, and others interested in participating in planning for natural, human-caused, and technological hazards. The Mitigation Plan provides a list of mitigation actions that are intended to assist the City of Carson in reducing risk and preventing loss from future hazard events. Natural hazards that were not profiled in this plan include volcanoes and avalanches as the planning area is not located near mountainous areas and lahars zones from volcanoes in the state of California. The mitigation action items address multi-hazard issues for the following 17 hazards:

- Drought and Water Shortage
- Earthquake
- Extreme Heat
- Extreme Winter Weather (Cold)
- Flood
- Hail
- High Wind
- Hurricane
- Industrial Pollution/Chemical Release
- Landslide/Mudflow
- Land Subsidence/Karst
- Pandemic
- Severe Storm/Thunderstorm/Lightning
- Tornado
- Tsunami and Seiche
- Urban Fire
- Wildfire

A) LOCAL METHODOLOGY AND UPDATE PROCESS

The City of Carson Hazard Mitigation Plan 2024 update has drastically increased the number of hazards profiled, from three to seventeen, to better understand the hazards that pose a risk to community and to better support the city's planning and preparedness efforts in addressing and reducing risk. This plan update it is intended to support all residents, including individuals with access and functional needs, cultural groups, limited English-speaking populations, children, the elderly, and other disproportionately impacted communities. The plan was updated with a whole community approach and involved the planning team, the city's key stakeholders, and the public.

The City of Carson Mitigation Plan is the result of a collaborative planning effort between City of Carson citizens, public agencies, non-profit organizations, the private sector, and regional and state organizations. Public participation played a key role in the development of goals and action items. A Multi-Jurisdiction Planning Team guided the process of developing the plan and consisted of many representatives.

The preparation of the Mitigation Plan was the responsibility of the stakeholders gathered together to form the Multi-Jurisdiction Planning Team, which consisted of representatives from various departments from the City of Carson and representatives from neighboring jurisdictions. The members had an understanding of how their jurisdiction's organizational structure and how the jurisdiction might be affected by hazard events. The Planning Team guided the development of the Plan, and assisted in developing plan goals and action items, identifying external stakeholders and plan reviewers, and sharing local expertise to create a more comprehensive plan.

i) Meetings

The following meetings were facilitated by the City's consultant Witt O'Brien's. All meetings were hosted virtually via Microsoft Teams:

Meeting #1: City of Carson Project Management Kick Off – April 27, 2023

The meeting was attended by Witt O'Brien's and City of Carson Emergency Management Staff. The discussion consisted of a review of the scope of work, timeline, and expectations, particularly in light of changes due to the updated guidance. Project Management meetings between the City's Emergency Management staff and Witt O'Brien's continued throughout the planning process.

Meeting #2: Planning Team Kick off Meeting – May 25, 2023

An overview of the planning process and role of hazard mitigation was facilitated virtually with stakeholders from City of Carson and neighboring jurisdictions. Participants discussed increasing the number of hazards profiled under the 2018 plan, assessed and provided qualitative feedback on local experiences, and were introduced to two Worksheets; one to document profiled hazards and the other to quantify community capabilities.

Meeting #3: HIRA Meeting – October 24, 2023

Witt O'Brien's delivered the Hazard Identification and Risk Assessment Analysis and the Planning Team reviewed the natural hazard mapping efforts, city capabilities, the feedback collected by the first public survey, and discussed the next steps in the development of the City of Carson Hazard Mitigation Plan.

Meeting #4: Mitigation Strategy Meeting – January 23, 2024

The meeting included a discussion of city resiliency in the face of natural hazards, in light of the data provided during the HIRA review meeting and feedback from the public. We reviewed expected hazard impacts, community goals for the future, and set the maintenance and implementation schedule. Planning Team members engaged in discussion on the quantification of risk and introduced what actionable steps make up the Mitigation Strategy section of the Hazard Mitigation Plan. Planning Team Members were to provide updates to the Action list following the meeting.

Meeting #5: Mitigation Plan Public Overview – June 27, 2024

This meeting, which was open to the public, offered an opportunity to review the purpose and outcomes of the Hazard Mitigation Plan update process.

ii) Equity and the Local Mitigation Planning Process

The recent FEMA Local Mitigation Planning Handbook 2023 emphasizes equity as part of the hazard mitigation planning guidance to encourage hazard mitigation plans use an equity lens throughout the entire planning process and into the plan itself. Examples of incorporating equity include engaging with historically marginalized communities, ensuring public outreach efforts are accessible to the whole community (e.g., translations in other languages), and that mitigation actions work to reduce risk to communities that are disproportionately affected by disasters. FEMA guidance for incorporating equity into the planning process include the following:

Procedural Equity: is committing to equity within the planning process.

- Making clear, fair, and inclusive processes. Work with partners who represent underserved groups and socially vulnerable populations to design and implement outreach and engagement methods that will reach the most marginalized and/or vulnerable members of the community.

- Giving chances for meaningful input. Underserved groups should have a true voice in planning and prioritizing mitigation. Invite nonprofit and community-based organizations that support these groups to join the local mitigation planning team. Invite other representatives as well. Welcome them to share their input throughout the planning process.

Structural Equity: builds on the need for accountability. It supports learning the history that led to privilege. It also supports working to correct past harms. Plans can address this by:

- Talking about equity early and often with the planning team. Use the principles of equity in all decision-making processes, from initial outreach to publication of the plan.
- Recognizing and dealing with the societal systems that cause inequity.
- Forming organizational infrastructure to address inequities. This should happen both at the staff and leadership levels. If inequities are raised during the planning process, make sure there are tools and paths to fix them. Think about working with consultants who have expertise in diversity, equity, and inclusion.

Distributional Equity: ensures that communities that are disproportionately at risk of hazards and their impacts are benefitted by mitigation actions that work to reduce their risk. Communities disproportionately at risk the hazard impacts include:

- High poverty
- Limited access to a vehicle
- Age (very old or very young)
- Limited English proficiency
- Disability status
- Race
- Ethnicity

The Hazard Mitigation Planning Team is committed to working to address and remove physical, social, temporal, language, accessibility, and historically institutional barriers through the planning process in order to strive for a plan that works for the whole community. Examples of challenges and possible solutions to strive for equitable outreach, outlined in the handbook, are described in the table below.

TABLE 1. BARRIERS TO EQUITABLE OUTREACH

CHALLENGE	POSSIBLE SOLUTIONS
Physical Barriers including a lack of transportation	• Provide transportation vouchers and hold meetings in locations easily accessible via public transit.
Social Barriers including a lack of childcare needed to	• Provide free childcare at all public planning workshops.

CHALLENGE	POSSIBLE SOLUTIONS
attend meetings and workshops	• Make sure to communicate this amenity well in advance to allow parents and caregivers time to plan ahead.
Temporal Barriers such as holding meetings during times when most people are working	• Make sure to hold meetings during non-business hours, i.e., during evenings or on weekends.
Limited English Language Proficiency	• Provide translators and public facing documents in languages other than English, if relevant to your community.
Historic Institutional Inequities towards many socially vulnerable populations and underserved groups may make certain community members less likely to engage with planning teams or to trust that their input will be respected and incorporated	• Work to address this by being transparent and taking an active listening role. • Communicate how information will be collected and used. • Acknowledge historic inequities while emphasizing that the planning process is a path towards resilience for the community's most at-risk residents.
Accessibility Barriers such as a lack of accommodation for those with visual or hearing impairments.	• Provide closed captioning for virtual meetings and American Sign Language (ASL) interpreters for in-person engagements.

Source: FEMA, Local Mitigation Planning Handbook 2023

B) THE PLANNING TEAM

The hazard mitigation planning team is comprised of stakeholders and partners from various departments within the City of Carson to provide their unique expertise and knowledge to the entire hazard mitigation planning process. According to FEMA, the planning team is the core group of people responsible for developing and reviewing drafts of the plan, informing the risk assessment, developing the mitigation goals and strategies, and submitting the plan for local adaptation. A list of the hazard mitigation planning team is described in the table below.

TABLE 2. HAZARD MITIGATION PLANNING TEAM MEMBERS

NAME	TITLE & DEPARTMENT
Nora Garcia	Emergency Services Manager, Emergency Management
Stephanie Cardona	Emergency Management Specialist, Emergency Management
Reann Munoz	Public Safety Supervisor, Public Safety
Alex Rocco	GIS Administrator, Information Technology

NAME	TITLE & DEPARTMENT
Kevin Kennedy	IT Manager, Information Technology
Tim Grierson	Recreation Superintendent, Recreation
Dara Sandoval	Recreation Program Manager, Recreation
Margie Revilla	Public Information Officer Manager, Sustainability Innovation
Reata Kulcsar	Innovation & Sustainability Manager, Sustainability Innovation
Gilbert Marquez	City Engineer, Public Works/Engineering
Freddy Loza	L&B Maintenance Superintendent, Public Works/Operations
Raymond Velasco	Operations Manager, PW/Operations
Roland Jen	Stormwater Engineer, PW/Operations
Adriana Perez	Sanitation Services Coordinator, Public Works/Operations
Robin Wilson	Public Works Programs Administrator, PW/Administration
Jason Jo	Transportation Services Supervisor, Transportation
Roobik Galoosian	Risk Manager, Risk Management
Cristine Gaiennie	Revenue Manager, Finance
Michael Dorta	Senior Civil Engineer, Building & Safety
Pasqual Aiello	Lieutenant, Sheriff's Department

The 2024 City of Carson Hazard Mitigation Plan update was led by the City of Carson's Office of Emergency Management, providing guidance and leadership for the overall project. The City of Carson staff supported the Hazard Mitigation Planning Team through the planning process and dissemination of information and administrative tasks.

C) PUBLIC PARTICIPATION

An important component in the City of Carson's community-based mitigation planning process involves public, stakeholder, and jurisdiction participation. Public-based participation provides a greater understanding of local concerns and insight to strive a higher degree of mitigation success by developing community "buy-in" from those directly affected by planning decisions of public officials and the various hazards that pose a threat to the jurisdiction. Public involvement can also provide community specific insight based on their lived experience and provide possible solutions to create a stronger more resilient community.

Feedback from the community was utilized by the planning team to develop the 2024 City of Carson Hazard Mitigation Plan. Hazards identified by community members were meticulously reviewed to ensure that all aspects of these hazards were thoroughly addressed. Feedback from the community was limited and rarely substantive. However, specific comments from members of the public were reviewed by the planning team and used to identify gaps in the risk assessment. Public feedback also helped the planning team determine mitigation actions that would be most supported by community members. The feedback process was also iterative – the Plan was reviewed after each round of outreach to validate that the information presented adequately addressed the concerns and desires of community members. Multiple rounds of outreach also allowed the planning team to see potential shifts in public sentiment that would be important for future planning efforts.

Public input was sought through virtual participation in public surveys and at a Town Hall meeting. Online surveys were intentionally chosen by the planning team because they offer the greatest opportunity for participation from members of the public, including underserved and socially vulnerable populations. First, online surveys allow members of the public to provide their feedback at any time in the day – this helps ensure that responses are not limited to a selection of the population that is available during one specific time of day. Second, online surveys do not require participants to travel, which may be burdensome for underserved and vulnerable populations including those with physical or mental disabilities, the elderly, those who lack access to transportation or childcare, and economically disadvantaged individuals. Third, online surveys could be completed over multiple sittings, which gives individuals an opportunity to participate without the feeling of being rushed. These opportunities were advertised via social media and discussed during annual community events like the All Hazard Community Training and Fire Safety Training. Survey results and copies of the social media activity promoting the surveys and Town Hall are available in Appendix B.

While no strategy is perfect, the planning team ultimately felt that the chosen approach would offer the best chance to generate wide participation among the public, particularly in an era where COVID-19 has resulted in a boom of virtual communication. The planning team's assumption is partially supported by peer-reviewed research which found that virtual settings "enable a diverse audience of people from different locations, creating a more robust participation and exchange of ideas."[1] Links to the surveys were advertised through the City's social media platforms, copies of which are provided in Appendix B.

From August 17, 2023, to September 25, 2023, an initial survey requesting public feedback on hazards in the City of Carson went live and was hosted electronically through SurveyMonkey. To encourage public participation and interest, a $50 amazon gift card was offered to a randomly selected respondent. Unfortunately, the survey was targeted by a spam attack with over 100 randomly generated responses. Once the spammed data was removed and the survey closed, there were 22 responses to the initial survey. Survey results are outlined in Appendix B.

On December 9, 2023, a second survey was conducted to the public to identify specific community concerns and aid in actional development. The survey was open to the public until January 30, 2024. Similar to the initial survey, the second survey was hosted by the website SurveyMonkey to provide an easy to access website to complete the survey. The survey

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[1] Guetter, Camila R., Maria S. Altieri, Marion C.W. Henry, Elizabeth A. Shaughnessy, Sadia Tasnim, Yangyang R. Yu, and Sanda A. Tan. "In-Person vs. Virtual Conferences: Lessons Learned and How to Take Advantage of the Best of Both Worlds." *American Journal of Surgery* 224, no. 5 (November 2022): 1334–36. https://doi.org/10.1016/j.amjsurg.2022.07.016.

included 38 questions regarding demographic information, understanding the community's perception of hazards and their impacts, and as well questions assessing the barriers and supported needed from communities at-risk and disproportionately impacted by hazards. The second survey resulted in 127 responses. Survey results are outlined in Appendix B.

To best incorporate the public's time and effort in completing both hazard mitigation surveys, the Hazard Mitigation Planning Team analyzed the results of the surveys to update, develop, and prioritize mitigation actions. In the Mitigation Strategy meeting held on January 23, 2024, the results of the second survey were shared with the Hazard Mitigation Planning Team and shared out after the meeting to all planning team members.

The City then held a town-hall style public meeting on June 27, 2024 to provide a public overview of the plan, process, and offer an opportunity for comment and discussion of proposed Mitigation Actions. The Public Meeting was coordinated with the release of the publicly available draft plan, and a final opportunity for participation in a digital survey.

D) STAKEHOLDER INVOLVEMENT

FEMA guidance directs local hazard mitigation planning efforts to involve community stakeholders. These stakeholders should include entities with one or more of the following five characteristics:

1. Local or regional entities involved in hazard mitigation activities
2. Agencies that have the authority to regulate development
3. Neighboring communities
4. Represent area businesses, academic institutions, or other private organizations
5. Represent nonprofit organizations or community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations

The following entities were contacted via email and invited to participate in the planning process through multiple community surveys, as well as attending the Town Hall.

- California State University Long Beach College of Professional and Continuing Education
- South Coast Air Quality Management District
- SoCalGas
- California Water Service
- Golden State Water Company
- Palos Verdes Peninsula Land Conservancy Office
- Kaiser Permanente

- Emergency Network Los Angeles (ENLA)
- Los Angeles County Fire Department
- Los Angeles County Department of Public Works
- Los Angeles County Sheriff's Department

Many of these community stakeholders exhibit more than one of the five stakeholder characteristics outlined by FEMA guidance for local hazard mitigation planning. The following table describes various functions of the community stakeholders which are relevant to the 2024 City of Carson Hazard Mitigation Plan.

TABLE 3. COMMUNITY STAKEHOLDERS BY GROUP

Community Stakeholder Name	Stakeholder Function	Corresponding FEMA Stakeholder Group
California State University Long Beach – College of Professional and Continuing Education	The College of Professional and Continuing Education (CPaCE) offers a diverse range of degrees, professional development certificates, and international education opportunities to enrich the lives of California State University Long Beach students.	Represent area businesses, academic institutions, or other private organizations
California Water Service	California Water Service is the largest regulated American water utility west of the Mississippi River and the third largest in the country.	Represent area businesses, academic institutions, or other private organizations
	California Water Service has invested more than $65 million in conservation programs, making it easier than ever to save water at home and work. These programs not only help mitigate drought conditions, but also save energy and	Local or regional entities involved in hazard mitigation activities

	reduce greenhouse gas emissions as well.	
Emergency Network Los Angeles (ENLA)	ENLA represents a network of nonprofits and government entities working in the space of community welfare and emergency management (mitigation, preparation, response, and recovery) in Los Angeles County.	Local or regional entities involved in hazard mitigation activities
	ENLA has over 50 nonprofit members including American Red Cross, The Salvation Army, Compton Veterans, Habitat for Humanity, Islamic Relief USA, Jewish Family Services, United American Indian Involvement, and others. Many of these members work to improve the lives of underserved and socially vulnerable populations.	Represent nonprofit organizations or community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations.
Golden State Water Company	Golden State Water Company is a regulated utility in California and is a wholly owned subsidiary of American States Water Company.	Represent area businesses, academic institutions, or other private organizations
	In compliance with the California Urban Water Management Planning Act, the Golden State Water Company prepares and adopts an Urban Water Management Plan (UWMP) and a Water Shortage Contingency Plan (WSCP) every five years.	Local or regional entity involved in hazard mitigation activities
Kaiser Permanente	Kaiser Permanente is a consortium of for-profit and not-for-profit integrated	Represent area businesses, academic institutions, or other private organizations

	managed care entities. The organization is active in eight states, including the State of California.	
Palos Verdes Peninsula Land Conservancy Office	The Conservancy preserves undeveloped land as open space for historical, educational, ecological, recreational and scenic purposes.	Represent area businesses, academic institutions, or other private organizations.
SoCalGas	SoCalGas is a natural gas distribution utility providing energy to 21.1 million consumers across more than 500 communities in California.	Represent area businesses, academic institutions, or other private organizations.
South Coast Air Quality Management District	South Coast Air Quality Management District's mission is to clean the air and protect the health of all residents in the South Coast Air District through practical and innovative strategies.	Local or regional agencies involved in hazard mitigation activities
	South Coast Air Quality Management District develops and enforces regulations designed to achieve public health standards by reducing emissions from business and industry.	Agencies that have the authority to regulate development
Los Angeles County Fire Department	The Los Angeles County Fire Department is responsible for protecting the lives and property of 4 million residents living in 1.25 million housing units in Unincorporated Los Angeles County, portions of which directly border the City of Carson.	Neighboring Communities

Los Angeles County Department of Public Works	The Los Angeles County Department of Public Works provides critical infrastructure and essential services across Los Angeles County. This includes projects within incorporated communities and unincorporated Los Angeles County.	Neighboring Communities
Los Angeles County Sheriff's Department	The Los Angeles County Sheriff's Department is the largest Sheriff's Department in the world with approximately 18,000 employees. The Department provides general law enforcement services to 42 contract cities, 141 unincorporated communities, 216 medical facilities, 37 Superior Courts, and nine community colleges.	Neighboring Communities

E) INCORPORATION OF EXISTING PLANS, STUDIES, AND REPORTS

The following plans, studies, and reports have been integrated into the Hazard Identification and Risk Assessment section of the 2024 City of Carson Hazard Mitigation Plan. A list of plans, studies, and reports used are listed below:

- 2040 City of Carson General Plan
- City of Carson Climate Action Plan
- Disaster Racism, Using Black Sociology, Critical Race Theory and History to Understand Racial Disparity to Disaster in the United States, October 2021
- California State Hazard Mitigation Plan
- Annual 2022 Drought Report, National Centers for Environmental Information (NCEI)
- UC Davis Center for Watershed Sciences. A Retrospective Economic Analysis: 2012-2016 Drought
- LA County Climate Vulnerability Assessment, October 2021
- California's Fourth Climate Change Assessment
- Drought Assessment in a Changing Climate, November 2023
- Rapid Intensification of the Emerging Southwestern North American Megadrought in 2020-2021, February 2022
- Residents' experiences during a hydrogen sulfide crisis in Carson, California, December 2023
- County of Los Angeles All Hazards Mitigation Plan
- Extreme Heat & Public Health Report, September 2020
- California Office of Environmental Health Hazard Assessment, 2018
- Scientific American, Increasing Power Outages Don't Hit Everyone Equally, August 2023
- Heat Exposure and Maternal Health in the Face of Climate Change, 2017
- Climate Change Suppresses Santa Ana Winds of Southern California and Sharpens Their Seasonality, January 2019
- Identifying and Managing Conjoint Threats: Earthquake-induced Hazardous Materials Releases in the US, September 1996
- Natural and Technologic Hazardous Materials Releases During and After Natural Disasters: A Review, April 2004
- Natech Risk and Management: An Assessment of the State of the Art, March 2008
- A Safety Function Deployment Approach to Risk Management of HazMat Highway Transportation, July 2021
- Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates, June 2022
- Social and Environmental Impacts of Landslides, September 2018

- Stability Analysis of Pumped Storage Hydropower Plant in Abandoned Open pit Mine Affected by Dynamic Surface Subsidence of Combined Mining, February 2014
- Past, Present, and Future: California Provides Insight on the Severity of the Drought and 2022 Guidance, 2022
- Disease Control Priorities: Improving Health and Reducing Poverty 3rd Edition, 2017
- Novel Framework for Assessing Epidemiologic Effects of Influenza Epidemics and Pandemics, January 2013
- Inequity and the Disproportionate Impact of COVID-19 on Communities of Color in the United States: The Need for a Trauma-Informed Social Justice Response, July 2020
- County of Los Angeles Emergency Medical Services (EMS) Agency, Incident After-Action Report (AAR): COVID-19 Pandemic, April 2022
- Pew Research, Black Americans' Views about Health Disparities, Experiences with Health Care, April 2022
- Duke Global Health, Statistics Say Large Pandemics are More Likely Than We Thought, August 2021
- FHI 360, Secondary Impacts of the COVID-19 Pandemic in the United States
- County of Los Angeles Public Health, COVID-19 Pandemic Response Interim Review, December 2022
- Accelerated COVID-19 Vaccine Development: Milestones, Lessons, and Prospects, August 2021
- Changning Impacts of Alaska-Aleutian Subduction Zone Tsunamis in California Under Future Sea-Level Rise, December 2021
- Wildfire Smoke a Guide for Public Health Officials, 2019
- Flood Risks Increase After Fires, November 2020

3) COMMUNITY PROFILE

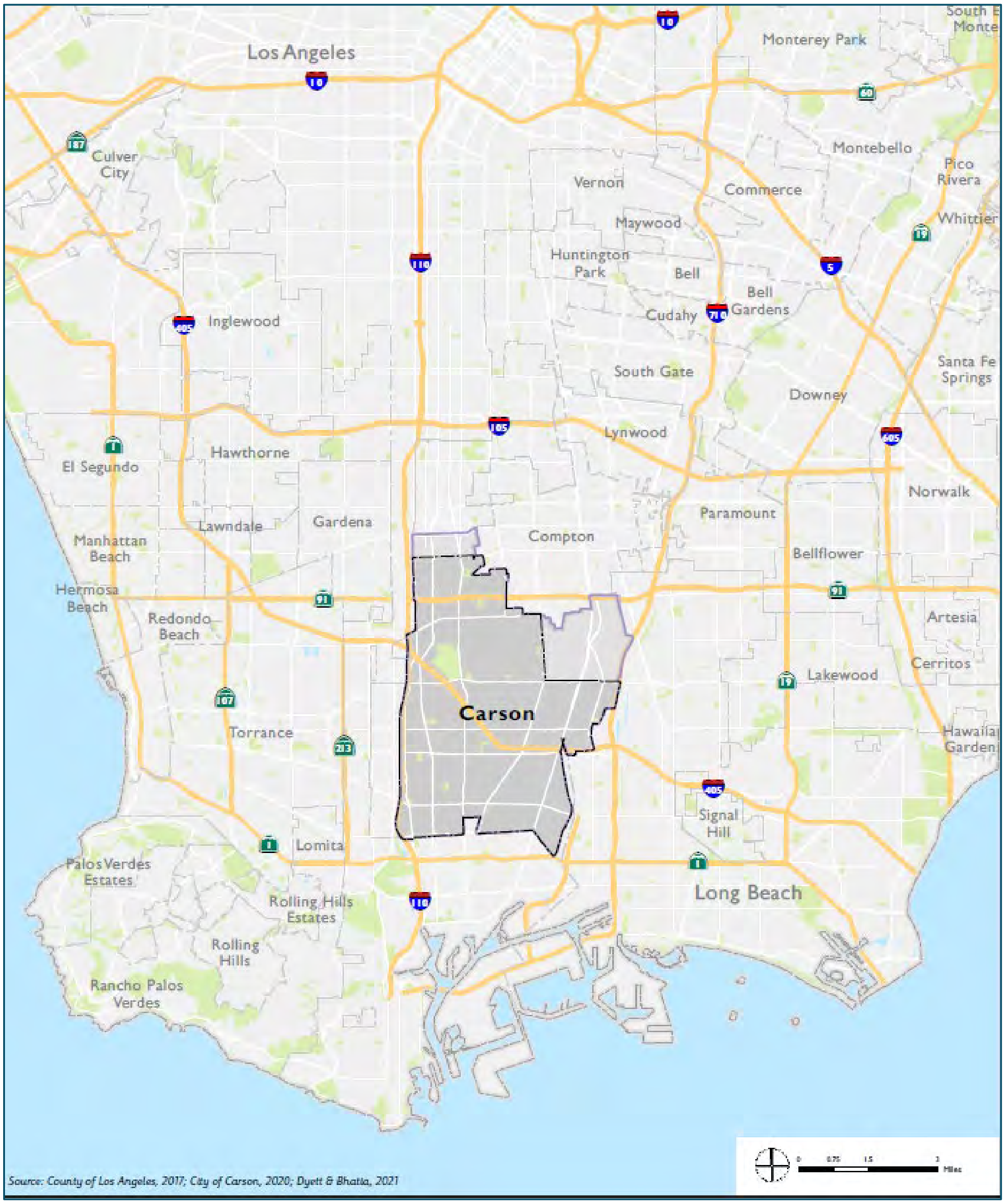
Founded in 1968, the City of Carson is a relatively new city located in the South Bay/Harbor area of Los Angeles County. Just 13 miles south of downtown Los Angeles, Carson enjoys a strategic position near two major maritime ports. Historically an industrial zone, Carson has transformed into a thriving center for residential, educational, and commercial activities. This transformation showcases the resilience and progressive vision of its community and leaders over the past several decades.

Carson is dedicated to creating a nurturing, welcoming, affordable environment for families and visitors. This includes offering a variety of job prospects and housing choices to support its expanding population. The city boasts a strong educational system, encompassing primary to higher education, as well as fostering a knowledgeable and skilled workforce. Its commercial sector is diverse, featuring a blend of small businesses and large corporations, reflecting Carson's economic vitality.

The City's 2040 General Plan is a bold step towards addressing its industrial legacy and related environmental concerns. Acknowledging the challenges posed by nearby pollution sources, Carson has developed extensive plans to lessen environmental impacts and promote environmental justice efforts. These efforts underscore Carson's commitment to a sustainable, health-focused future for its residents.

Carson is more than just a location; it's a vibrant community of diverse cultures and backgrounds. This diversity is celebrated through a variety of cultural events, community gatherings, and inclusive city initiatives, contributing to the rich and unique fabric of the city. A map of the City of Carson is shown in the figure below.

FIGURE 1 - MAP OF THE REGION

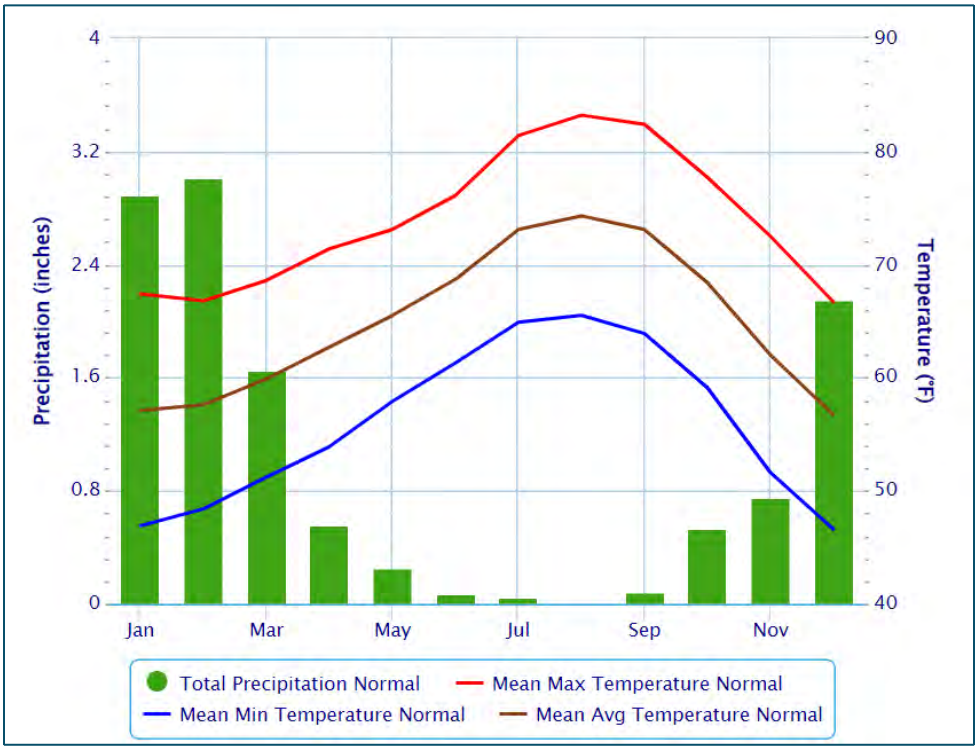


A) CLIMATE

Located near the Pacific Ocean, the City of Carson benefits from a mild climate influenced by offshore breezes. Typical temperatures range from an average low of 57 degrees Fahrenheit in January to 74 degrees in July, shown in the table below. However, these temperatures can fluctuate significantly, especially under the influence of the Santa Ana winds, which can bring hotter conditions and lower humidity.

The area receives an average annual rainfall of about 12.02 inches, with February usually being the rainiest month, shown in the figure below. Unlike more temperate regions, Southern California experiences its rainfall in intense, sporadic storms, rather than through regular, moderate showers. This pattern results in a "feast or famine" scenario within the same year, where periods of heavy rainfall are followed by extended dry spells.

FIGURE 2: MONTHLY CLIMATE NORMAL 1991 - 2020 LONG BEACH AREA, CA



Source: National Weather Service (NWS)

The City of Carson is committed to providing a more livable, equitable, and economically vibrant community and has developed a Climate Action Plan (CAP) to concentrate efforts to reduce Greenhouse Gas Emissions (GHG) within the jurisdiction. Based on the 2017 City of Carson Climate Action Plan, the city produces (GHG) from the following sectors, commercial energy, on-road transportation, solid waste, residential energy, water, off-road sources, and wastewater. The CAP identifies climate action goals, actions, strategies, and measures to combat GHGs and strive for a healthier and safer environment and community. As natural hazards increase in frequency and intensity, the goals, strategies, and actions outlined in the CAP can assist in mitigation impacts to the City of Carson.

According to the City's General Plan, the Dominguez Channel runs northwest to southeast through the center of the City of Carson. The Dominguez Channel is part of the Los Angeles River Flood Control System which makes it vulnerable when the Los Angeles River Floods. The area surrounding the Dominguez Channel is designated as a 100-year flood zone. Because the metropolitan basin is largely built out, water originating in higher elevation communities can have a sudden impact on adjoining communities at lower elevations.

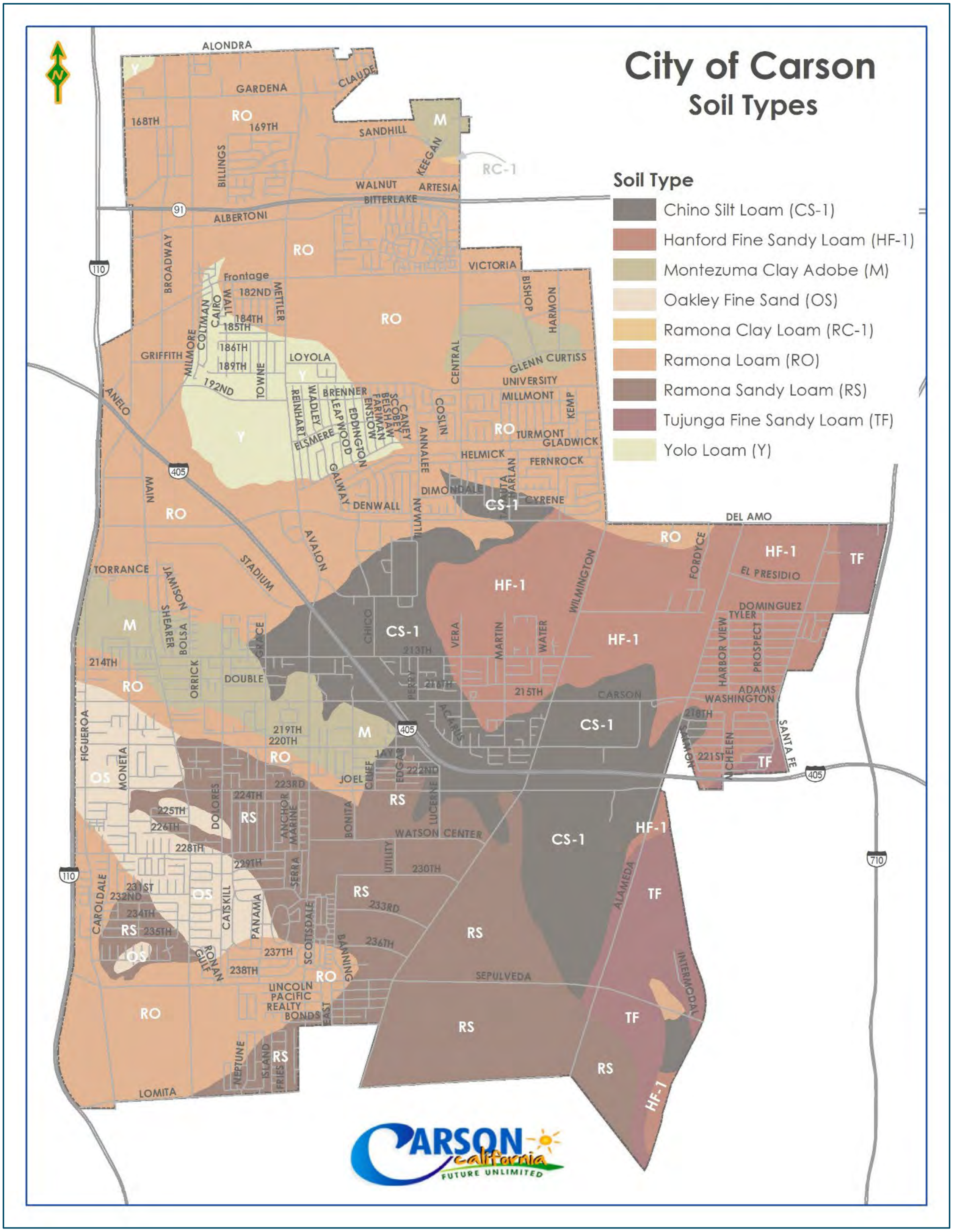
The characteristics of the minerals and soils present in the city can exacerbate or indicate where certain locations may experience increased risk. Rock hardness and soil characteristics can determine whether an area will be prone to geologic hazards such as earthquakes, liquefaction, and landslides. According to the General Plan, soil in the City of Carson consists of Holocene age alluvial deposits consisting of poorly consolidated sand, silt, clay, and gravel. Overall, the soil types within the City of Carson include Chino Silt Loam, Hanford Fine Sandy Loam, Montezuma Clay Adobe, Oakley Fine Sand, Ramona Clay Loam, Ramona Loam, Ramona Sandy Loam, Tujunga Fine Sandy Loam, and Yolo Loam. A map of the different soil types across the city is shown below.

TABLE 4. SOIL TYPE AND DESCRIPTION

SOIL TYPE	DESCRIPTIONS
Chino Silt Loam	Chino silt loam is a thermic, fine-loamy soil in southern California, ideal for agriculture with its calcareous silt loam layers.
Hanford Fine Sandy Loam	The Hanford fine sandy loam, a deeply well-drained soil with a moderately coarse texture from alluvial granite material, thrives in California's stream terraces, alluvial fans, and floodplains. Its optimal physical and chemical properties make it a cornerstone for agriculture.
Montezuma Clay Adobe	The Montezuma series features moderately deep, well-drained soils on California's fan piedmonts, with an ashy composition supporting grazing and wildlife habitats. Its distinct ashy, glassy texture and layers, including gravelly ashy loamy sand and silica-cemented duripan, make it unique.
Oakley Fine Sand	The Oakley series consists of very deep, well-drained, fine-loamy soils, formed over calcareous alluvium and Permian redbed sediments, ideal for cropland uses like wheat and sorghum, as well as native grasslands. These soils have moderate to slow permeability, suitable for diverse agricultural practices.
Ramona Clay Loam	The Ramona clay loam is a thermic soil in California's valleys, ideal for grain, hay, citrus, and olives, with moderate permeability and supporting diverse vegetation including native grasses and chaparral.
Ramona Loam	The Ramona loam is a fine-loamy, thermic soil primarily designed for agriculture and environmental uses in specific regions. This soil type is known for its balance of physical

SOIL TYPE	DESCRIPTIONS
	properties, supporting a variety of vegetation and agricultural crops.
Ramona Sandy Loam	The Ramona sandy loam is a versatile, well-drained soil ideal for various agricultural practices, supporting both crop cultivation and native vegetation in California.
Tujunga Fine Sandy Loam	The Tujunga fine sandy loam, forming in granitic alluvium on alluvial fans and floodplains, is well-drained and very deep, suited for agriculture and urban use in central and southern coastal California. It excels in supporting citrus, grapes, other fruits, and grazing, showcasing high adaptability.
Yolo Loam	The Yolo loam, a fine-silty, well-drained soil in the Sacramento Valley and California Coast Range valleys, is ideal for diverse crop cultivation, including row, field, and orchard crops, due to its moderate permeability and favorable conditions.

FIGURE 3 – SOIL TYPES IN CARSON AS OF 2024



Source: USDA, Official Soil Series Descriptions and Series Classification

B) HISTORY

Spanning about 19 square miles with an elevation of 37 feet, the City of Carson is a notable part of south-central Los Angeles County. Situated just 13 miles south of downtown Los Angeles, Carson was officially incorporated as a city in 1968, as indicated in the map below. Despite its relatively recent incorporation, Carson boasts a deep and rich history.

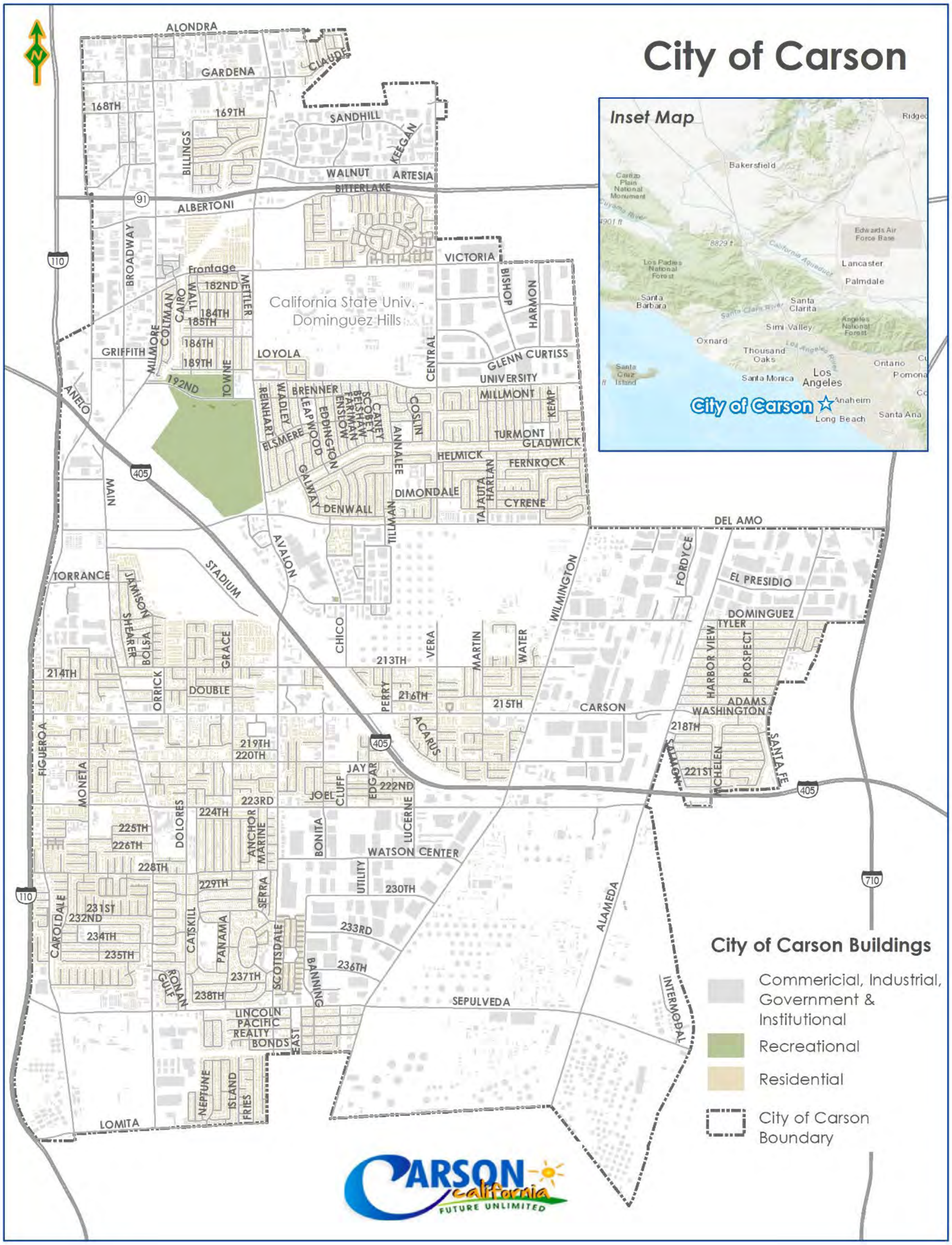
Long before its official establishment, the area now known as Carson was inhabited by the Gabrielino Indians. This indigenous group experienced displacement with the arrival of Spanish explorers and settlers in the late 18th century. The Spanish government began awarding land grants in California, with Juan Jose Dominguez, a retired soldier, becoming the first recipient in Southern California. His grant, Rancho San Pedro, remained under the ownership of the Dominguez family for nearly 150 years. This land was a focal point for politics, business, and ranching in the region.

By the late 1800s, as the Dominguez family started to sell portions of their ranch, the area saw a significant shift. This change paved the way for small-scale farming, burgeoning industries, and the rise of commerce, laying the foundations of the Carson community by the early 20th century. Post-World War II, the area experienced a surge in population and industrial growth, culminating in its incorporation in 1968.

Today, Carson is a vibrant community, reflecting its historical roots while evolving into a diverse and dynamic city. Its strategic location near Los Angeles and its historical significance in the development of Southern California continue to shape its identity and growth.[2]

[2] Carson Local History – LA County Library. https://lacountylibrary.org/carson-local-history/

FIGURE 4 – CITY OF CARSON BASE MAP AS OF 2024



C) ECONOMY

Located near the country's two busiest maritime ports, ports of Los Angeles and Long Beach, Carson has historically been an industrial community, that today is also a growing residential, education, and commercial hub. The city's roots in oil extraction and refining, and its location along the country's busiest freeway (I-405) and freight corridor, led to extensive manufacturing, warehousing and distribution uses. The Union Pacific, southern Pacific, and BNSF railroads traverse the city with tracks north to south. Passenger transportation is provided by the Metro Green and Blue Lines. Since incorporation as a city in 1968, government and community efforts have been focused on improving the quality of life of Carson residents in addition to strengthening the community as a job and economic powerhouse [3]

D) LAND USE AND DEVELOPMENT

Carson is part of the very first land grant in the history of California. In fact, 75,000 acres of land named Ranch San Pedro was originally a homestead and has transformed its land into being a hub for oil drilling and aerospace manufacturing, too much of the land use comprising of refineries, warehousing, and storage in the current day. Industrial uses continue to dominate the city's land use pattern to the present day, occupation nearly of the planning area acreage. The City of Carson land use map is shown in the map below.

As Carson's demographics and economy evolve, the city seeks to promote new technologies that complement an adaptive environment and encourages the development of flexible space that can adapt to changing patterns in population, retail trends, and job production, as well as striving for complete neighborhood and streets.

i) Redevelopment

Much of the city has already been developed with many of the developable vacant sites already planned. Therefore, future development will focus on reusing existing sites, with existing structures, as redevelopment of underperforming retail sites, or cleanup and redevelopment of old industrial brownfield sites. The city aims to foster revitalization of formerly industrial or vacant and remediated sites, and along corridors through the reuse of commercial sites. Areas for redevelopment include Avalon Boulevard, Main Street, Del Amo Boulevard, and Broadway. Another major development project is the District at South Bay, and the redevelopment of the Shell site is envisioned to become a research and development campus with a mixture of uses, including office, industrial, and a large park.

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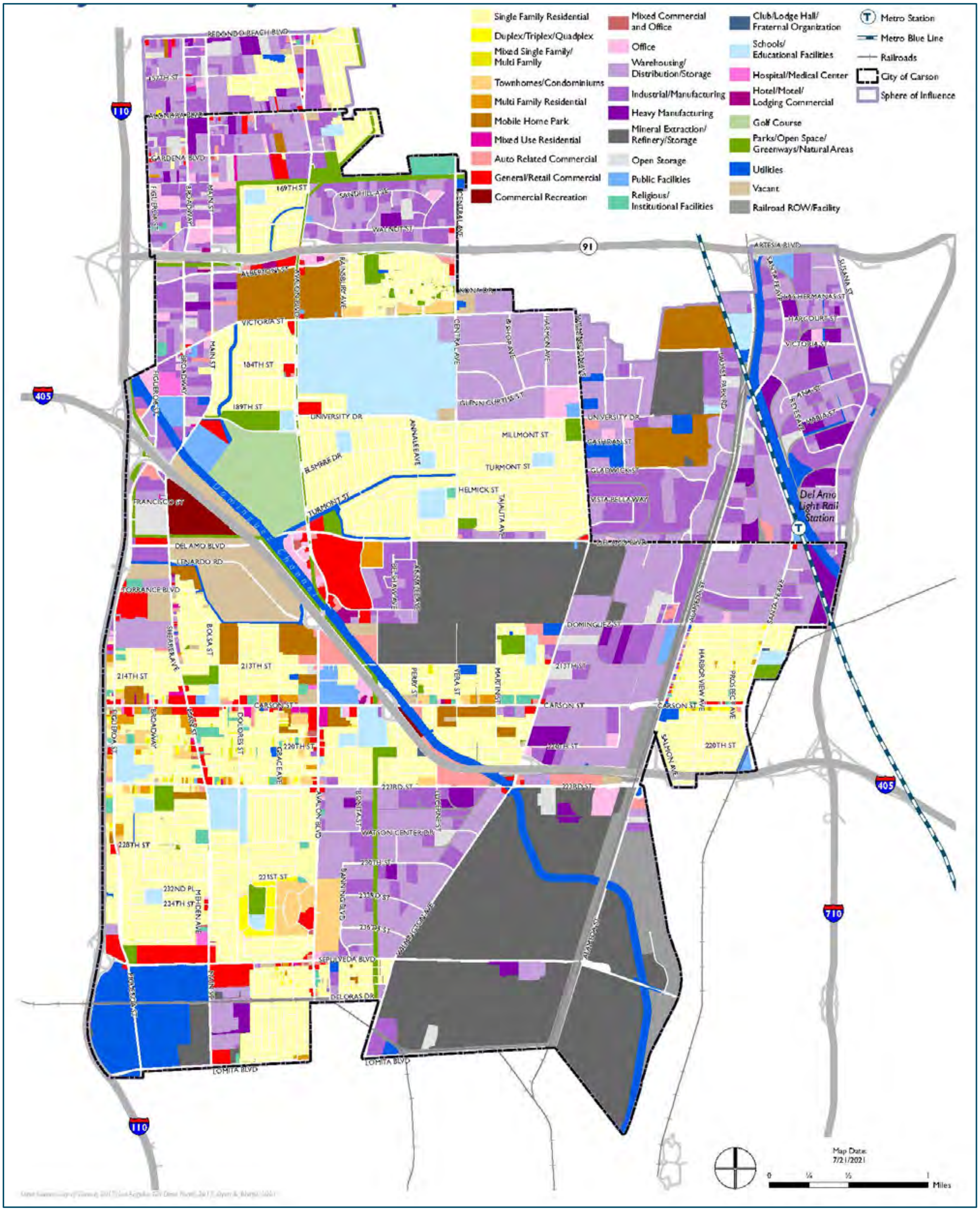
[3] Carson 2040 General Plan

FIGURE 5 – EXISTING LAND USE MAP AS OF 2021



ii) Housing, Jobs, and Population

In the general plan, the city commits to investing more in mixed use housing (i.e., residential mixed-use projects along West Carson Street and Avalon Boulevard) and providing affordable new housing through underutilized sites as well as through the rehabilitation of older, lower quality housing. From 2017 to 2021, Carson has developed about 2,620 new housing units, 220,400 square feet of commercial uses, and 518,000 square feet of industrial uses through projects such as the Carson Arts affordable housing project, Carson Town Center, and California Pak 1.

An estimated 13,730 new housing units are projected to be completed in Carson in the next 20 years, bringing the total number of housing units in the city to approximately 42,140. The table below shows the population and number of employed residents increase of the past several decades. This new development is projected to accommodate an increase in population of 43,600, for a total buildout population of 141,700.

TABLE 5 – CITY OF CARSON HISTORIC POPULATION AND EMPOYMENT

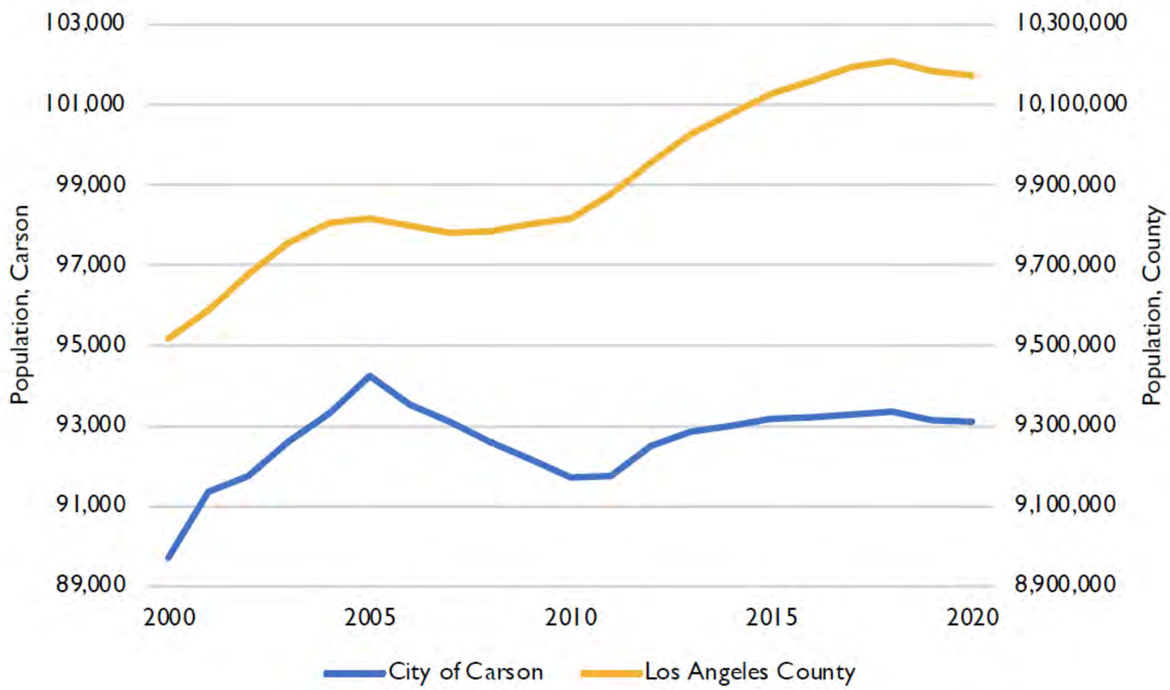
	2000	*2005*	*2010*	*2015*	*2020*
Population	89,700	94,200	91,700	93,200	93,100
Employed Residents	37,300	42,600	39,300	41,700	44,600
Jobs	52,300[1]	51,800	49,800	56,100	58,500[1]

1. Available data for jobs is limited to 2002-2018. Values shown for 2000 and 2020 are from 2002 and 2018, respectively.
2. Numbers shown in this table only include the City of Carson and do not include the Sphere of Influence.
3. Numbers are rounded to the nearest hundredth.

Source: Carson General Plan

Likewise, population and employment in Carson have also fluctuated but have been increasing. The figure below shows the population increase in the City of Carson compared to Los Angeles County.

FIGURE 6. POPULATION GROWTH TRENDS: CARSON AND LOS ANGELES COUNTY



Source: Carson General Plan Updated 2024

Employment has increased with a 17.6 percent growth in jobs between 2010 to 2018. Comparatively, Los Angeles County experienced a smaller growth of 13.4 percent in jobs over the same time frame. The housing supply is expected to increase at a faster pace than jobs, resulting in a greater balance of about 1.49 jobs per employed resident, shown in the table below. In 2020, the Carson Planning Area had an estimated 1.77 jobs for every employed resident. Jobs are projected to continue increasing under the General Plan.

TABLE 6. PLANNING AREA JOBS/EMPLOYED RESIDENTS BALANCE, 2020-2040

	2020[1]	2040	Percent Change
Jobs	77,600	96,500	24%
Population	98,100	141,700	44%
Employed Residents	43,900	64,600	47%
Jobs/Employed Residents	**1.77**	**1.49**	**-15%**

1. Calculation of Existing (2020) numbers are based on project buildout projections.
2. Numbers are rounded to the nearest 100.

Source: Carson General Plan

iii) Population Density Standards

For calculation purposes, the General Plan assumes 3.50 persons per household, and uses an average housing vacancy rate of 4.8 percent. Currently (U.S. Census ACS estimate 2015-2019) Carson maintains 3.62 persons per household, which is greater than the Los Angeles County average at 3.02 persons per household. Carson's higher persons per household number is likely due to a variety of factors, including the sharing of households by CSUDH students, the significant presence of single-family unit types associated with a traditional family structure, and cultural norms of sharing housing with multiple generations.

E) HISTORICAL AND CULTURAL RESOURCES

Historic and cultural resources are the physical and spiritual reminders of historical moments, people, and places in American history and culture. Within the City of Carson, there are 49 historic properties according to the California State Parks Office of Historic Preservation. The table below provides detailed information on the historic properties and the map below shows the location of the historic properties.

TABLE 7. CITY OF CARSON LIST OF HISTORIC PROPERTIES

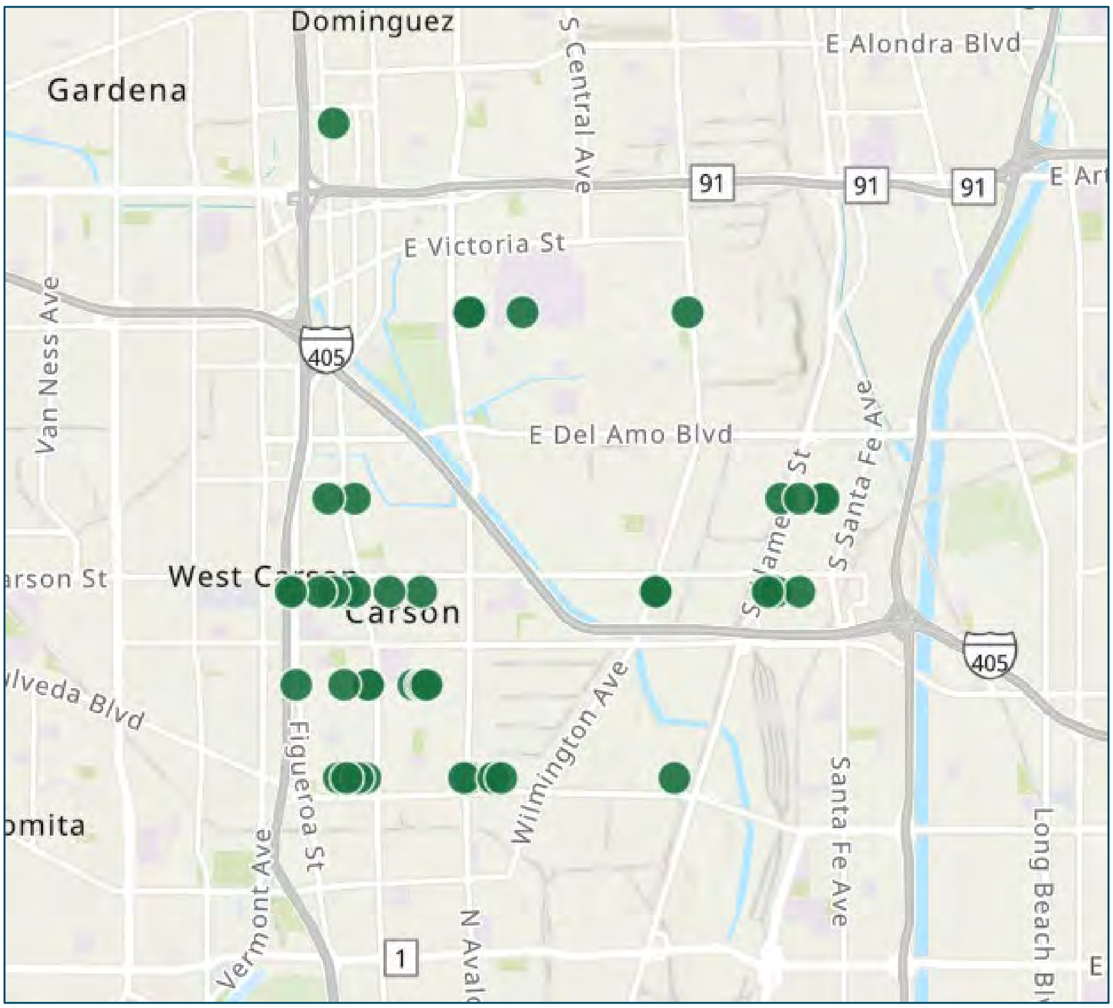
NAME	ADDRESS	YEAR
	753 E Lincoln Street	1941
	2514 E Madison Street	1928
	E Monroe Street	1936
	E Realty Street	1950

NAME	ADDRESS	YEAR
	734 E Sepulveda Blvd	1937
Pacific Electric Railway Watson Street	1850 E Sepulveda Blvd	1905
	E Tyler Street	
	2510 E Van Buren Street	1942
7-Eleven Olympic Velodrome	1000 E Victoria Street	1982
	2510 E Washington Street	1940
	2531 E Washington Street	1929
	2616 E Washington Street	1924
	19018 Galway Avenue	1960
	19327 Galway Avenue	1951
	19403 Galway Avenue	1960
	23620 Idabel Avenue	1943
	2617 Jackson Street	1929
	22129 Kinard Avenue	1957
	22031 Main Street	1988
	22723 Marbella Avenue	1951
	608 Martinshire Street	1954
	21409 Moneta Avenue	1948
	22139 Neptune Avenue	1955
	22512 Neptune Avenue	1951
	22529 Neptune Avenue	1951
	22628 Neptune Avenue	1951
	21806 Orrick Avenue	1954
	768 Pacific Street	1930
	22603 Ravenna Street	1952
	815 Realty Street	1930
L.J. Turner Market	21608 South Alameda Street	1944
	21305 S Figueroa Avenue	1938
Initial United States Air Meet Sit (State Landmark)	18501 S Wilmington Avenue	N/A
	20836 Shearer Avenue	1949
	229 W 214th Street	1954
	124 W 225th Street	1955
	125 W 226th Street	1956
	254 W 232nd Place	1952
	233 W 223rd Street	1952
	137 W 234th Street	1952
	178 W 234th Street	1952
	229 W 234th Street	1952

NAME	ADDRESS	YEAR
	333 W Carson Street	1946
	621 W Carson Street	1966
	305 W Clairion Drive	1954
	423 W Gardena Blvd	1931
Castaic Union School District-Comm	31616 North Ridge Route Road	1910
Suangna Native American Village (Point of Interest)	Watson Industrial Park	

Source: California State Parks Office of Historic Preservation

FIGURE 7 – CITY OF CARSON HISTORIC PROPERTIES



Source: California State Parks Office of Historic Preservation 2024

F) CRITICAL FACILITIES

Facilities critical to government functioning or providing emergency response and recovery activities (i.e., life safety and property and environmental protection) can include local government 9-1-1 dispatch centers, government emergency operations centers, schools (hosting shelters), police and fire stations, public works facilities, communications centers, hospitals, bridges and major roads, and shelters. Facilities that, if damaged, could cause serious secondary impacts may also be considered "critical”. A hazardous materials facility is one example of this type of critical facility.

Critical facilities are those facilities that are vital to the continued delivery of key city services or that may significantly impact the city’s ability to recover from the disaster. These facilities may include government facilities, schools, rail facilities, protective services, airport facilities, and wastewater facilities. All critical facilities within the City of Carson are illustrated on the map below. There are eight rail facilities, five protective services, one airport facility, one wastewater facility, one government facility, and over 20 schools. Critical facilities may also be called “community assets” or, can be categorized under FEMA’s Community Lifelines as a feature that enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security. Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.

FIGURE 8. FEMA COMMUNITY LIFELINES AS OF 2024

Safety and Security - Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety

Food, Hydration, Shelter - Food, Hydration, Shelter, Agriculture

Health and Medical - Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management

Energy - Power Grid, Fuel

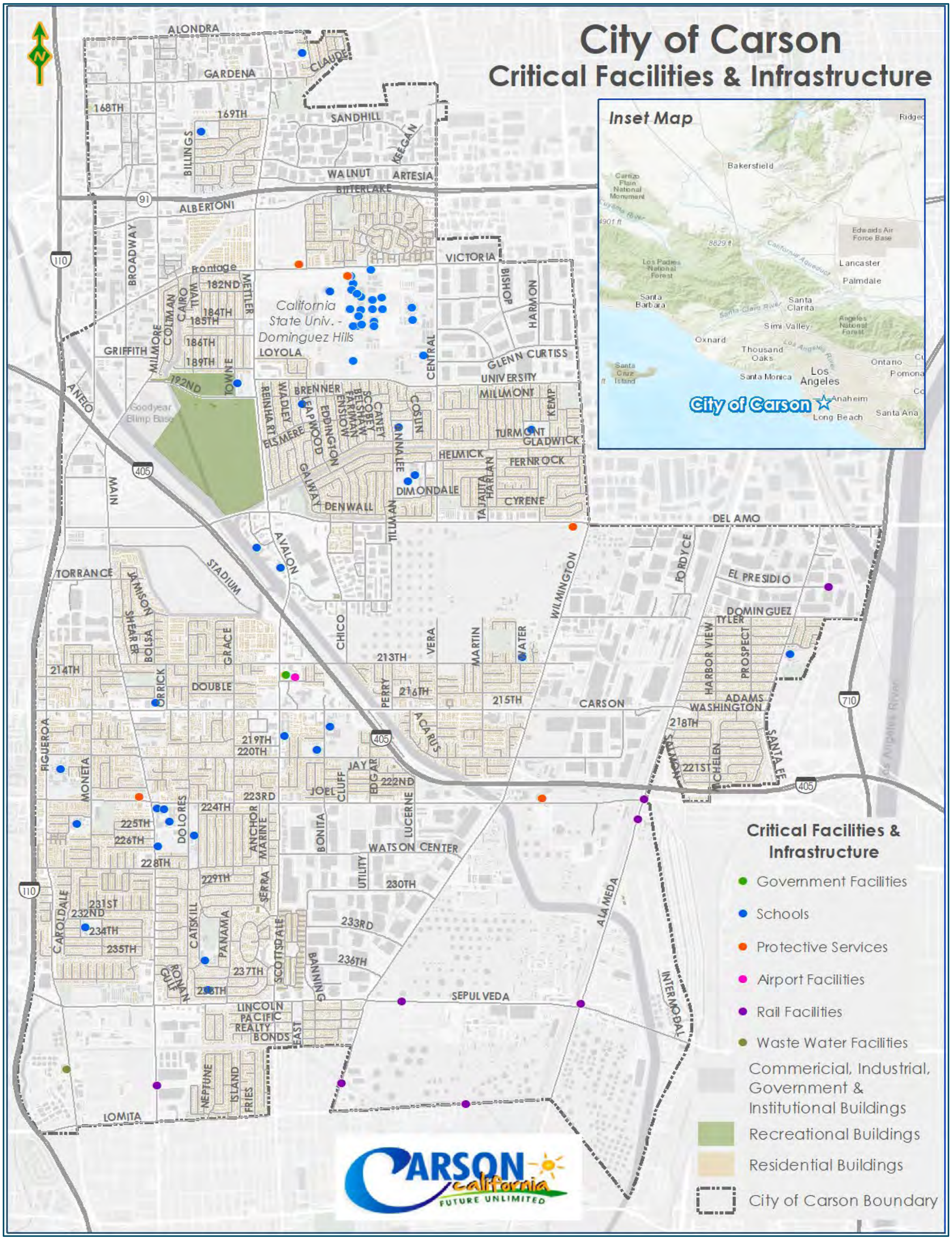
Communications - Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch

Transportation - Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime

Hazardous Materials - Facilities, HAZMAT, Pollutants, Contaminants

Water Systems - Potable Water Infrastructure, Wastewater Management

FIGURE 9 - CITY OF CARSON CRITICAL FACILITIES AND INFRASTRUCTURE AS OF 2024



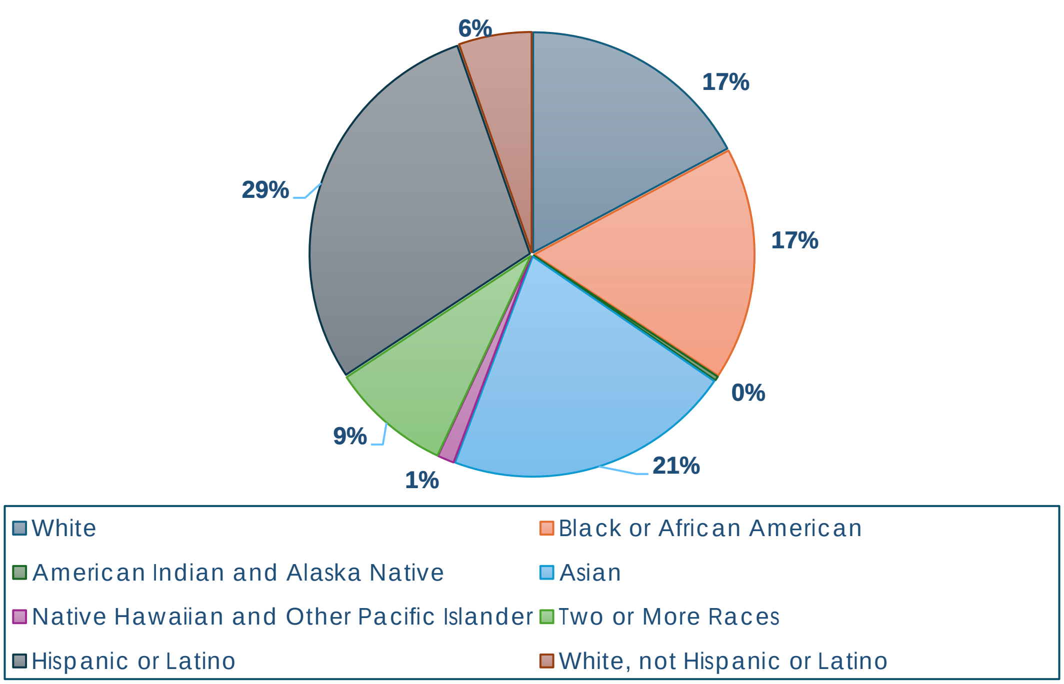
G) POPULATION AND DEMOGRAPHICS

The City of Carson, according to the 2020 Census, has a population of 95,558, up from 91,714 from 2010 Census. The City of Carson is an ethnically and culturally diverse community with 29 percent Hispanic or Latino, 21 percent Asian, 17percent Black or African American, 17 percent White, 9 percent Two or More Races, 6 percent White, not Hispanic or Latino, 1.6 percent Native Hawaiian and Other Pacific Islander, and .4 percent American Indian and Alaska Native. The age breakdown for the City of Carson consists of 58 percent of the population 19-64 years old, 20 percent people under 18 years old, 17 percent 65 years and older, and 5 percent persons under 5 years old. Visual descriptions of the city's race and ethnicity and age demographic data are shown below.

Additional demographic information is described below.

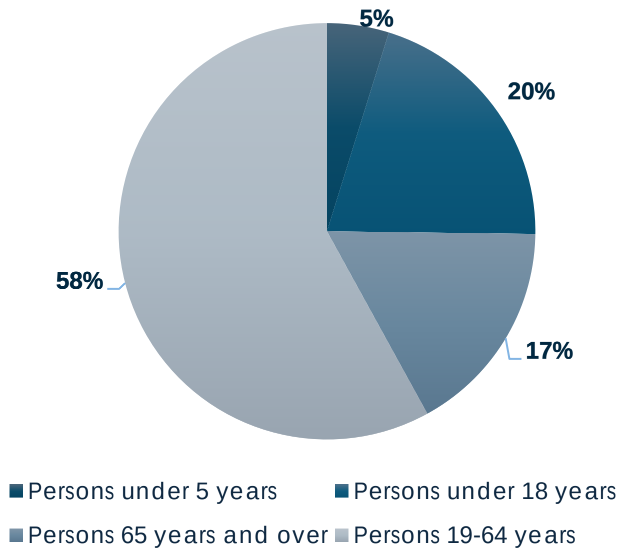
- **$92,548** is the median household income (2021 dollars), 2017-2021.
- **9.1 percent** of people are living in poverty.
- **7.8 percent** of persons have a disability, under the age of 65 years (2017-2021)
- **7.9 percent** of people are without health insurance, under the age of 65 years old.
- **54 percent** of persons who speak another language at home other than English.
- **83.1 percent** of persons have a high school graduate or higher, percent of persons aged 25 year or older (2017-2021)
- **29.6 percent** of persons have a bachelor's degree or higher, percent of persons aged 25 year or higher (2017-2021)

FIGURE 10: CITY OF CARSON POPULATION BY RACE & ETHNICITY



Source: U.S. Census Bureau 2020

FIGURE 11: CITY OF CARSON POPULATION BY AGE



Source: U.S. Census Bureau 2020

Vulnerable Communities

Emergencies and disasters often highlight and exacerbate existing societal inequities, affecting groups based on socioeconomic status, race, age, disability, and other social factors.[4] These events disproportionately impact certain populations, creating additional challenges in the preparation, response, and recovery phases. For instance, the COVID-19 pandemic shed light on pre-existing disparities such as limited healthcare access, leading to higher rates of hospitalizations and mortality among vulnerable groups. It's essential to recognize and understand these community-specific limitations and barriers to strive for equitable preparedness, mitigation, and response strategies for future incidents.

The Social Vulnerability Index

To aid in this, the Centers for Disease Control and Prevention (CDC) developed the Social Vulnerability Index (SVI), a comprehensive tool designed for emergency management planners and practitioners at state, local, and tribal levels. The SVI helps identify communities with high social vulnerability, potentially facing greater impacts during emergencies and disasters. This tool is instrumental in guiding targeted efforts in preparedness, response, and recovery, and in understanding the unique challenges certain communities may face, such as evacuation difficulties due to lack of transportation.

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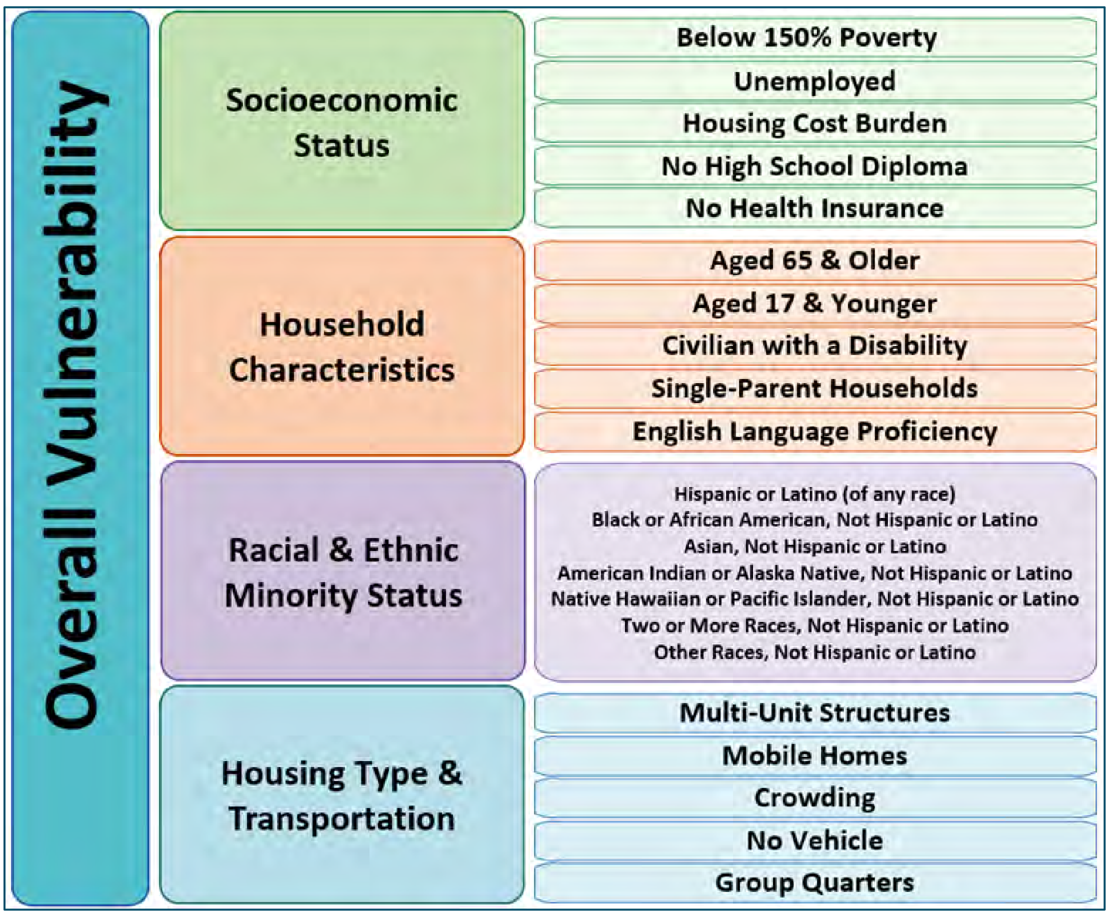
[4] Breen, Kyle. *Disaster Racism: Using Black Sociology, Critical Race Theory, and History to Understand Racial Disparity to Disaster in the United States*. Disaster Prevention and Management: An International Journal, October 2021, DOI: 10.1108/DPM-02-2021-0059.

The SVI utilizes 16 variables, including factors like education level, presence of disabilities, and access to transportation, to calculate a community's vulnerability score. This score ranges from 0 to 1, where higher scores indicate increased vulnerability. The evaluation is percentile-based, with communities in the top 10 percent (above the 90th percentile) for a variable scoring a 1, denoting high vulnerability, and those in the bottom 10 percent scoring a 0. Additionally, the SVI categorizes these 16 variables into four distinct themes, providing deeper insights into specific vulnerability aspects, shown in the figure below. These themes and their constituent variables offer a nuanced understanding of a community's resilience and ability to handle disasters, both in terms of human impact and financial consequences. The figure below shows the breakdown to calculate the overall SVI score. The proceeding maps described the SVI score and theme scores for the City of Carson.

FIGURE 12. SOCIAL VULNERABILITY INDEX THEMES AND ININDICATORS



Source: CDC, 2024

FIGURE 13 – CITY OF CARSON OVERALL SVI

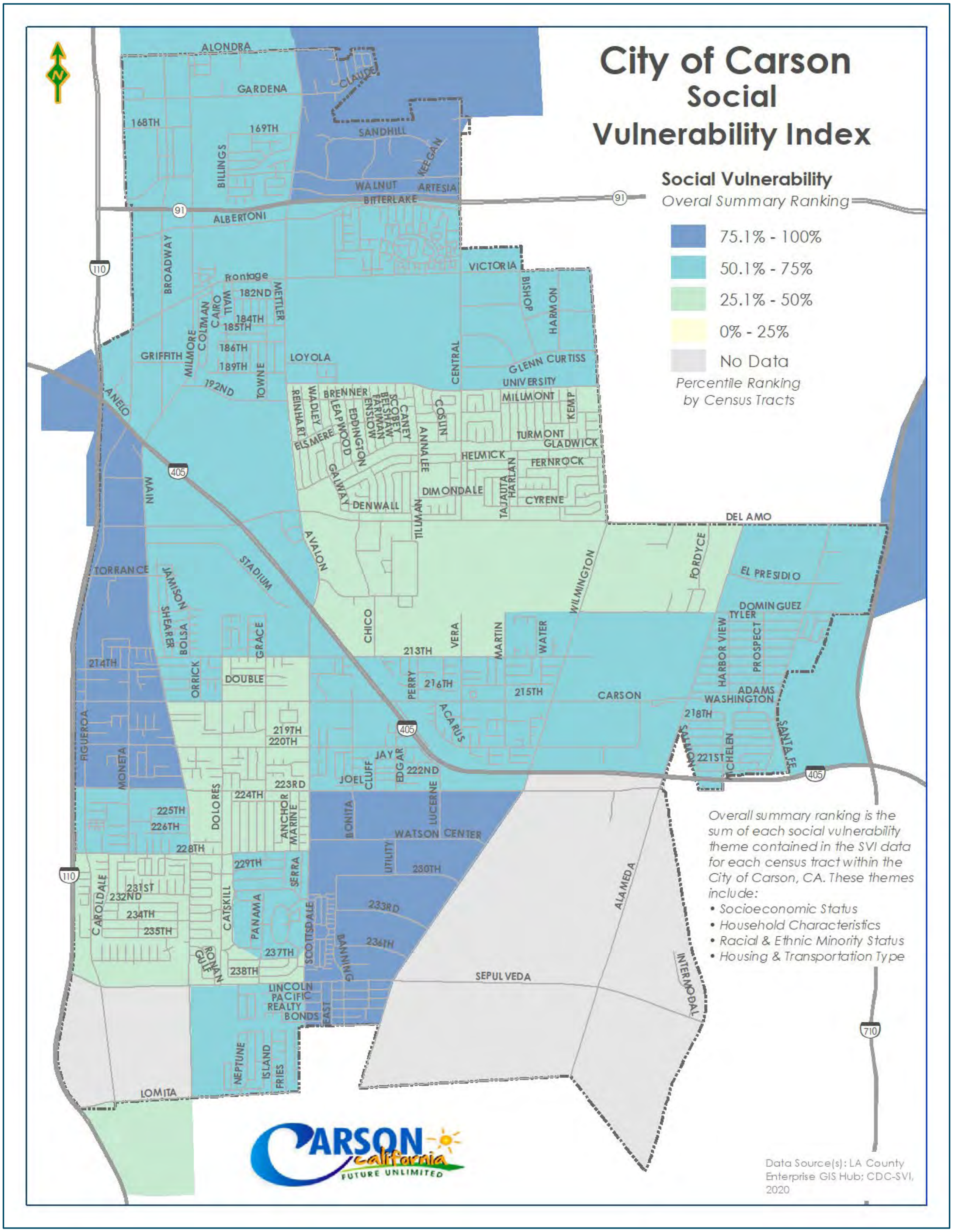


FIGURE 14 - CITY OF CARSON SVI RACIAL & ETHNIC MINORITY THEME

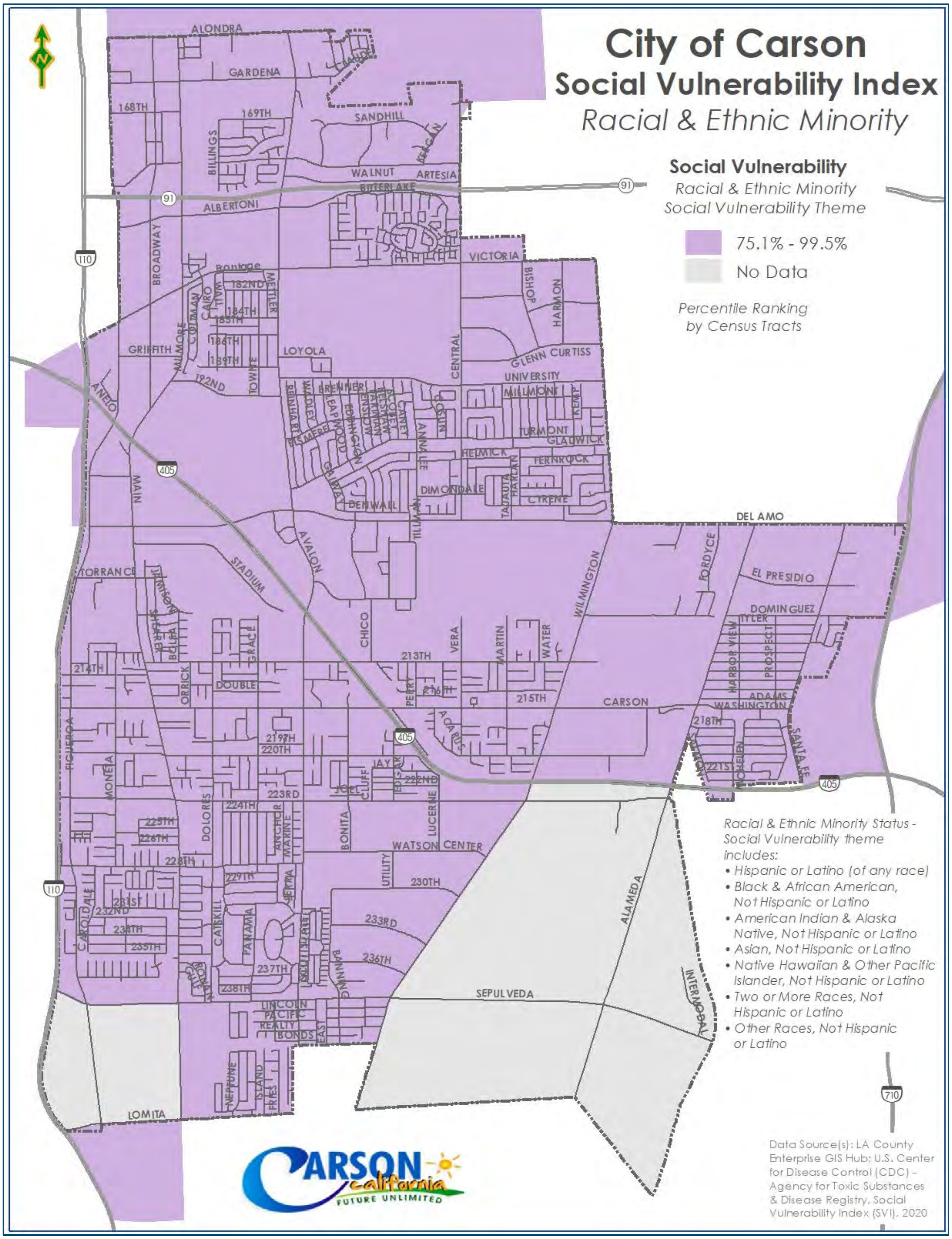


FIGURE 15 – CITY OF CARSON SVI SOCIOECONOMIC STATUS THEME

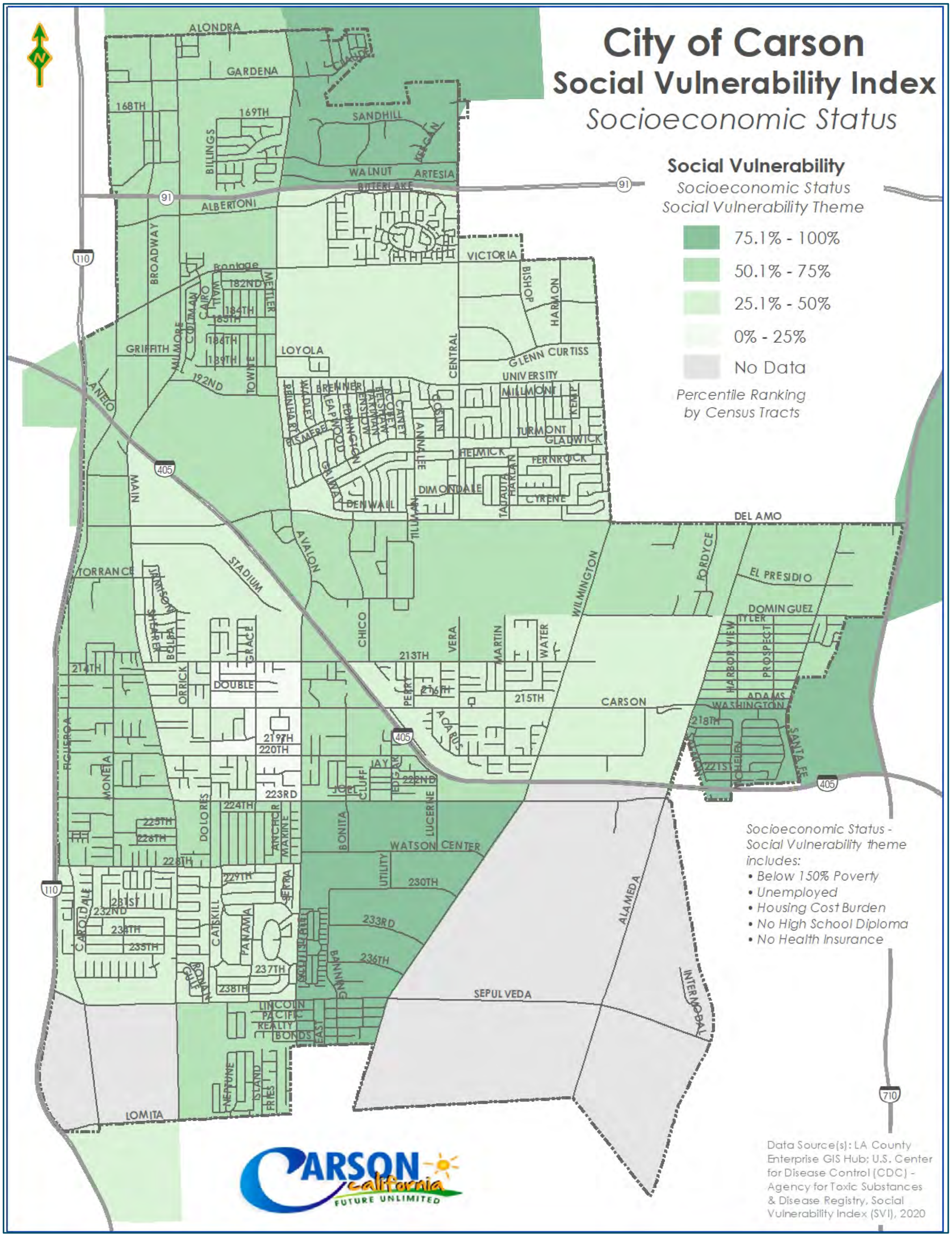


FIGURE 16 – CITY OF CARSON SVI HOUSING AND TRANSPORTATION THEME

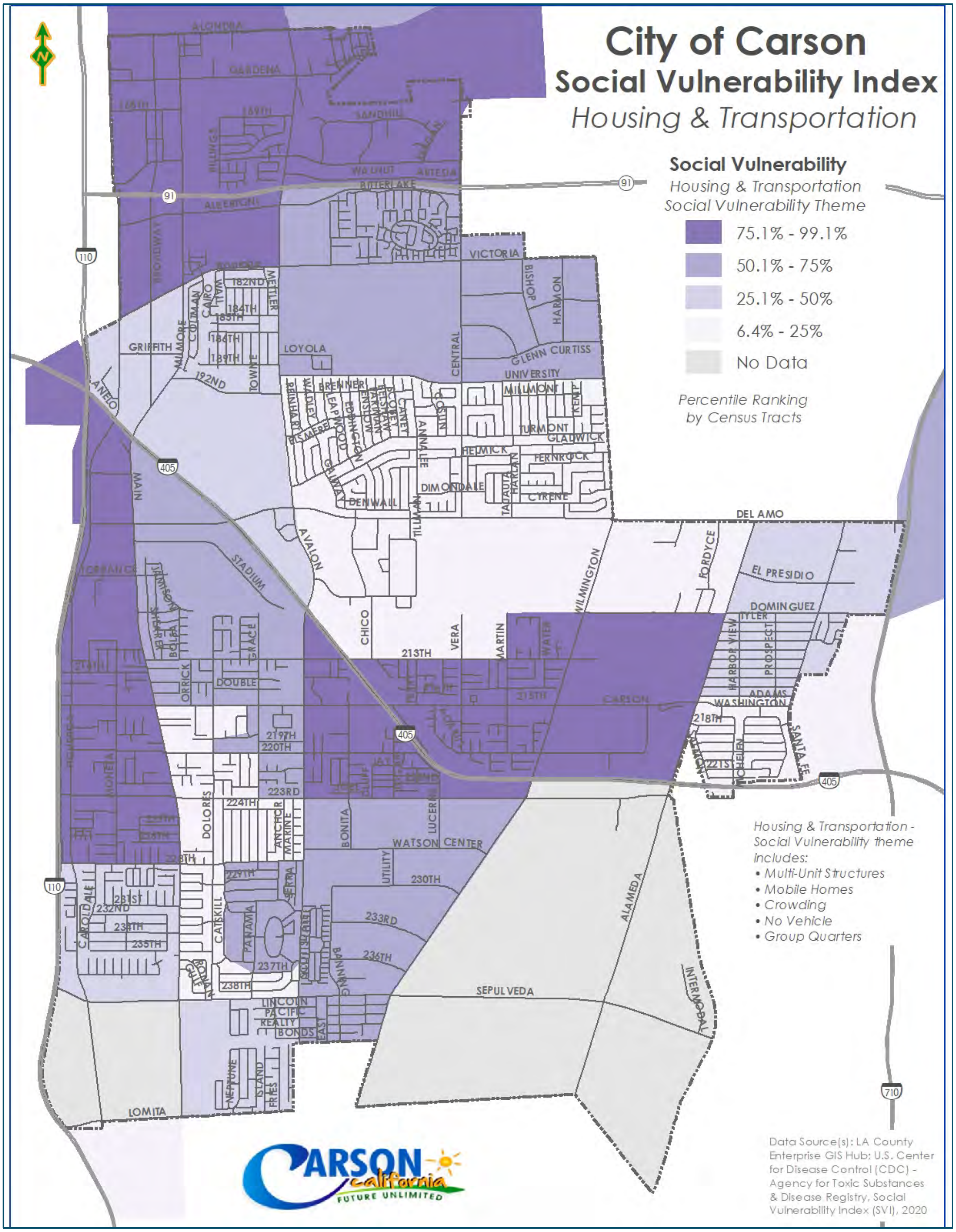
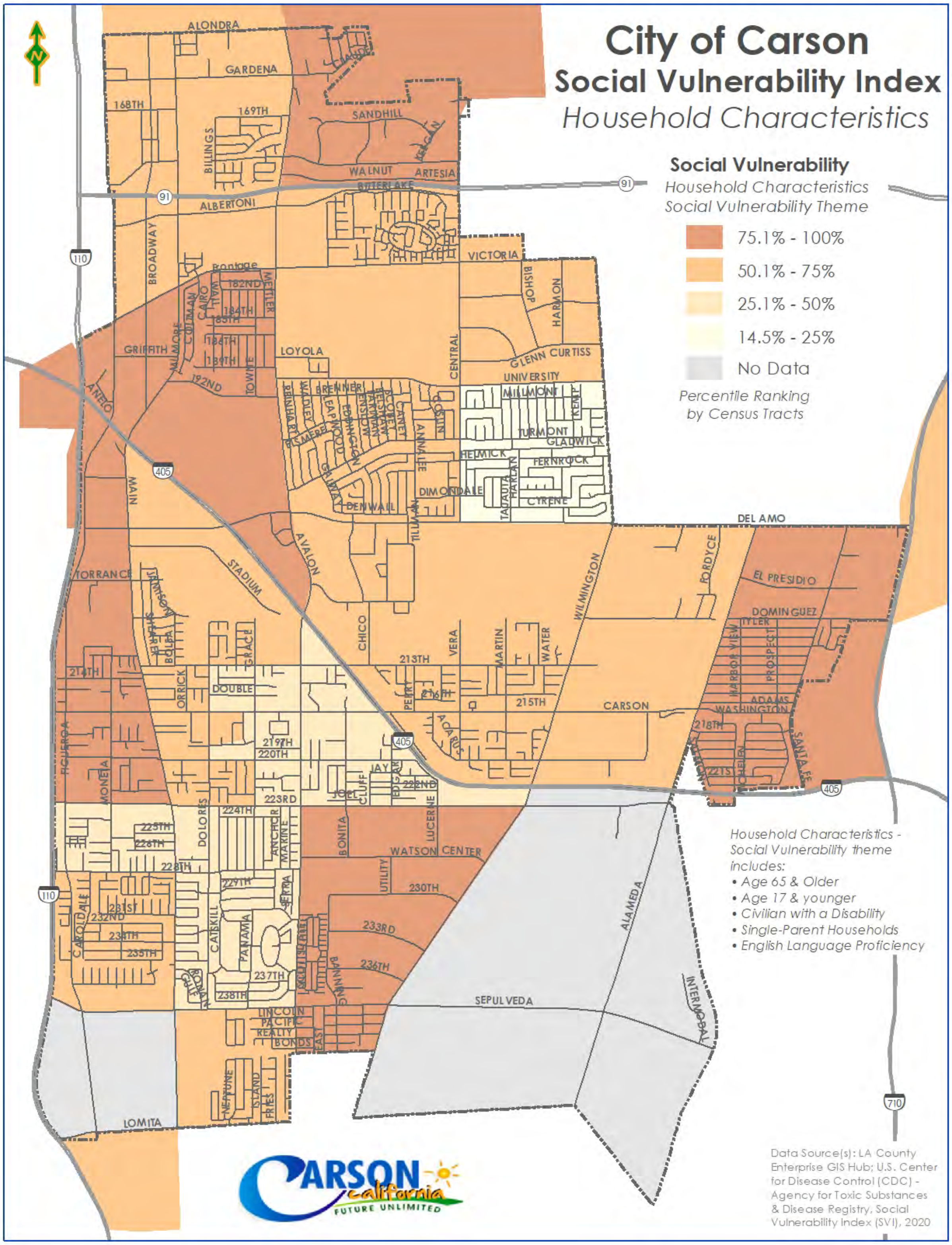


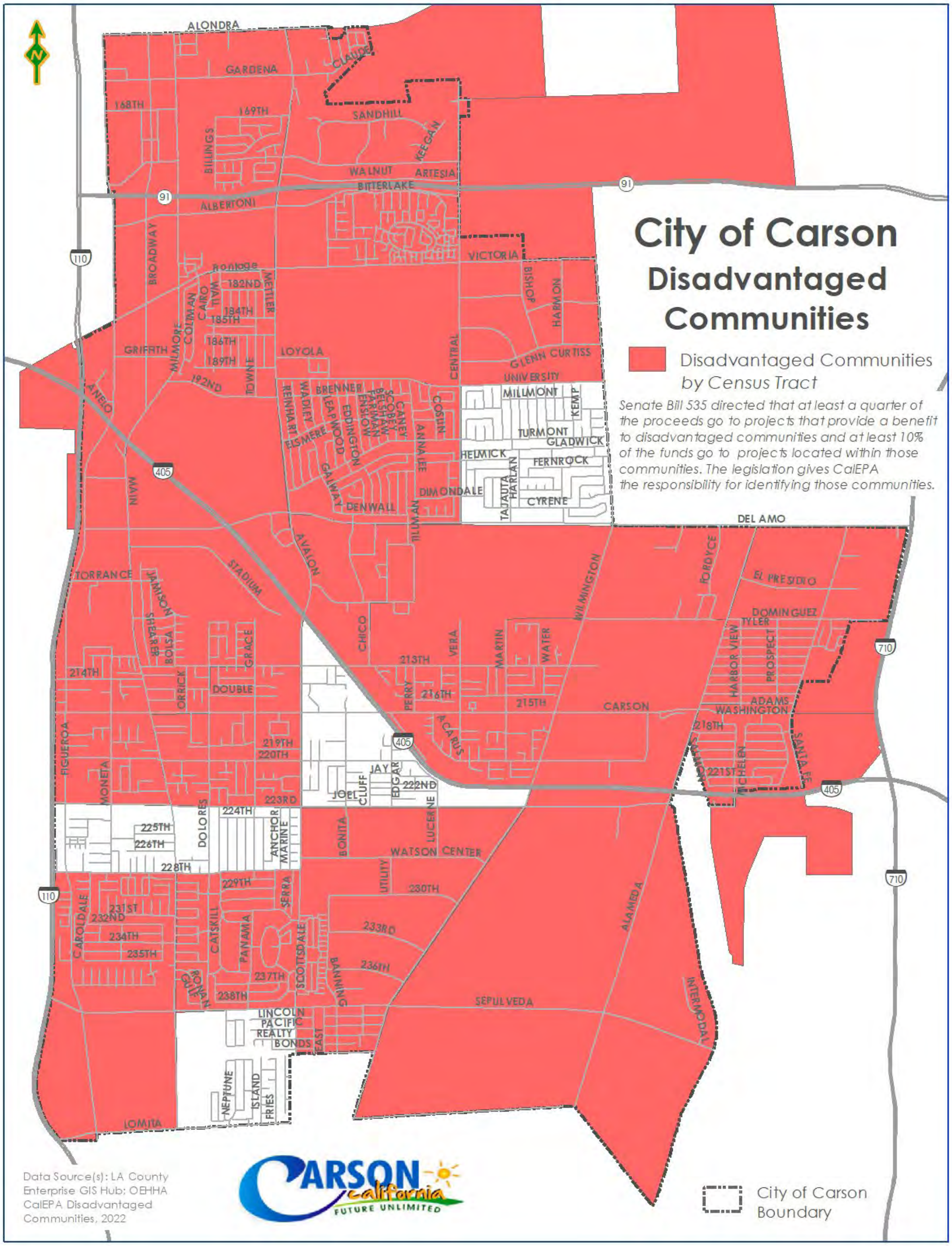
FIGURE 17 – CITY OF CARSON SVI HOUSEHOLD CHARACTERISTICS THEME



CalEnviroScreen

The California Environmental Protection Agency developed a tool called CalEnviroScreen to identify communities most impacted by poverty and pollution. The Senate Bill 535 Disadvantaged Communities map identifies census tracts that have an overall CalEnviroScreen score of 75 or above, meaning they are among the top 25 percent most vulnerable and burdened by pollution in the state. In the City of Carson, nearly all the census tracts are identified as disadvantaged communities, shown in the figure below. According to the 2040 City of Carson General Plan, these areas are comprised of the Shell, Marathon, and Phillips 66 oil refineries and other industrial uses. Since the facilities are one of the largest employers in the area, people are working and living nearby and are impacted by the pollution. In fact, the pollution burden scores are among the top 3rd percentile in the state of California.

FIGURE 18 – CITY OF CARSON DISADVANTAGED COMMUNITIES BY CENSUS TRACT



4) HAZARD IDENTIFICATION AND RISK ASSESSMENT

This section outlines the City of Carson's Local Hazard Identification & Risk Assessment (HIRA) conducted in updating this Hazard Mitigation Plan. Risk assessments measure the potential impact of hazards on people, the economy, and both built and natural environments. They involve:

1. Identifying and profiling concerning hazards
2. Cataloging community assets
3. Analyzing hazard risks
4. Summarizing the community's vulnerability to these hazards

This assessment forms the foundation for our mitigation planning, aiming to prioritize actions that reduce risk from these hazards.

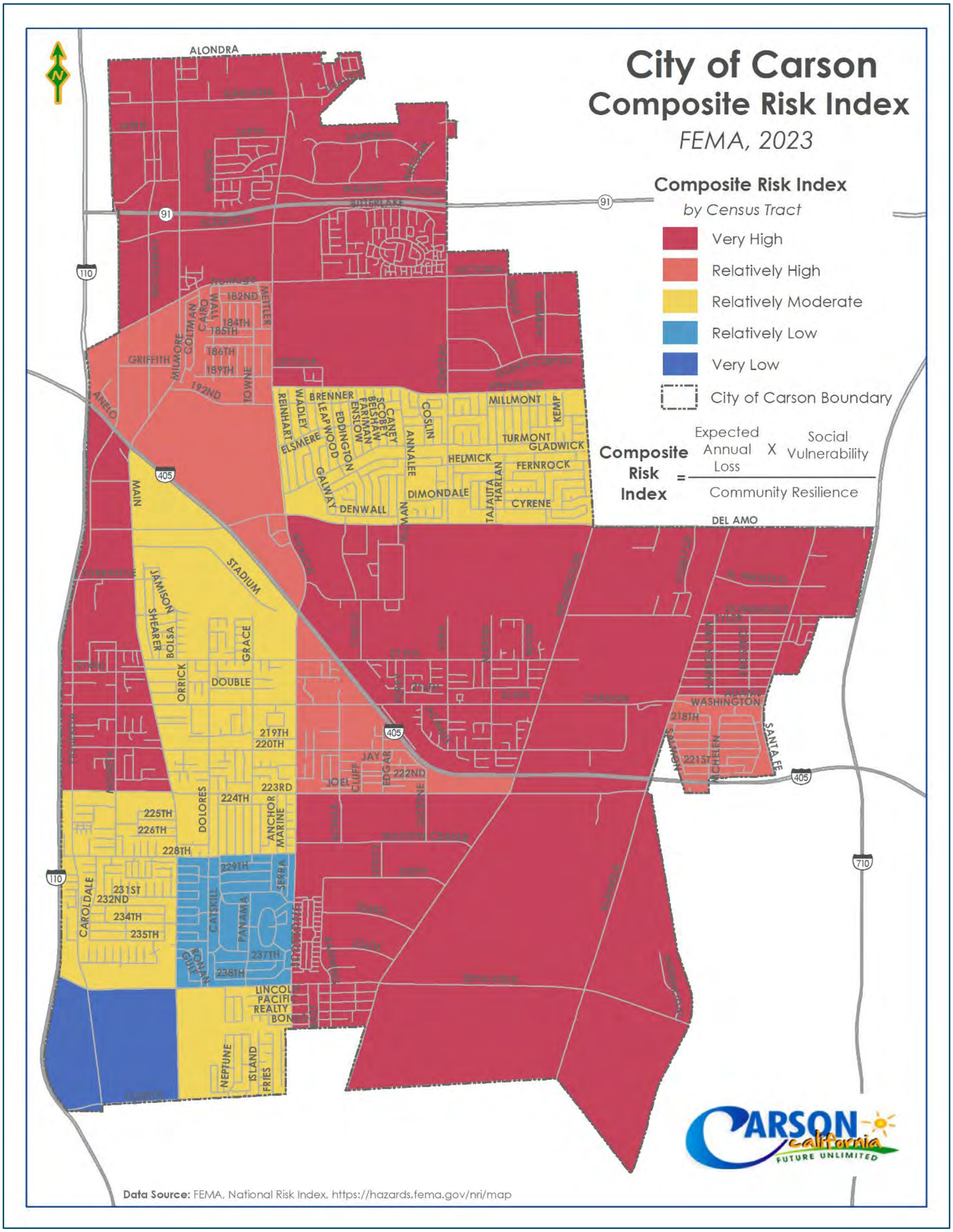
The HIRA is a method used to evaluate risk based on the likelihood of a hazard event, its exposure to people and property, and the resulting consequences. Various methodologies, from qualitative to quantitative, are employed for this purpose.

The City of Carson faces numerous natural hazards. Those highlighted in this HIRA are deemed genuine threats by the Hazard Mitigation Planning Team. They align with hazards recognized by the State of California and the Federal Emergency Management Agency (FEMA) for this state and region.

The National Risk Index is a dataset and online tool the help spatially represent risk across communities in the United States for 18 natural hazards. It was designed and built by FEMA in close collaboration with diverse stakeholders and partners within academia, local, state, and federal government, and the private sector. The risk index can be calculated at the census tract level which can be seen for the City of Carson in the map below.

Overall, the City of Carson has a relatively moderate to very high composite risk index. While two of the census tracts have a very low to relatively low risk index, it does not necessarily mean that those two census tracts are significantly less at risk than surrounding census tracts based on how small scale these risk index scores are calculated. The composite risk index is calculated by incorporating three factors which include expected annual loss, social vulnerability, and community resilience.

FIGURE 19 - FEMA COMPOSITE RISK INDEX FOR THE CITY OF CARSON AS OF 2024



A) SUMMARY OF HAZARDS

As part of the planning process, the City of Carson's Hazard Mitigation Planning Team reviews the hazard of concern profiled in the previous plan and considered other hazards that are profiled in the California State Hazard Mitigation Plan. Since the previous hazard mitigation plan only profiled three hazards, the planning team identified additional hazards that pose a risk to the planning area.

The 17 hazards identified for the 2024 plan are provided in the following table, along with hazard descriptions.

TABLE 8. HAZARD PROFILE DESCRIPTIONS

#	HAZARD	DESCRIPTION
1	**Drought/Water Shortage**	A drought is a deficiency of precipitation over an extended period resulting in a water shortage. (FEMA, NRI).
2	**Earthquake**	An earthquake is a shaking of the earth's surface by energy waves emitted by slowly moving tectonic plates overcoming friction with one another underneath the earth's surface (FEMA, NRI).
3	**Extreme Heat**	Extreme heat is a period of abnormally and uncomfortably hot and unusually humid weather typically lasting two or more days with temperatures outside the historical averages for a given area. Extreme heat is responsible for the highest number of annual deaths among all weather-related hazards (FEMA, NRI).
4	**Extreme Winter Weather (Cold)**	Extreme cold is a rapid fall in temperature within 24 hours and extreme low temperatures for an extended period (FEMA, NRI).
5	**Flood**	A flood occurs when the existing channel of a stream, river, canyon, or other watercourse cannot contain excess runoff from rainfall or snowmelt, resulting in overflow onto adjacent lands. In coastal areas, flooding may occur when high winds or tides result in a surge of seawater into areas that are above the normal high tide line.
6	**Hail**	Hail is a form of precipitation that occurs during thunderstorms when raindrops, in extremely cold areas of the atmosphere, freeze into balls of ice before falling towards the earth's surface (FEMA, NRI).
7	**High Wind**	High Wind consists of damaging winds, often originating from thunderstorms, that are classified as exceeding 58 mph (FEMA, NRI).
8	**Hurricane**	A hurricane is a tropical cyclone or localized, low-pressure weather system that has organized thunderstorms but no front (a boundary separating two air masses of different densities) and maximum sustained winds of at least 74 mph (FEMA, NRI).

#	HAZARD	DESCRIPTION
9	**Industrial Pollution/ Chemical Release**	When these chemicals are released into the environment leads to different forms of pollution like air pollution, water pollution, and land pollution. A chemical release is the discharge or release of hazardous liquids, gases, or solids. It can occur due to an accident, a failure or an attack involving hazardous products (EPA).
10	**Landslide/ Mudflow**	A landslide is the movement of a mass of rock, debris, or earth down a slope (FEMA, NRI).
11	**Land subsidence/ Karst**	Land subsidence is a gradual settling or sudden sinking of the Earth's surface due to removal or displacement of subsurface earth materials. Karst is a type of landscape where the dissolving of the bedrock has created sinkholes, sinking streams, caves, springs, and other characteristic features (USGS).
12	**Pandemic/ Epidemic**	A pandemic is a global outbreak of disease that occurs when a new virus emerges in the human population, spreading easily in a sustained manner, and causing serious illness. An epidemic describes a smaller-scale infectious outbreak, within a region or population, that emerges at a disproportional rate. Infectious disease outbreaks may be widely dispersed geographically, impact large numbers of the population, and could arrive in waves lasting several months at a time (CDC).
13	**Severe Storm/ Thunderstorm/ Lightening**	Severe storms refer to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life such as thunderstorms and lightning. NOAA classifies a thunderstorm as a storm with lightning and thunder produced by cumulonimbus clouds, usually producing gusty winds, heavy rain, and sometimes hail. Thunderstorms are usually short in duration but can cause significant damage. Lightening is an electrical discharge that results from the built of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt." This flash of light usually occurs within the clouds or between the clouds and the ground. (NWS).
14	**Tornado**	A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground and is visible only if it forms a condensation funnel made up of water droplets, dust, and debris (FEMA, NRI).
15	**Tsunami and Seiche**	A tsunami is a wave or series of waves generated by an Earthquake, Landslide, volcanic eruption, or even a large meteor hitting the ocean and causing a rise or mounding of water at the ocean surface. A tsunami can travel across an open ocean at about 500 mph and slow down to about 30 mph as it approaches land, causing it to grow significantly in height.

#	HAZARD	DESCRIPTION
		A seiche is a standing wave oscillating in a body of water. Wind and atmospheric pressure can contribute to seiche events. They are usually limited to partially or fully enclosed basins (NOAA)
16	**Urban Fire**	Urban fires are classified as "uncontrolled burning in a residence or building from natural, human or technical causes". These fires have the potential to spread to adjoining structures. Local city and county fire departments are tasked with the response and control of urban fires.
17	**Wildfire**	A wildfire is an unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies (FEMA, NRI).

B) PREVIOUS DISASTERS

Southern California is familiar with disasters from many hazards that pose a risk to the region. The list of previous disasters impacting Los Angeles County and therefore have impacted the planning area are described in the table below. The list includes disasters occurring from January 1953 to May 2024 from various hazards including hurricanes, severe storms, fires, droughts, and earthquakes.

TABLE 9. LOS ANGELES COUNTY FEMA DISASTER DECLARATIONS (1953-2024)

Disaster Number	Description	Declaration Date & Incident Period	Assistance Provided
DR-4769	California Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides	04-13-2024 (01-31-2024 to 02-09-2024)	N/A
DR-4699	California Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	04-03-2023 (02-21-2023 to 07-10-2023)	Individual Assistance, Public Assistance, Hazard Mitigation Assistance
DR-3592	California Severe Winter Storms, Flooding, Landslides, and Mudslides	03-10-2023 (03-09-2023 to 07-10-2023)	N/A
DR-4683	California Severe Winter Storms, Flooding, Landslides, and Mudslides	01-14-2023 (12-27-2022 to 01-31-2023)	Individual Assistance, Public Assistance, Hazard Mitigation Assistance
EM-3591	California Severe Winter Storms, Flooding, and Mudslides	01-09-2023 (01-08-2023 to 01-31-2023)	N/A

Disaster Number	Description	Declaration Date & Incident Period	Assistance Provided
DR-4569	California Wildfires	10-16-2020 (09-04-2020 to 11-17-2020)	Individual Assistance, Public Assistance, Hazard Mitigation Assistance
FM-5374	California Bobcat Fire	11-13-2020 (11-13-2020)	N/A
DR-4482	California COVID-19 Pandemic	03-22-2020 (01-20-2020 to 05-11-2023)	Individual Assistance, Public Assistance, Hazard Mitigation Assistance
EM-3428	California COVID-19	03-13-2020 (01-20-2020 to 05-11-2023)	Public Assistance
FM-5297	California Getty Fire	10-28-2019 (10-28-2019)	Public Assistance
FM-5296	California Tick Fire	10-24-2019 (10-24-2019)	Public Assistance
FM-5293	California Saddleridge Fire	10-11-2019 (10-10-2019)	Public Assistance, Hazard Mitigation Assistance
DR-4407	California Wildfires	11-12-2018 (11-8-2018 to 11-25-2018)	Individual Assistance, Public Assistance, Hazard Mitigation Assistance
EM-3409	California Wildfires	11-9-2018 (11-8-2018 to 11-25-2018)	N/A
FM-5280	California Woolsey Fire	11-9-2018 (11-8-2018)	N/A
DR-4353	California Wildfires, Flooding, Mudflows, and Debris Flows	01-02-2018 (12-4-2017 to 01-31-2018)	Individual Assistance, Public Assistance, Hazard Mitigation Assistance
EM-3396	Wildfires in California	11-8-2017 (12-4-2017 to 11-29-2017)	N/A
FM-5227	California Skirball Fire	12-6-2017 (12-6-2017 to 12-15-2017)	Public Assistance
FM-5226	California Rye Fire	12-5-2017 (12-5-2017 to 12-14-2017)	Public Assistance
FM-5225	California Creek Fire	12-5-2017 (12-5-2017 to 12-14-2017)	Public Assistance
FM-5201	California la Tuna Fire	9-2-2017 (9-1-2017 to 9-10-2017)	Public Assistance

Disaster Number	Description	Declaration Date & Incident Period	Assistance Provided
DR-4305	Severe Winter Storms, Flooding, and Mudslides in California	03-16-2017 (01-18-2017 to 01-23-2017)	Public Assistance, Hazard Mitigation Assistance
FM-5135	California Sand Fire	07-23-2016 (07-22-2016 to 08-01-2016)	Public Assistance
FM-5132	California Sage Fire	07-09-2016 (07-09-2016 to 07-14-2016)	Public Assistance
FM-5129	California Fish Fire	06-21-2016 (06-20-2016 to 06-30-2016)	Public Assistance
FM-5124	California Old Fire	06-05-2016 (06-04-2016 to 06-10-2016)	Public Assistance
FM-5051	California Colby Fire	01-16-2014 (01-16-2014 to 01-22-2014)	N/A
FM-5025	California Power House Fire	06-02-2013 (05-31-2013 to 06-08-2013)	Public Assistance
FM-2851	California Crown Fire	07-30-2010 (06-29-2010 to 08-03-2010)	Public Assistance
DR-1884	Severe Winter Storms, Flooding, and Debris and Mud Flows in California	03-08-2010 (01-17-2010 to 02-06-2010)	Public Assistance
FM-2828	California Pv Fire	08-28-2009 (08-27-2009 to 08-29-2009)	Public Assistance
FM-2830	California Station Fire	08-28-2009 (08-27-2009 to 09-25-2009)	Public Assistance
DR-1810	Wildfires in California	11-18-2008 (11-13-2008 to 11-28-2008)	Individual Assistance, Public Assistance
FM-2792	California Freeway Complex Fire	11-15-2008 (11-15-2008 to 11-20-2008)	Public Assistance
FM-2791	California Sayre Fire	11-15-2008 (11-14-2008)	N/A
FM-2789	California Sesnon Fire	10-13-2008 (10-13-2008 to 10-19-2008)	Public Assistance
FM-2788	California Mareck Fire	10-12-2008 (10-12-2008 to 10-17-2008)	Public Assistance
FM-2763	California Santa Anita Fire	04-27-2008 (04-26-2008 to 05-02-2008)	Public Assistance
DR-1731	California Wildfires	10-24-2007 (10-21-2007 to 03-31-2008)	Individual Assistance, Public Assistance
EM-3279	Wildfires in California	10-23-2007 (10-21-2007 to 03-31-2008)	N/A
FM-2736	California Ranch Fire	10-22-2007	N/A

Disaster Number	Description	Declaration Date & Incident Period	Assistance Provided
		(10-20-2007)	
FM-2733	California Buckweed Fire	10-21-2007 (10-21-2007)	N/A
FM-2732	California Canyon Fire	10-21-2007 (10-21-2007)	N/A
FM-2708	California Canyon Fire	07-08-2007 (07-07-2007 to 07-10-2007)	Public Assistance
FM-2694	California Island Fire	05-10-2007 (05-10-2007 to 05-15-2007)	Public Assistance
FM-2691	California Griffith Park Fire	05-09-2007 (05-08-2007 to 05-11-2007)	Public Assistance
DR-1689	Severe Freeze in California	03-13-2007 (01-11-2007 to 01-17-2007	N/A
FM-2583	California Topanga Fire	09-28-2005 (09-28-2005 to 10-10-2005)	Public Assistance
EM-3248	California Hurricane Katrina Evacuation	09-13-2005 (08-29-2005 to 10-01-2005)	Public Assistance
DR-1585	California Severe Storms, Flooding, Landslides, and Mud and Debris Flows	04-14-2005 (02-16-2005 to 02-23-2005)	Public Assistance
DR-1577	Severe Storms, Flooding, Debris Flows, and Mudslides in California	02-04-2005 (12-27-2004 to 01-11-2005)	Individual Assistance, Public Assistance
FM-2535	California Crown Fire	07-21-2004 (07-20-2004 to 07-23-2004)	Public Assistance
FM-2534	California Foothill Fire	07-18-2004 (07-17-2004 to 07-23-2004)	Public Assistance
FM-2528	California Pine Fire	07-14-2004 (07-12-2004 to 07-21-2004)	Public Assistance
DR-1498	Wildfires in California	10-27-2003 (10-21-2003 to 03-31-2004)	Individual Assistance, Public Assistance
FM-2502	California Verdale Fire	10-25-2003 (10-24-2003 to 10-29-2003)	N/A
FM-2466	California Pacific Fire	01-07-2003 (01-06-2003 to 01-10-2003)	Public Assistance
FSA-2464	California Williams Fire	09-24-2002 (09-22-2002 to 09-29-2002)	Public Assistance
FSA-2462	California Leona Fire	09-04-2002 (09-03-2002 to 09-12-2002)	Public Assistance
FSA-2417	California Copper Fire	06-06-2002 (06-05-2002 to 06-14-2002)	Public Assistance

Disaster Number	Description	Declaration Date & Incident Period	Assistance Provided
DR-1203	California Severe Winter Storms and Flooding	02-09-1998 (02-02-1998 to 04-30-1998)	N/A
EM-3120	California Severe Fires	10-23-1996 (10-21-1996 to 10-31-1996)	Public Assistance
DR-1046	California Severe Winter Storms, Flooding, Landslides, Mud Flows	03-12-1995 (02-13-1995 to 04-19-1995)	N/A
DR-1044	California Severe Winter Storms, Flooding, Landslides, Mud Flows	01-10-1995 (01-03-1995 to 02-10-1995)	N/A
DR-1008	California Northridge Earthquake	01-17-1994 (01-17-1994 to 11-30-1994)	N/A
DR-1005	California Fires, Mud and Landslides, Soil Erosion, Flooding	10-28-1993 (10-26-1993 to 04-22-1994)	N/A
DR-979	California Severe Storm, Winter Storm, Mud and Landslides, Flooding	02-03-1993 (01-05-1993 to 03-20-1993)	N/A
DR-942	California Fire During a Period of Civil Unrest	05-02-1992 (04-29-1992 to 05-28-1992)	N/A
DR-935	California Snow Storm, Heavy Rain, High Winds, Flooding, Mudslide	02-25-1992 (02-10-1992 to 02-18-1992)	N/A
DR-894	California Severe Freeze	02-11-1991 (12-19-1990 to 01-03-1991)	N/A
DR-872	California Fires	06-30-1990 (06-26-1990 to 07-03-1990)	N/A
DR-812	California Severe Storms, High Tides, Flooding	02-05-1988 (01-17-1988 to 01-22-1988)	N/A
DR-799	California Earthquake, Aftershocks	10-07-1987 (10-01-1987 to 11-20-1987)	N/A
DR-677	California Coastal Storms, Floods, Slides, Tornadoes	02-09-1983 (01-21-1983 to 03-30-1983)	N/A
DR-635	California Brush, Timber Fires	11-27-1980 (11-27-1980)	N/A
DR-615	California Severe Storms, Mudslides, Flooding	02-21-1980 (01-08-1980)	N/A
EM-3067	California Brush Fires	10-29-1978 (10-29-1978)	N/A
DR-547	California Coastal Storms, Mudslides, Flooding	02-15-1978 (02-15-1978)	N/A

Disaster Number	Description	Declaration Date & Incident Period	Assistance Provided
DR-299	California San Fernando Earthquake	02-09-1971 (02-09-1971)	N/A
DR-295	California Forest, Brush Fires	09-29-1970 (09-29-1970)	N/A
DR-253	California Severe Storms, Flooding	01-26-1969 (01-26-1969)	N/A

Source: FEMA

In addition to the disaster declarations from FEMA, Los Angeles County has been covered by multiple California disaster proclamations. Governor-proclaimed disasters covering Los Angeles County since 1991 are listed in the following table.

TABLE 10. CALIFORNIA STATE DISASTER PROCLAMATIONS FOR LOS ANGELES COUNTY, 1991 - 2024

Date of Disaster	Type of Disaster
February 2024	Severe Winter Storms
August 20, 2023	Hurricane Hilary
February-March 2023	Severe Winter Storms
December 27, 2022 – January 2023	Severe Winter Storms
September 9, 2022	Tropical Storm Kay
August 31, 2022	Fire (Route Fire)
December 2021	Winter Storms
October 2021	Drought
September 2020	Fires (Slater, Bobcat, and Oak Fires)
August 2020	Fires
October 27, 2019	High winds and wildfires
October 25, 2019	Wildfires (Kincade and Tick Fires)
October 10, 2019	Wildfire (Saddleridge Fire)
January-February 2019	Winter Storms
November 2018	Wildfire (Hill & Woolsey Fires)
December 2017	Wildfires (Creek and Rye Fire)
September 2017	Wildfire (La Tuna Fire)
January 2017	Storm System
July 22, 2016	Wildfire (Sand Fire)
October 23, 2015	Aliso Canyon natural gas leak
October 2015	Rainstorms
June-July 2015	Wildfires
July 18, 2015	Rainstorms
January 2014	Drought

Date of Disaster	Type of Disaster
May 30 – June 11, 2013	Wildfire (Powerhouse Fire)
November 30, 2011	Windstorms
December 2010 – January 2011	Winter Storms
January 17-21, 2010	Winter Storms
August – September 2009	Wildfires
November 2008	Wildfires
October 2008	Wildfires
October 21, 2007	Wildfires
January 2007	Freeze
November 12, 2003	Flash Flooding
October – November 2003	Wildfires
February 2, 1998	El Nino
October 1996	Firestorms
February 1995	Late Winter Storms
January 1995	Severe Winter Storms
January 17, 1994	Earthquake
October 27 – 28, 1993	Firestorms
December 1992	Late Winter Storms
April 29, 1992	Civil Disorder
February 1992	Winter Storms

Source: California State Board of Equalization, Chronological List of Governor-Proclaimed Disasters

C) DROUGHT & WATER SHORTAGE

i) Hazard Profile

Drought is a common hazard in the state of California. California, including the City of Carson, has experienced significant dry periods. Drought is a gradual process, occurring slowly over a period. A drought is a period of drier-than-normal conditions that results in water-related problems. When rainfall is less than normal for several weeks, months, or years, the flow of streams and rivers declines, water levels in lakes and reservoirs fall, and the depth to water in wells increases. If dry weather persists and water-supply problems develop, the dry period can become a drought. [5]

The term "drought" can have different meanings to different people, depending on how a water deficiency affects them. Droughts have been classified into different types such as:

- **meteorological drought**: lack of precipitation
- **agricultural drought**: lack of soil moisture
- **hydrologic drought**: reduced streamflow or groundwater levels
- **socioeconomic drought**: based on direct and indirect socio-economic impacts on society and the economy.

Droughts are differentiated between short- and long-term drought. Short-term drought can have impacts on agriculture and grasslands, and the drought classification can rapidly change. Long-term drought has a great impact on hydrology and ecology. [6]

- **S**: short-term, typically less than 6 months (agriculture, grasslands)
- **L**: long-term, typically more than 6 months (hydrology, ecology)
- **SL**: area contains both short- and long-term impacts.

(1) Duration

Drought is an extended period of unusually dry weather when there is not enough rain. However, drought may look different and have different thresholds than other regions. For example, a drought in Atlanta, Georgia could be a very wet period based on the climate in Phoenix, Arizona. Historical drought periods in the State of California have lasted anywhere from one to five years. The end of a drought can be difficult to determine. While a single

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[5] USGS California Water Science Center. 'Drought Defined.' *USGS California Water Science Center*, U.S. Geological Survey. https://ca.water.usgs.gov/california-drought/what-is-drought.html.
[6] U.S. Drought Monitor. 'Drought Classification.' *U.S. Drought Monitor*, National Drought Mitigation Center. https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx.

rainstorm will provide short-term relief from a drought, it might take weeks or months before levels of precipitation return to normal.[7]

(2) Seasonality

Seasonal variations depend on rainfall and dry conditions. In some years, California can go a long period of time without significant rainfall and other years will see rainfall alleviating drought periods and their impacts. It is difficult to determine when drought conditions occur, especially as it is difficult to determine when they start and end.

(3) Speed of Onset

Determining the start of a drought can be difficult. Unlike other hazards that happen suddenly and cause immediate impacts, the onset of a drought can be gradual and subtle. Droughts can take weeks, months, or even years for the long-term effects of inadequate rainfall to become apparent.

(4) Location

The entirety of the planning area is considered to be equally vulnerable to droughts due to the tendency of this hazard to impact wide geographic areas.

(5) Water Supply and Usage

The City of Carson uses water supply from three groundwater basins and surface waters from Ash Canyon and Kings Canyon Creek, Carson River, and the Marlette/Hobart system. The local water usage in the city. Typically, water usage peaks in the summer from 5-6 million gallons per day in the winter to 24 million gallons per day due to outside irrigation. Currently, the city has water restrictions from June 1 to September to conserve water. [8]

Recently, the City of Carson updated their Water Conservation Plan in 2023 which includes a Drought Plan in Appendix D. The Drought Plan is activated through authorization from the City Manager and/or designee to avoid a city-wide water emergency. There are three stages outlined in which different measures are put into place to cut back water usage, described in the table below. [9]

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[7] U.S. Geological Survey. 'When Does a Drought Begin and End?' *U.S. Geological Survey*, U.S. Department of the Interior. https://www.usgs.gov/faqs/when-does-a-drought-begin-and-end.

[8] Carson City. 'Daily Water Supply & Demand.' *Carson City*. https://www.carson.org/government/departments-g-z/public-works/divisions/water/daily-water-supply-demand."

[9] Carson City Public Works. *Water Conservation Plan*. September 2023, Carson City.

TABLE 11. CITY OF CARSON DROUGHT STAGES

STAGE	MEASURES
Stage 1	**Voluntary cutbacks** • Contact the Carson City Parks Department and request that they voluntarily cut back outdoor irrigation of City parks, planters, and City buildings as much as possible until further notice. • Contact the Carson City School District and request that they voluntarily cut back outdoor irrigation as much as possible until further notice. • Contact State Buildings and Grounds and request that they voluntarily cut back outdoor irrigation as much as possible until further notice. • Contact legislative Counsel Bureau Ground Division and request that they voluntarily cut back outdoor irrigation as much as possible until further notice. • Request that the Fire Department suspend all certification testing of Fire trucks and pumping equipment and suspend all drills with live water flow until further notice. Request that all residents in the affected areas voluntarily cut back outdoor irrigation as much as possible until further notice.
Stage 2	**Required reduction of portable water use** • Direct the Carson City Parks Department to stop all potable water irrigation of City parks, planters, and City buildings until further notice. • Contact the Carson City School District and direct them to stop all outdoor irrigation until further notice. • Contact the Legislative Counsel Bureau Grounds Division and direct them to stop all outdoor irrigation until further notice. • Direct the Carson City Fire Department to stop all certification testing of Fire trucks and pumping equipment and stop all drills with live water flow until further notice. • Require all residents in the affected areas to stop all outdoor irrigation until further notice. • Notify the media of additional watering restrictions in the affected areas and ask for everyone's assistance in conserving as much water as possible.
Stage 3	Citywide ban on all outside irrigation until further notice

Source: City of Carson

ii) Magnitude

The magnitude or intensity of drought can be measured by the U.S. Drought Monitor (USDM) through maps that are updated weekly to show the location and intensity of drought across the country. The USDM identifies areas in drought and labels them by intensity using four categories of drought, D1 (the least intense) to D4 (the most intense). It also describes areas with no drought and uses the D0 category to indicate abnormally dry areas that could be entering or recovering from drought, shown in the table below.

TABLE 12. USDM DROUGHT MONITOR CATEGORIES

CATEGORY	DESCRIPTION
None (Gray)	Normal or wet conditions
D0 (Light Yellow)	Abnormally Dry
D1 (Light Orange)	Moderate Drought
D2 (Orange)	Severe Drought
D3 (Red)	Extreme Drought
D4 (Dark Red)	Exceptional Drought

Source: USDA

Other drought indices have been developed by the National Oceanic and Atmospheric Administration (NOAA) to measure impacts and severity of meteorological and hydrological drought as well as to map their extent and locations.

- **The Crop Moisture Index**: measures the short-term drought weekly to assess impacts on agriculture.
- **The Palmer Z Index**: measures the short-term drought on a monthly scale.
- **The Palmer Drought Severity Index**: is based on long-term weather patterns. The intensity of drought in each month is dependent on current weather plus the cumulative patterns of previous months.
- **The Palmer Hydrological Drought Index**: quantifies hydrological effects (reservoir levels, groundwater levels, etc.) which take longer to develop and last longer. This index responds more slowly to changing conditions than the Palmer Drought Index.
- **The Standardized Precipitation Index**: only considers precipitation.

The State of California maintains a safe, clean, and reliable water service, Cal Water by following a set of drought severity stages to determine the level of water conservation and assess potential water-use restrictions described in the table below. [10]

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[10] California Water Service. 'Stages of Drought.' *California Water Service*. https://drought.calwater.com/stages_of_drought.

TABLE 13. STATE OF CALIFORNIA DROUGHT SEVERITY STAGES

STAGE	DESCRIPTION
1	• We implement policies and guidelines for reducing water usage by 10 percent. • Residential and business customers are subject to water-use restrictions. • Outdoor irrigation is subject to limited times. • Leak repairs must be made in a timely manner. • Shut-off nozzles are required when using a hose to wash a car. • Outdoor watering is prohibited within 48 hours of rain.
2	• We implement policies and guidelines for reducing water usage by 20 percent. • Residential and business customers are subject to additional water-use restrictions. • Outdoor irrigation by residential and business customers is limited further to 1-3 days per week, depending on local ordinance. • Use of non-recirculating systems in all new conveyer car wash and commercial laundry systems are prohibited. • Use of single pass cooling systems in new connections is prohibited.
3	• We implement policies and guidelines for reducing water usage by 30 percent. • Residential and business customers are subject to additional water-use restrictions. • Water usage for construction and dust control is prohibited. • Irrigation of ornamental turf on public street medians is prohibited. • Filling ornamental lakes or ponds is prohibited.
4	• We implement policies and guidelines for reducing water usage by 40 percent. • Residential and business customers are subject to additional water-use restrictions. • Vehicle washing is prohibited, except with recirculated water or low-volume systems. • Use of water for recreational purposes, such as water parks, is prohibited. • Filling swimming pools is prohibited.
5	• We implement policies and guidelines for reducing water usage by 50 percent. • Residential and business customers are subject to additional water-use restrictions. • Net zero demand increase is required on new water service connections. • Single pass cooling systems are prohibited. • Swimming pool covers are required.
6	• We implement policies and guidelines for reducing water usage by more than 50 percent.

	• Residential and business customers are subject to additional water-use restrictions. • All landscape irrigation is prohibited. • New water service connections are prohibited.

Source: California Water Service

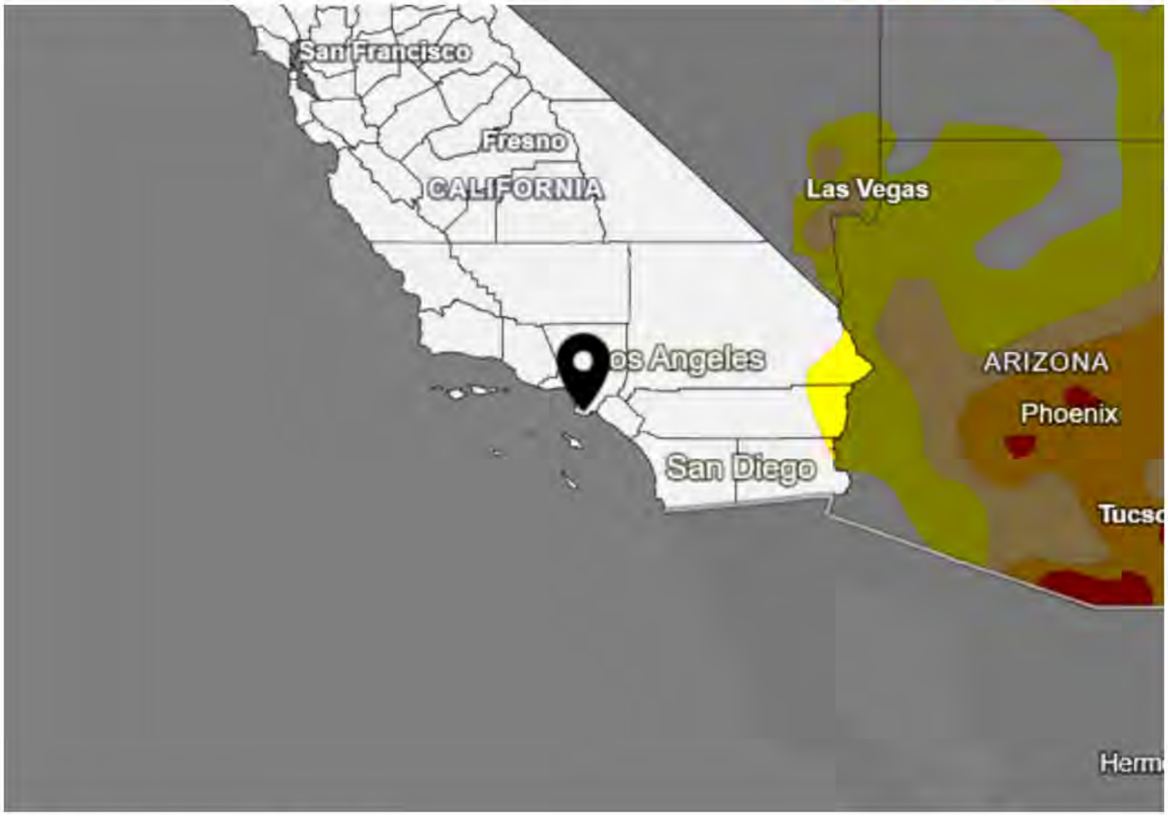
iii) Extent

Large - Drought encompasses a large spatial extent across the planning area. It is likely that if the City of Carson is experiencing a drought, the whole city will be impacted. Drought conditions have been identified in Los Angeles County and the City of Carson. Drought is not a location-specific hazard and affects the entire planning area equally in terms of spatial extent. The entire state of California, including Los Angeles County and the City of Carson, is at risk of drought and its relevant impacts throughout the year. From 2003-2023, drought conditions existed continuously somewhere in the state, with 80 to 100 percent of the state impacted for 12 of the last 20 years.[11] Currently, as of November 2023, zero percent of the state's total area is experiencing drought conditions. According to the latest USGS Drought Monitor shown in the map below.

[11] United States Drought Monitor. *Time Series.* https://droughtmonitor.unl.edu/Data/Timeseries.aspx

FIGURE 20 - U.S. DROUGHT MONITOR OF SOUTHERN CALIFORNIA

U.S. Drought Monitor



Drought & Dryness Categories	% of Los Angeles County
D0 - Abnormally Dry	0%
D1 – Moderate Drought	0%
D2 – Severe Drought	0%
D3 – Extreme Drought	0%
D4 – Exceptional Drought	0%
Total Area in Drought (D1–D4)	0%

The U.S. Drought Monitor depicts the location and intensity of drought across the country using 5 classifications: Abnormally Dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought (D1–D4). The U.S. Drought Monitor is a joint effort of the National Drought Mitigation Center, U.S. Department of Agriculture, and National Oceanic and Atmospheric Administration. Source(s): NDMC, NOAA, USDA

Source(s): NDMC, NOAA, USDA
Data Valid: 11/28/23

Drought.gov

iv) Past Occurrences

According to the "Water Year 2023: Weather Whiplash, From Drought to Deluge", from the California Department of Water Resources, California Natural Resources Agency, stated in their report that 2023 demonstrated dramatic extremes of California's climate. At the beginning of 2023, California had the three driest years on record that prompted the Governor to issue a proclamation of a state of emergency for Los Angeles County described in the table below. The storms from 2023 have provided relief from the water shortages of the prior drought years due to atmospheric rivers, tropical storms, and hurricane events.

TABLE 14. DROUGHT ORDERS, PROCLAMATIONS, NOTICES, AND LETTERS (CALIFORNIA WATER BOARDS)

EXECUTIVE ORDER NUMBER	DATE	DESCRIPTION
N-5-23	3/24/2023	Governor Newsome issued the executive order that eases drought emergency provisions due to the then current water conditions.
N/A	10/2021	A Proclamation of a State of Emergency was issued for additional counties including Los Angeles County. The meteorological summer in California and the rest of the western United States was the hottest on record.

Source: California Water Boards

Based on historical area in Los Angeles County, there have been five significant multi-year droughts in the last 47 years (1976 to 2023) described in the table below. The planning area has experienced various levels of drought for roughly 16 years of the last 47 years. This equates to a drought occurring about every three years. As temperatures increase, the probability of future droughts will likely increase as well.

TABLE 15. PERIODS OF DROUGHT IN LOS ANGELES COUNTY.

DROUGHT PERIOD	DESCRIPTION
2020-2023	The three-year drought is the most recent drought period. The state ranked driest on record for much of 2022, including driest ever January-March, January-May, and January-October. [12] Drought conditions started on February 11, 2020, and ended October 10, 2023.

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[12] A National Centers for Environmental Information. 'Annual 2022 Drought Report.' *National Oceanic and Atmospheric Administration*. https://www.ncei.noaa.gov/access/monitoring/monthly-report/drought/202213#west-sect.

DROUGHT PERIOD	DESCRIPTION
2012-2017	Drought produced severe impacts to water wells throughout the state of California, with a high number of wells running dry. Land subsidence due to increased groundwater pumping also occurred in numerous areas of the state such as the San Joaquin and Central Valleys. Crop damage was widespread as well. Water allotments were drastically reduced in many towns and water agencies, with extremely high costs for procuring water. In addition, job loss occurred with many families requiring food supply assistance, and water supply assistance provided to homeowners with dry wells. According to a report released by UC Davis Center for Watershed Sciences, the 2012-2017 period of the California drought cost the state's agriculture industry about $1 billion in lost revenue, with a total statewide economic cost of the drought calculated to be $2.2 billion.[13] The report says, "it is responsible for the greatest water loss ever seen in California agriculture - about one third less than normal." The report calls the groundwater situation in California "a slow-moving train wreck." Spring snowpack at Donner Summit reached record low levels in 2014, exceeded in 2015 by a remarkable April 1 snow-water-equivalent value of only 5% of average. Decreased precipitation since contributed to near-record low levels in the Shasta Reservoir. The ongoing drought has contributed to declines in crop values across the state. For example, crops including cotton, corn silage and barley (the field crop category) fell by 42 percent.[14]
2007-2009	This six-year drought occurred when most major reservoirs in California had been constructed. Despite carryover storage in reservoirs to buffer drought impacts, a drought water bank was initiated in 1991 to make water available for sale to areas of extreme need.
1987-1992	This six-year drought occurred when most major reservoirs in California had been constructed. Despite carryover storage in reservoirs to buffer drought impacts, a drought water bank was initiated in 1991 to make water available for sale to areas of extreme need.
1976-1977	California had one of its most severe droughts due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California to that time, with the previous winter recorded as the fourth driest. The cumulative impact led to widespread water shortages and severe water conservation measures throughout the state.

[13] UC Davis Center for Watershed Sciences. *A Retrospective Economic Analysis: 2012 – 2016 Drought*. UC Davis, 12 July 2023, https://watershed.ucdavis.edu/doc/droughts-economic-impact-agriculture/retrospective-economic-analysis-2012-2016-drought.

[14] National Oceanic and Atmospheric Administration National Centers for Environmental Information. *State Climate Summaries: California.* https://statesummaries.ncics.org/chapter/ca/

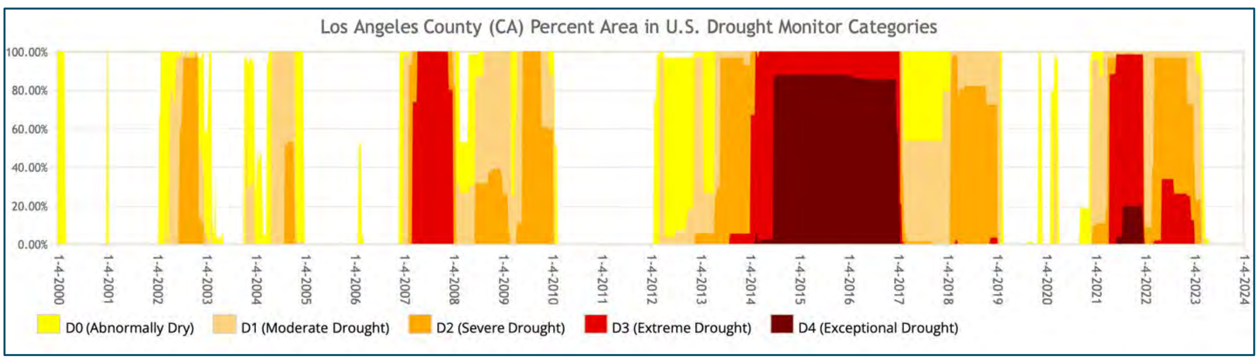
DROUGHT PERIOD	DESCRIPTION
1928 and 1934	This seven-year drought predated the construction of many of the water projects in California including the Federal Central Valley Project and State Water Project. Because the 1928-34 drought constituted the first major drought on record in California, it served as the basis for early reservoir operations planning and the development of shortage criteria for water supply contracts. [15]

Source: Drought.gov

Frequency

Using the data from the U.S. Drought Monitor from 2000-2023, Los Angeles County has experienced moderate (D1) to exceptional drought (D4) about 60 percent of the time. The U.S. Drought Monitor produces weekly reports and of the 1248 weekly reports that had been produced, when the data was pulled in on December 6th, 2023, 736 weekly reports indicated that Los Angeles County experienced some level of drought (D1-D4). The figure below depicts a drought time series from January 2000 to December 2023 for Los Angeles County.

FIGURE 21: US DROUGHT MONITOR TIME SERIES - LOS ANGELES COUNTY 2000-2023



Source: USDA

v) Future Probability

Likely —The US Drought Monitor's time series data (2000-2023) indicates that some degree of drought has nearly a 100 percent probability of occurrence in the state in any given year. Given the City of Carson lies within a drought impacted region, it is prudent to extend this likelihood of occurrence to the planning area.

[15] USGS California Water Science Center. 'California Droughts Compared.' *U.S. Geological Survey*. https://ca.water.usgs.gov/california-drought/california-drought-comparisons.html.

Drought will likely occur more often due to rising temperatures and shifting precipitation patterns within the planning area. [16] The planning area will likely experience an increase in intensity, duration, and frequency as well as the understanding of drought in the context of socio-economic considerations and resource constraints. Observational data suggests that a prolonged mega drought has an increasing likelihood of occurring in southwestern part of the U.S. during the 21st century. Mega droughts are defined as a period of unusually dry weather, typically caused by a lack of precipitation, that disrupts nature by damaging crops, causing water shortages, and more. [17]Climate change is causing the probability of extreme events to change a phenomenon known statistically as "non-stationary". [18]

According to California's Fourth Climate Change Assessment, by 2100 water supply from snowpack is project to decline by two-thirds. The assessment states that water management practices in California face growing challenges from continued climate change and extreme weather. [19]

vi) Secondary Hazards

Drought is commonly associated with extreme heat days and can worsen conditions for wildfires to occur through creating dry conditions.

TABLE 16. SECONDARY HAZARDS TO DROUGHT

HAZARD	DESCRIPTION
Wildfire	A prolonged lack of precipitation dries out vegetation and can become increasingly susceptible to ignition as the duration of the drought extends.
Extreme Heat	Drought is commonly accompanied by extreme heat which can increase the risk for heat-related illness such as heat cramps, heat stroke, and heat exhaustion. Pets and livestock are also at risk for heat-related injuries. Additionally, extreme heat can cause damage to crop and impact the economy and food supply.
Land Subsidence	In wetter periods, water goes into storage, while in drier periods, or droughts, water is removed from storage. Long-term overdraft or excessive pumping of

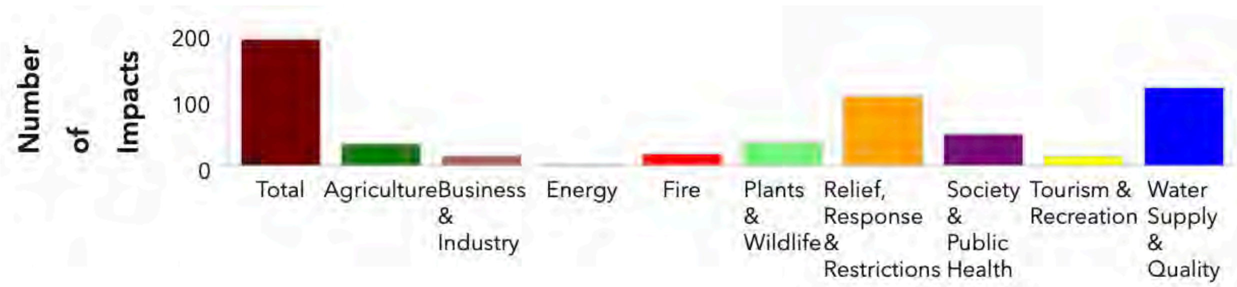
[16] Los Angeles County. *LA County CVA Executive Summary*. Los Angeles County, Oct. 2021, https://ceo.lacounty.gov/wp-content/uploads/2021/10/LA-County-CVA-Executive-Summary-English.pdf.
[17] Drought.gov. 'Research Spotlight: Climate-Driven Megadrought.' *Drought.gov*. https://www.drought.gov/research-spotlight-climate-driven-megadrought.
[18] 2023 Drought Assessment in a Changing Climate: Priority Actions and Research Needs." *Drought.gov*, Nov. 2023, https://www.drought.gov/sites/default/files/2023-11/Drought-Assessment-Changing-Climate-Report-11-2023_0.pdf.
[19] California Climate Change Assessment. 'State Key Findings.' *California Climate Assessment*. https://climateassessment.ca.gov/state/overview/.

HAZARD	DESCRIPTION
	a groundwater aquifer, can also result in subsidence and sinking ground surface.

vii) Vulnerability & Impact Assessment

The Drought Impact Reporter was developed in 2005 by the University of Nebraska-Lincoln to provide a national database of drought impacts. Droughts can have an impact on agriculture, business and industry; energy; fire; plants and wildlife; relief, response, and restrictions; society and public health; tourism and recreation; and water supply and quality. The reports are submitted from individuals to federal, state, and local agencies, as well as the public. The following figure depicts the drought impacts to Los Angeles County from 2005 to 2024 based on reports received by the Drought Impact Reporter. It's important to note that this data is only available down to the county level.

FIGURE 22: NUMBER OF DROUGHT IMPACTS TO LOS ANGELES COUNTY 2005 – 2024



Economic Impact on Water Agencies

Prolonged drought conditions resulted in mandatory water use restrictions, leading to historically low water sales. Water agencies, such as the Metropolitan Water District of Southern California, faced decreased revenue from water sales while experiencing higher labor and financing costs. This financial strain prompted rate increases for customers from San Diego to Ventura County.

Residents and businesses in affected areas are subject to higher water bills, compounding the financial burden during an already challenging period.

Regional Water Shortages and Conservation Mandates

The Metropolitan Water District of Southern California declared a regional drought emergency, urging water agencies to reduce their reliance on imported water sources, such as the State Water Project and Colorado River. The possibility of mandatory water allocations may force agencies to either reduce consumption or face significant financial penalties for exceeding water usage limits.

Consequences: Water shortages could lead to stricter conservation measures across Southern California, impacting residents, businesses, and industries. This could also increase costs for water users as agencies pass on penalties or implement steep additional fees.

Government Regulations on Water Use

In response to ongoing drought, the State Water Resources Control Board proposed emergency drought regulations to prevent water waste. Measures included limiting excessive irrigation, restricting the use of potable water for street cleaning, and banning landscape irrigation within 48 hours of rainfall.

These regulations aim to curb water use across the state, but they also place restrictions on landscaping, maintenance activities, and other water-dependent operations. Non-compliance may lead to fines or enforcement actions, particularly for local businesses and homeowners.

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets to better understand and mitigate risk from hazards.

(1) People

Based on future risks and impacts to population health and recent events in the past, drought poses a limited risk to the population. Drought can affect population health and can pose health implications. Due to the long duration in which drought can form, health implications from drought can be seen both in the short-term and in the long-term such as: [20]

- **Water Quality and Quantity**
    - Drought can reduce the water supply impacting not only households and businesses but especially disproportionately impacted communities. Water quality can be compromised due to increased salinity, increased algal production, less dilution, and reduced oxygen levels in the water system.
- **Food and Nutrition**
    - Drought can create dry conditions and impact the food quality, supply, and distribution to communities which can cause malnutrition.
- **Air Quality**

[20] Centers for Disease Control and Prevention. 'Health Implications of Drought.' *CDC*. https://www.cdc.gov/nceh/drought/implications.htm.

- Drought increases the risk for wildfires and dust storms. Particulate matter from these poor air quality events and particulate matter can irritate the lungs and exacerbate chronic heart and lung conditions.

- **Sanitation and Hygiene**
  - Water shortage due to drought can impact available clean water for cleaning, sanitation, and hygiene which can reduce or control disease.
- **Recreational Risks**
  - Individuals who engage with water-related recreational activities during drought can be at increased risk for waterborne disease caused by bacteria, protozoa, and other contaminants such as chemicals and heavy metals.
- **Infectious Disease**
  - Drought often creates drier conditions which can increase the risk of disease (i.e., Valley Fever)
- **Chronic Disease**
  - Drought can cause adverse health impacts for individuals with certain chronic health conditions such as asthma and some immune disorders.

The burden of drought impacts on communities varies depending on age, socioeconomic status, access to health care, and gender. [21] Especially water shortage as the cost of water will increase based on the lower supply and higher demand, which can be very difficult for low-income communities for example. Additionally, Carson is expected to increase its population in the next several decades which will increase the risk of the population.

Locally, within the City of Carson, residents in 2021 were burdened by a noxious order caused by hydrogen sulfide or “sewer gas” from rotting vegetation in the Dominguez Channel exacerbated partially due to the persistent drought at the time. Residents unfortunately experienced adverse health impacts including nausea, headaches, weakness, unconsciousness, and dizziness, especially disproportionately impacting communities of color. [22]

(2) Structures and Systems

Drought can cause limited impacts to property within the City of Carson. Long-term impacts of drought and properties may cause the soil to shrink and crack, resulting in issues with the foundation of the structure. Immediate impacts to properties within the planning area are

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[21] Centers for Disease Control and Prevention. 'Health Implications of Drought.' *CDC*. https://www.cdc.gov/nceh/drought/implications.htm

[22] Grist. 'The Mystery Behind the Toxic Fumes That Engulfed Carson, California.' *Grist*, https://grist.org/equity/carson-california-industrial-warehouse-fire-refinery-pollution-displacement/

minimal to none. Additionally, the economic impact due to drought and water shortages will be felt by industries that rely heavily on water for their business. Landscaping businesses for example are affected by drought due to summer water restrictions which can significantly alter business. A prolonged drought can financially impact businesses as well as individual households in the increased cost for water.

Critical Facilities

Drought can cause limited impacts to critical facilities within the City of Carson. The Cybersecurity & Infrastructure Security Agency (CISA) with the National Drought Resilience Partnership developed a planning guide for Drought and Infrastructure. The guide identifies critical facilities that are vulnerable to drought including critical manufacturing, dams, energy, food and agriculture, healthcare and public health, transportation systems, and water or wastewater systems. Each of these sectors may experience operational impacts that contribute to slow down or the stoppage of essential goods and services to meet demand needs, and indirect or cumulative impacts of dependent sectors and communities when supply needs cannot be met. The figure below outlines the potential impacts drought and water shortage can have on the FEMA community lifelines which include water and wastewater systems, food, hydration, and shelter, health and medical, energy, as well as safety and security.

TABLE 17. POTENTIAL VULNERABILITIES OF LIFELINES TO DROUGHT

LIFELINES	IMPACT TYPE	DESCRIPTION
Water & Wastewater Systems		This is the most directly affected lifeline. Drought conditions can significantly reduce water availability for domestic, agricultural, and industrial uses. Water quality may also be affected, and wastewater treatment processes might be strained due to lower water volumes.
Food, Hydration, Shelter		Drought can impact agricultural production, leading to food shortages or increased food prices. If the drought is severe and prolonged, it could also lead to challenges in providing adequate shelter and housing, especially for vulnerable populations.
Health & Medical		Reduced water quality and quantity can lead to health issues, including dehydration and sanitation-related diseases. Healthcare facilities may also face challenges in maintaining operations with limited water supplies.

LIFELINES	IMPACT TYPE	DESCRIPTION
Energy	Energy (Power & Fuel)	Energy production, particularly in facilities that rely on water for cooling or hydroelectric power, can be affected. There may also be increased competition for available water between energy producers and other users.
Safety & Security	Safety and Security	Drought can increase the risk of wildfires, strain emergency services, and potentially lead to conflicts over scarce resources.

Additionally, as stated in the Carson General Plan, the city has identified over 20 leaking underground storage tanks that can threaten the city's water quality. In the next several decades, as the city's population increases, the water demand on the system will increase as well to supply more water to more residents within the city and stress the water system.

To combat drought and water shortages, the Pure Water Southern California Demonstration Plant in Carson plans on using grant funding to turn sewage water to drinking water. The project will be divided into phases and is expected to produce about 115 million gallons of recycled water a day, enough for 385,000 Southern California households, and could be completed by 2032. [23]

(3) Natural, Cultural, and Historic Resources

There are 49 identified historical and cultural properties within the City of Carson. These properties are unlikely to be significantly impacted by drought and water shortages. No specific properties have been identified at higher risk from drought or water shortages.

(4) Risk Analysis

High - Drought and water shortages pose a high risk to the planning area. The City of Carson, located in Southern California, is susceptible to drought and the subsequent impacts due to increasing temperatures and lack of precipitation driven by climate change. Drought is more than likely to occur in any given year based on historical data and is projected to increase in frequency.

Drought impacts pose a great risk to population health which can be exacerbated by existing health disparities. For example, the Dominguez Channel incident, worsened by drought impacts,

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[23] Rachel Beckers. "'Not 'Toilet to Tap:' CA Will Turn Sewage into Drinking Water." CalMatters, 2023, https://calmatters.org/environment/2023/08/california-toilet-to-tap-water/

disproportionately impacted low-income and communities of color living near the Dominguez Channel. Hydrogen sulfide, a toxic odorous gas, was found to reach 7000 parts per billion (ppb) which exceeds California's 30 ppb acute air quality standard. This event burdened many communities and posed a risk to their health. [24]

Drought and water shortages can cause disruptions to services and critical facilities, especially to water and wastewater systems. The City of Carson is home to many industries and critical facilities that would be impacted by drought and water shortages. In addition to critical facilities and businesses by impacted by drought, individuals and households are also impacted by water restrictions and increased cost of water usage, especially during periods of prolonged drought when the water supply is low, and demand is high.

According to the Water Shortage Vulnerability Scoring and Tool, developed by the California Department of Water Source through Senate Bill 552, the City of Carson has a high vulnerability. In California, rising temperatures are projected to increase the average lowest elevation at which snow falls, reducing water storage in the snowpack, particularly at those lower mountain elevations which are now on the margins of reliable snowpack accumulation. Higher spring temperatures will also result in earlier melting of the snowpack. The shift in snow melting earlier in the season is critical for California's water supply because flood control rules require that water be allowed to flow down-stream and that water cannot be stored in reservoirs for use in the dry season. As such, state-level drought risk factors that have led to drought's state-wide severity and extent, and potential impacts also create drought vulnerabilities for the City of Carson. California is the single most productive agricultural state, and its agricultural industry relies heavily on reservoir water supplied by snowmelt and rainfall runoff. Yearly variations in snowpack depths have implications for water availability as snowmelt from the winter snowpack feeds a network of reservoirs.

As such, the state and the City of Carson planning area stakeholders potentially have less capacity to address future drought risks due to projected temperature increases and shortages in water; ground-water withdrawals have been occurring at a deficit rate of 1 to 2-million-acre feet per year, where the impacts of drought include decreased availability of water for agriculture and environmental uses. In forested and other vegetated areas, prolonged drought decreases the moisture content of forest fuels and increases the risk of high severity wildfires.

Moreover, climate change will likely adversely impact the vulnerability of watersheds and ecosystems in their ability to deliver important ecosystem services. These changes may limit the natural capacity of healthy forests to capture water and regulate stream flows. Sierra Nevada mountain winters and springs are warming, and on average, precipitation as snowfall relative to rain is decreasing. A warming climate with reduced snowpack will result in earlier snowmelt and

[24] Malodors as environmental injustice: health symptoms in the aftermath of a hydrogen sulfide emergency in Carson, California, USA | Journal of Exposure Science & Environmental Epidemiology (nature.com) https://www.nature.com/articles/s41370-023-00561-x

will subsequently reduce downstream water availability during summer and early fall. Additionally, based on future development trends, it is likely that more people and structures will be at risk of drought impacts as the population and housing supply increases. An increase in population will likely increase the demand on water, further straining the water system.

To mitigate drought impacts, the City of Carson is employing strategies to combat impacts to strive towards a more resilient community. Pre-planned summer outdoor water restrictions, combined with the City's future efforts to recycle sewage water into drinking water, will assist the city in reducing water shortages and ensuring clean water availability for all uses in the community and the region.

D) EARTHQUAKE

i) Hazard Profile

An earthquake occurs when two blocks of the earth suddenly slip past one another creating a vibration through the release of energy in the earth's crust. The vibrations that are generated are called "seismic waves". The surface where they slip is called the fault or fault plane. Earthquakes can result in ground shaking, soil liquefaction, landslides, fissures, avalanches, fires, and tsunamis. Additionally, earthquakes can cause buildings to collapse and cause heavy items to fall, resulting in injuries and property damage. Earthquakes can occur anywhere and at any time.

A fault is a fracture or zone of fractures between two blocks of rock. Faults allow blocks to move relative to each other. The movement may occur rapidly, in the form of an earthquake and may occur slowly, in the form of creep. There are major faults which include Normal, Reverse, Strike-Slip, and Oblique Slip Faults.

(1) Duration

Typically, earthquakes last only a few seconds but depends on the severity of the event. Strong ground shaking during a moderate to large earthquake will last about 10 to 30 seconds. In rare cases, earthquakes can last for several minutes during very large earthquakes.

(2) Seasonality

Earthquakes can occur during any time of year at any time of the day or night without any specific tendencies.

(3) Speed of Onset

One of the many reasons earthquakes are so dangerous is because they can occur very quickly without much warning at all. [25]

(4) Location

The entirety of the planning area is considered to be vulnerable to earthquakes. Any appreciable differences in impact would likely be the result of a confluence of various highly-local circumstances.

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[25] How Earthquakes Break the Speed Limit (berkeley.edu) https://seismo.berkeley.edu/blog/2019/03/08/how-earthquakes-break-the-speed-limit.html

ii) Magnitude

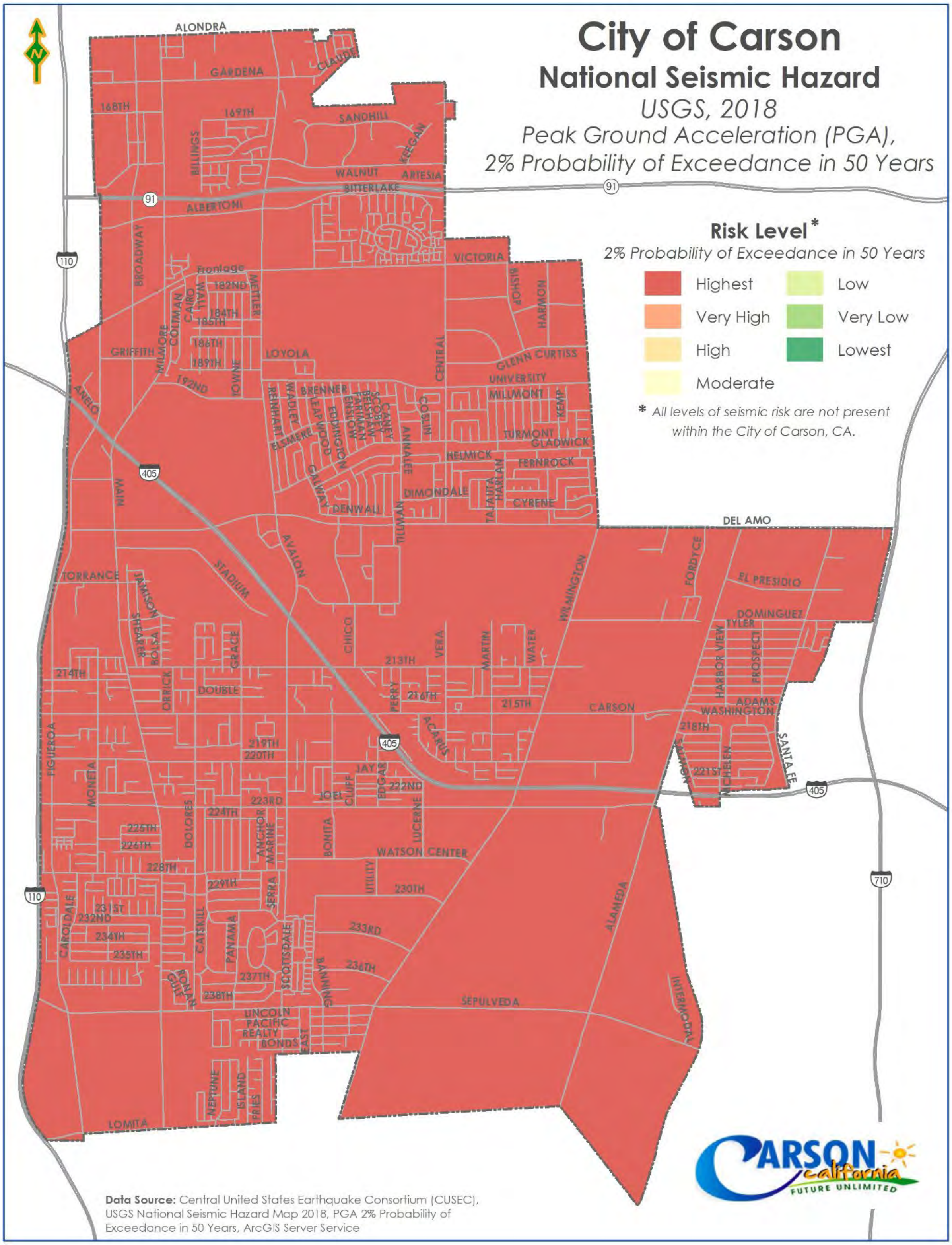
Common effects of earthquakes are ground motion and shaking, surface fault ruptures, and ground failure. Ground motion is the vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter. Soft soils can further amplify ground motions. The severity of these effects is dependent on the amount of energy released from the fault or epicenter. There are many scales in which to measure the severity of earthquakes which include: Peak Ground Acceleration (PGA), Magnitude Scale, and the Modified-Mercalli Scale (MMI).

(1) Peak Ground Acceleration (PGA)

Peak Ground Acceleration (PGA) measures the rate of change of motion relative to the established rate of acceleration due to gravity (g = 980 centimeters per second, per second). PGA is used to project the risk of damage from future earthquakes by showing earthquake ground motions that have a specified probability (i.e., 10 percent, 5 percent, or 2 percent) of being exceeded in 50 years. The ground motion values are used for reference in construction design for earthquake resistance and can also be used to assess relative hazard between sites when making economic and safety decisions.

Within the City of Carson, the entire jurisdiction is at the highest risk for Peak Ground Acceleration (PGA) two percent probability of exceedance in the next 50 years, shown in the map below.

FIGURE 23 - CITY OF CARSON PEAK GROUND ACCELERATION (PGA) 2% PROBABILITY OF EXCEEDANCE IN 50 YEARS



(2) Magnitude Scale

Another tool used to describe earthquake intensity is the Magnitude Scale. The Magnitude Scale is sometimes referred to as the Richter Scale. The two are similar but not the same. The Magnitude Scale was devised as a means of rating earthquake strength and is an indirect measure of seismic energy released. The Scale is logarithmic with each one-point increase corresponding to a 10-fold increase in the amplitude of the seismic shock waves generated by the earthquake. In terms of actual energy released, however, each one-point increase on the Richter scale corresponds to about a 32-fold increase in energy released. Therefore, a magnitude 7 (M7) earthquake is 100 times (10 X 10) more powerful than a M5 earthquake and releases 1,024 times (32 X 32) the energy.

An earthquake generates different types of seismic shock waves that travel outward from the focus or point of rupture waves and are divided into primary (P) and secondary (S) waves. Because P waves move faster (1.7 times) than S waves they arrive at the seismograph first. By measuring the time delay between arrival of the P and S waves and knowing the distance to the epicenter, seismologists can compute the magnitude for the earthquake.

(3) Modified Mercalli Scale (MMI)

The Modified Mercalli Scale (MMI) is another means for rating earthquakes, but one that attempts to quantify intensity of ground shaking. Intensity under this scale is a function of distance from the epicenter (the closer to the epicenter the greater the intensity), ground acceleration, duration of ground shaking, and degree of structural damage. This rates the level of severity of an earthquake by the amount of damage and perceived shaking. The table below describes the various values and shaking severity of earthquakes based on the MMI.

TABLE 18. MODIFIED MERCALLI SCALE (MMI)

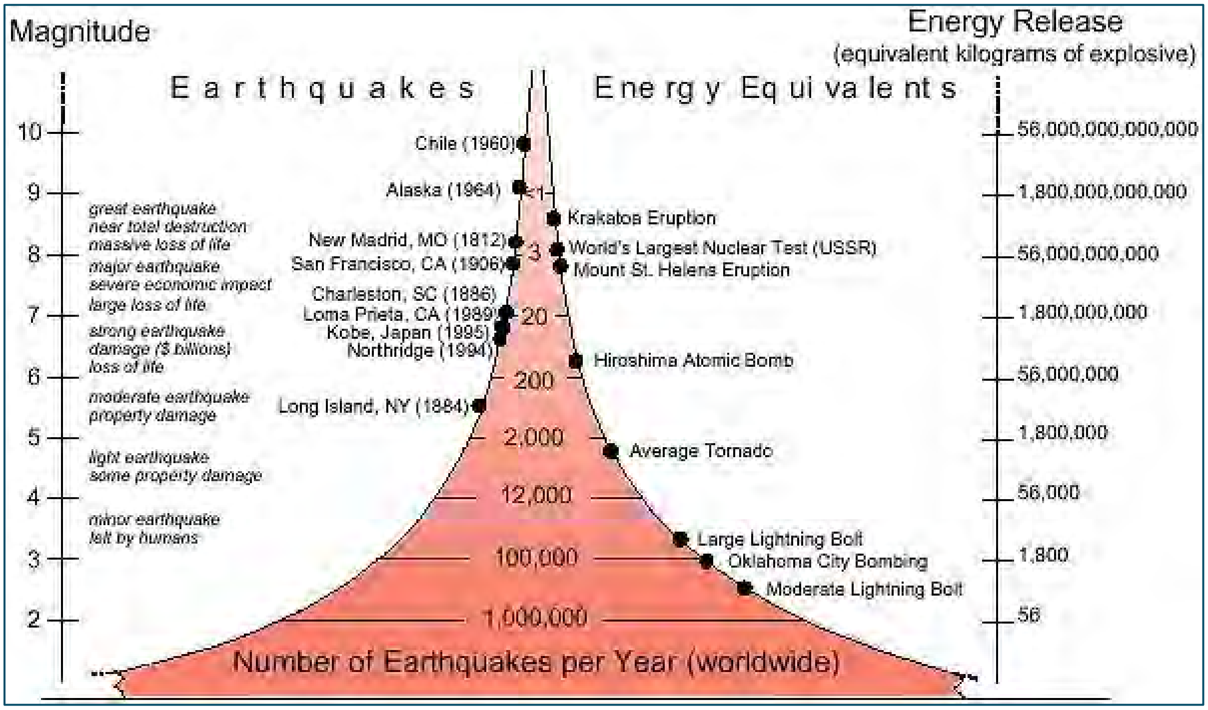
SCALE	INTENSITY	DESCRIPTION	CORRESPONDING RITCHER SCALE MAGNITUDE
I	Instrumental	Usually detected only on seismographs	< 4.2
II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.	
III	Slight	Felt quite noticeably indoors, especially on upper floors. Most people don’t recognize it as an earthquake (i.e. a truck rumbling).	
IV	Moderate	Can be felt by people walking; dishes, windows, and doors are disturbed.	

SCALE	INTENSITY	DESCRIPTION	CORRESPONDING RITCHER SCALE MAGNITUDE
V	Slightly Strong	Sleepers are awoken; unstable objects are overturned.	< 4.8
VI	Strong	Trees sway: suspended objects swing; objects fall off shelves; damage is slight.	< 5.4
VII	Very Strong	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, and considerable in poorly built or badly designed structures; some chimneys are broken.	<6.1
VIII	Destructive	Damage is slight in specially designed structures; considerable in ordinary, substantial buildings. Moving cars become uncontrollable; masonry fractures, poorly constructed buildings damaged.	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open; damage is considerable in specially designed structures; buildings are shifted off foundations	
X	Disastrous	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed along with foundations. Ground cracks profusely; liquefaction and landslides widespread.	<7.3

Source: USGS

The graph below illustrates the increasing intensity of energy that is released and as the measured magnitude increases. While each whole number increase in magnitude represents a tenfold increase in the measured amplitude, it represents an increasing rate of 32 times more energy released in the same increase in magnitude. As the magnitude of an earthquake is measured higher, the intensity of the earthquake worsens progressively from one category to the next.

FIGURE 24: EARTHQUAKE MAGNITUDE AND EQUIVALENT ENERGY RELEASE[26]



Source: USGS 2024

iii) Extent

Large - The State of California is particularly vulnerable to earthquake activity due to California's location residing between two large tectonic plates. The City of Carson is in the southern portion of the Los Angeles Basin. In general, fault systems surround and traverse through Los Angeles County, including the area of City of Carson. Throughout the basin the ground is saturated with sediment eroded from the mountains and foothills via multiple stream and river channels and resulting in liquefaction zones scattered across the region.

The Pacific Plate and the North American Plate come together at the San Andreas Fault 50-60 miles northeast of the City of Carson. In addition to the San Andreas Fault, Los Angeles County is home to or near additional fault systems with the potential to generate strong ground shaking. The Newport-Inglewood Fault traverses south to north paralleling the Orange County coastline extending within ½ mile of the City of Carson. The Palos Verdes Fault crosses the Palos Verdes Peninsula approximately six miles southeast of the city. The 40-mile-long Compton Fault parallels the Palos Verdes Fault in a southeast to northwest direction five miles southeast of the City of Carson. The Whittier-Elsinore Fault extends from the eastern base of the Santa Ana

[26] U.S. Geological Survey. *Graph Showing Earthquake Magnitudes and Equivalent Energy Release.* Retrieved 05.04.2021 from: https://www.usgs.gov/media/images/graph-showing-earthquake-magnitudes-and-equivalent-energy-release

Mountains and western base of the Puente Hills 16 miles to the northeast of the city. There are numerous additional faults in the area on all sides of the city.

- **Carson's Seismic Concerns:** The City of Carson is situated in an area with several significant fault lines. The Avalon-Compton Fault, a part of the Newport-Inglewood - Rose Canyon Fault Zone, is the only active fault within the Planning Area. It lies east of Avalon Boulevard and north of SR-91. This fault, along with the regional shear zone, has shown moderate to high seismic activity historically, with numerous earthquakes exceeding a Richter magnitude of four. The 1933 Long Beach Earthquake, attributed to the Newport-Inglewood Fault Zone, underscores its activity. The estimated maximum earthquake magnitude for this zone ranges between 6.0 and 7.4. Additionally, the Cherry Hill Fault, though lesser known, is a significant seismic fault line near Carson. It's part of the complex network of faults across the Los Angeles Basin and, despite its lower activity compared to major faults, still poses a considerable earthquake risk.[27]
- **Broader Regional Faults:** Beyond Carson, the greater Los Angeles region is affected by several major fault lines. The Newport-Inglewood-Rose Canyon Fault extends 47 miles from Culver City through Inglewood to Newport Beach and into the Pacific Ocean, becoming the Rose Canyon Fault in San Diego County. The San Andreas Fault, California's longest and most significant fault, has a 59 percent chance of producing a Magnitude 6.7 or larger earthquake in the next 30 years. The last major event was the 1857 Fort Tejon earthquake, estimated at Magnitude 8.0. The Palos Verdes Fault, approximately 80 kilometers long, runs near communities like San Pedro, Palos Verdes Estates, Torrance, and Redondo Beach, though it hasn't had significant recent activity. Similarly, the Elsinore-Whittier Fault, about 40 kilometers long, near Yorba Linda, Hacienda Heights, and Whittier, and the Santa Monica Fault, running underneath notable areas like Rodeo Drive, Beverly Hills, and Westwood, have remained quiet in modern history. Lastly, the San Jacinto Fault, a strand of the Southern San Andreas fault, is one of the most active in Southern California, affecting San Bernardino, Riverside, San Diego, and Imperial Counties.

iv) Past Occurrences

California's geological history is deeply intertwined with seismic activity. The state has experienced numerous chronic and destructive earthquakes. On average, California witnesses three to four significant earthquakes annually, causing structural damage. Earthquakes of magnitude 6.0 to 6.9 occur once every two to three years, underlining the state's constant vigilance against seismic threats.

[27] Los Angeles Earthquake Prediction – What is LA's Risk of Getting Hit? https://www.earthquakeauthority.com/Blog/2020/los-angeles-earthquake-prediction-and-risk#los-angeles-faults

Within the broader context of California, Los Angeles County stands out for its frequent earthquake activity. The entire region is prone to seismic disturbances, with a history marked by several significant earthquakes leading to substantial damage.

The infamous San Andreas Fault is a key player in California's seismic activity. Paleoseismological studies suggest that this fault generates large magnitude earthquakes (8.0+) at intervals ranging from 45 to 332 years, with an average interval of about 140 years. Additionally, other lesser-known faults in the state have been responsible for destructive earthquakes since 1857.

Among the notable earthquakes that have shaken the region are the 1933 Long Beach Earthquake, the 1971 San Fernando Earthquake, the 1987 Whittier Earthquake, and the 1994 Northridge Earthquake. Each of these events has contributed to the evolving understanding of seismic risks in California.

Turning to the City of Carson, the area has directly experienced one earthquake, with six more recorded near its jurisdictional boundary, shown in the map below. These earthquakes have ranged from Magnitude 3.8 to 5.4. Earthquakes occurring outside Carson's boundaries, depending on their magnitude, can still significantly impact the city. The table below lists historical earthquakes exceeding Magnitude 5.0 in the Los Angeles area, emphasizing the widespread impact of seismic activity in the region. A list of historical earthquakes higher than M 5.0 within the Los Angeles area are shown below.[28]

[28] County of Los Angeles All-Hazards Mitigation Plan. *All-Hazards Mitigation Plan.* Retrieved 12.07.2023 from: https://lacounty.gov/emergency/county-of-los-angeles-all-hazards-mitigation-plan/

FIGURE 25 - CITY OF CARSON HISTORICAL EARTHQUAKE FAULTS AND FAULT ZONES AS OF 2024

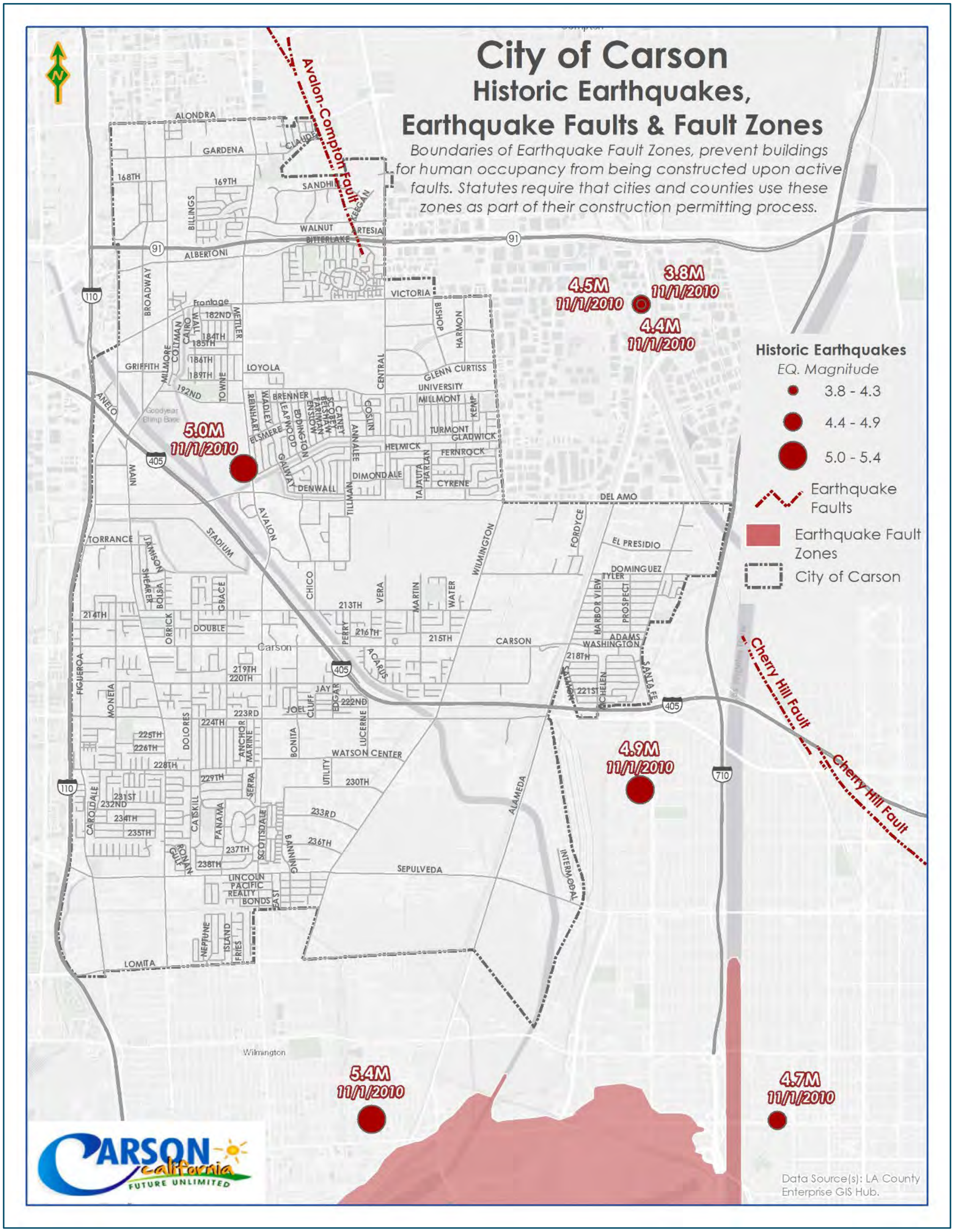


TABLE 19: HISTORIC EARTHQUAKES NEAR CARSON, CA

HAZARD	YEAR	DATE	LOCATION	RITCHER MEASURE	DEATHS AND PROPERTY DAMAGE
Earthquake	1812	December 8	San Juan Capistrano	7.5	40 Deaths. Mission San Juan Capistrano severely to moderately damaged. Mission San Gabriel moderately damaged.
Earthquake	1812	December 21	West Ventura Earthquake	7.1	N/A
Earthquake	1952	December 21	Kern County Earthquake	7.5	N/A
Earthquake	1971	February 9	San Fernando	6.6	58-65 deaths, 200-2,000 injuries, and up to $553 million in damages
Earthquake	1987	October 1	Whittier-Narrows	5.9	8 deaths, 200 injuries, and $358 million in damages
Earthquake	1990	February 28	Upland (San Bernardino County)	5.7	No deaths, 30 injuries, and $12.7 million in damages
Earthquake	1991	June 28	Sierra Madre	5.6	1 death, 100+ injuries, and $40 million in damages
Earthquake	1994	January 17	Northridge	6.7	57 deaths, 8,700 injuries. Estimated $40 billion in damages
Earthquake	2008	July 29	Chino Hills (San Bernardino County)	5.5	8 injuries and limited damages
Earthquake	2014	March 28	La Habra (Ventura County)	5.1	Few injuries and $10 million dollars in damages
Earthquake	2019	July 6	Ridgecrest	7.1	N/A

Source: LA County Hazard Mitigation Plan

- **January 9, 1994:** Northridge Earthquake became the costliest seismic event in California history. The earthquake caused extensive damage to structures, the transportation infrastructure, utility systems, water storage, communications, and critical facilities. This level of damage due to the fault that ruptured was directly underneath a densely populated urban area. The Northridge Earthquake was found to raise the nearby mountains by as much as 70 centimeters. The earthquake was provided a federal disaster declaration (DR-1008).

- **October 1, 1987:** Whittier Narrows Earthquake shook a large part of southern California. The earthquake caused $358 million in damage, especially in the Alhambra, Pasadena, and Whittier areas. The earthquake resulted in extensive infrastructure damage, multiple injuries, and 8 fatalities. The earthquake was provided a federal disaster declaration (DR-799).
- **February 9, 1971:** Magnitude 6.5 San Fernando Earthquake struck the San Fernando Valley in Los Angeles just after 6am. The intense shaking caused the collapse of freeway overpasses, hospitals, and other infrastructure. It damaged thousands of homes and businesses, a reservoir, and critical infrastructure. 65 people were killed and 2,000 more were injured. The shaking was felt for 300 miles including in Las Vegas, Nevada. The earthquake was provided a federal disaster declaration (DR-299).
- **March 10, 1933:** Long Beach Earthquake registered at a Magnitude 6.4 occurred along the Newport-Inglewood Fault. The earthquake resulted in over $50 million in damages, 500 injuries, and 120 fatalities. Unreinforced masonry structures were the source of most of the casualties. 70 schools were destroyed and 120 were damaged. This earthquake promoted statewide standards in building design and construction for schools and other structures to better withstand seismic events.

v) Future Probability

Highly Likely - The Working Group on California Earthquake Probabilities (WGCEP) represents a groundbreaking collaboration among key seismic research entities: the United States Geological Survey (USGS), the Southern California Earthquake Center (SCEC), and the California Geological Survey (CGS). This group is at the forefront of earthquake prediction research, utilizing cutting-edge science and technology to develop the Uniform California Earthquake Forecasts (UCERFs).

The latest iteration, UCERF Version 3, marks a significant leap in earthquake forecasting. It provides a comprehensive three-dimensional perspective on earthquake likelihoods across California. This advanced model specifically assesses the probability of experiencing a Magnitude 6.7 or greater earthquake within the next 30 years, offering invaluable insights for regions across the state.

Of particular interest is the forecast for the Los Angeles County fault systems, which have direct implications for areas including and surrounding the City of Carson. The following table encapsulates these probabilities, offering detailed insights derived from the UCERF3 model.

An Evolution in Earthquake Prediction: Updated from its predecessor, UCERF2, in 2015, UCERF3 represents a significant advancement in understanding and forecasting seismic activity. The model's enhanced accuracy and detailed approach have been pivotal in shaping current earthquake preparedness strategies in California. These probabilities are estimated from the

Uniform California Earthquake Rupture Forecast 3 (UCERF3) which was updated from the UCERG2 in 2015 and are shown below in more detail.

TABLE 20: MAJOR POTENTIALLY ACTIVE FAULTS IN PROXIMITY TO THE CITY OF CARSON

FAULT ZONE	RECURRENCE	MAXIMUM MAGNITUDE	UCERF3 LIKELIHOOD[29]
Compton	Historic: Unknown	6.5 to 7.1	1%
Hollywood	Historic: 1,600 years	5.8 to 6.5	1-2%
Newport-Inglewood	Historic: Unknown	6.0 to 7.4	1%
Palos Verdes	Historic: Unknown	6.0 to 7.0	3%
San Andreas	Varies: 100-300 years	6.8 to 8.0	18-20%
Santa Monica	Historic: Unknown	6.0 to 7.0	1%
Sierra Madre	Historic: 1,000-3,000 years	6.0 to 7.0	1-2%
Verdugo	Historic: Unknown	6.0 to 6.8	1%
Whittier	Historic: Unknown	6.0 to 7.2	1%

Source: Working Group on California Earthquake Probabilities (WCGEP)

While climate change is altering the landscape of natural hazards such as drought due to rising temperatures, climate change has little to no impact on the future probability of earthquakes within the planning area.

vi) Secondary Hazards

According to the U.S. Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities and are depicted in the table below.

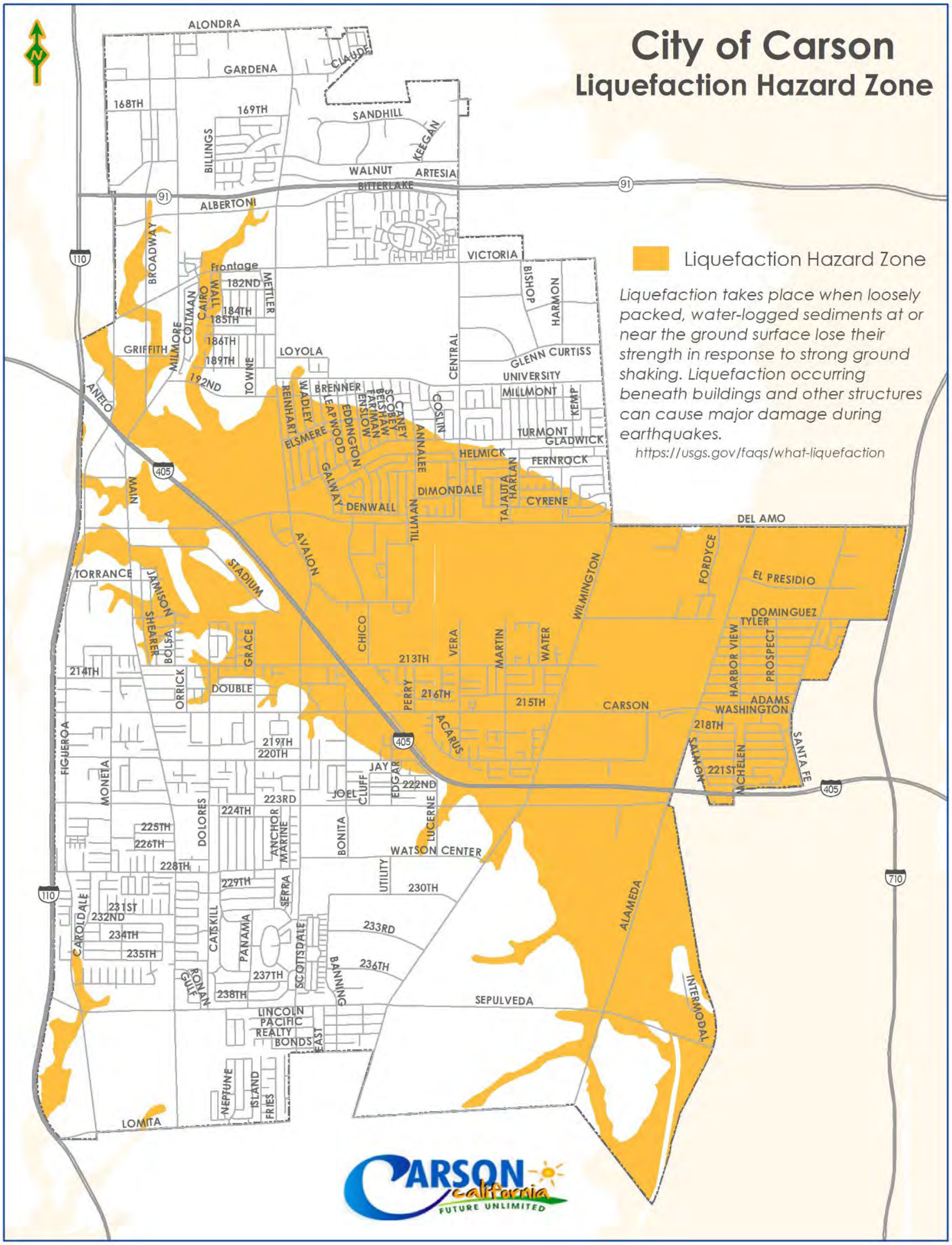
TABLE 21: SECONDARY HAZARDS FROM EARTHQUAKES

HAZARD	DESCRIPTION
Hazmat Incidents	Hazardous material incidents following an earthquake represent a significant and complex challenge. Earthquakes, by their very nature, can cause extensive structural damage, leading to the disruption of systems and containers that store or transport hazardous materials. This disruption can result in leaks, spills, or even explosions of hazardous substances, such as chemicals, gases, and radioactive materials. The immediate aftermath of an earthquake often sees a chaotic environment, where the release of these materials can go undetected or unaddressed for a critical period.

[29] Working Group on California Earthquake Probabilities (WGCEP). *The Third California Earthquake Rupture Forecast.* Retrieved 12.07.2023 from: http://www.wgcep.org/UCERF3

HAZARD	DESCRIPTION
Liquefaction	Many areas in Southern California have sandy soils that are subject to liquefaction. Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures. Many communities in Southern California are built on ancient river bottoms and have sandy soil. In some cases, this ground may be subject to liquefaction, depending on the depth of the water table. In the City of Carson, there is a significant portion of the city that is in the liquefaction hazard zone.
Ground Shaking	Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.
Landslides	Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in Southern California have a high likelihood of encountering such risks, especially in areas with steep slopes.
Amplification	Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Amplification can also occur in areas with deep sediment filled basins and on ridge tops.
Tsunami	Earthquakes can trigger tsunamis which can cause significant damage to many locations beyond where the earthquake struck. Coastal communities near the earthquake epicenter that are also vulnerable to tsunamis could experience devastating impacts.
Fires	Earthquakes can result in gas lines or power lines that are broken or down which can increase fire risk. It may be difficult to control a fire, particularly if the water lines feeding fire hydrants are also broken.

FIGURE 26 - CITY OF CARSON LIQUEFACTION HAZARD ZONE AS OF 2024



vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

Impact

The City of Carson is susceptible to significant ground shaking due to its proximity to several active seismic faults, notably the Newport-Inglewood Fault Zone, which runs near the city. Earthquakes resulting from these faults can lead to severe consequences, including the collapse of buildings and bridges, disruption of utility services, and triggering of secondary hazards such as fires and hazardous materials releases. Historically, collapsing infrastructure during earthquakes has contributed to some of California's most costly disasters.

In Carson, critical infrastructure like major highways (I-405 and I-110), oil refineries, and industrial facilities are at heightened risk during seismic events. Areas built on soft or water-saturated soils—classified as NEHRP Soil Types D, E, and F—or located within liquefaction zones are particularly vulnerable to ground failure. Such conditions can cause extensive cracking, settlement, and lateral spreading of the ground, leading to significant structural damage.

Warning Time and Early Warning Systems

Advancements in earthquake early warning technologies offer Carson residents and businesses crucial seconds to take protective actions before strong shaking begins. California's Earthquake Early Warning system, accessible through applications like MyShake and the U.S. Geological Survey's ShakeAlert, provides statewide coverage that includes Carson. By detecting the initial seismic waves that precede damaging shaking, these systems can send alerts to smartphones and integrated systems, allowing for immediate response measures such as seeking cover, shutting down equipment, or pausing critical operations.

Cascading Impacts in Carson

The effects of an earthquake in Carson can extend beyond immediate structural damage, leading to various cascading impacts:

- Surface Fault Rupture: While less likely within Carson itself, nearby fault ruptures can cause ground deformation affecting underground utilities and transportation networks, leading to service disruptions.
- Fires: The presence of oil refineries, chemical plants, and industrial facilities elevates the risk of fires following an earthquake. Damaged gas lines, electrical faults, and overturned equipment can ignite fires that may spread rapidly, especially if emergency response efforts are hindered.

- Liquefaction: Certain areas in Carson are prone to liquefaction due to loose, water-saturated soils. This phenomenon can result in ground failure, damaging buildings, roads, and underground pipelines.
- Landslides: Although Carson is relatively flat, constructed slopes, embankments, and freeway overpasses could experience slope failures during strong shaking, posing risks to infrastructure and public safety.
- Hazardous Materials Release: Industrial zones in Carson store and handle various hazardous materials. Earthquake-induced damage to these facilities can lead to the release of toxic substances, posing health risks and environmental contamination.
- Power Outages: Damage to electrical infrastructure can cause widespread power failures, disrupting essential services like water supply, communication networks, and emergency response capabilities.
- Transportation Disruptions: Earthquake damage to roadways, bridges, and overpasses can impede movement within and through Carson, affecting evacuation efforts, emergency services, and economic activities.

Environmental Impacts

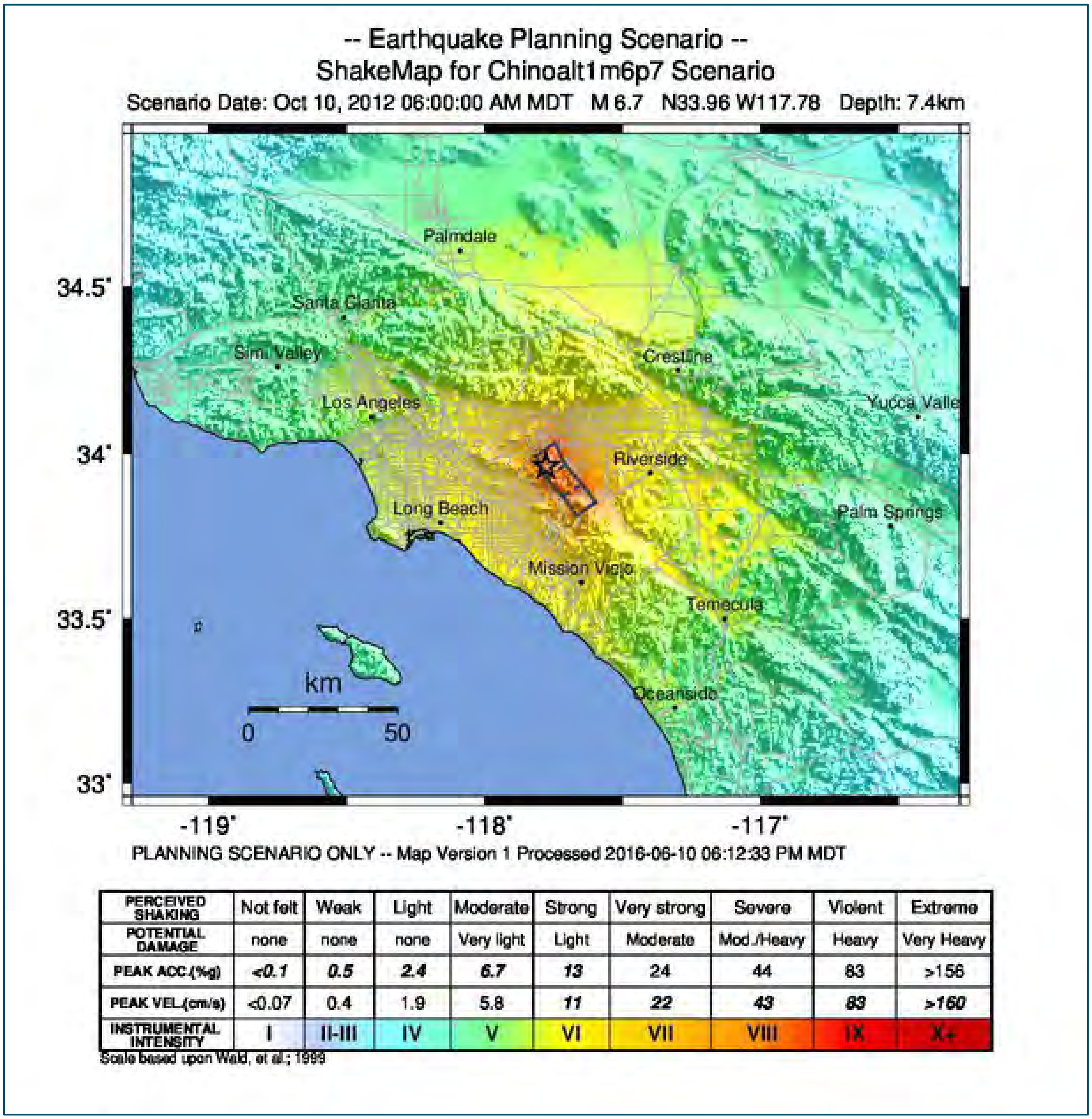
Earthquakes can have significant environmental consequences in Carson:

- Damage to Natural Habitats: Parks and green spaces may suffer from ground shaking, ground failure, or secondary hazards like fires, affecting local flora and fauna.
- Water Resources: Seismic activity can alter groundwater levels or lead to contamination from hazardous materials releases, impacting water quality and availability for residents and ecosystems.
- Air Quality: Fires and the release of hazardous substances can degrade air quality, posing health risks to the community, especially vulnerable populations like children and the elderly.

(1) HAZUS

As part of the risk assessment, an earthquake HAZUS analysis was conducted. HAZUS is a nationally standardized risk modeling methodology and identifies areas with high risk for natural hazards and estimates physical, economic, and social impacts of earthquakes, hurricanes, floods, and tsunamis. The HAZUS program is managed by FEMA's Natural Hazards Risk Assessment Program and partnered with other federal agencies, research institutions, and regional planning authorities, to increase the quality of HAZUS resources by incorporating the latest scientific and technological approaches and meet the needs of the emergency management community. [30] Each section below will provide a summary of the HAZUS analysis conducted for various earthquake scenarios for the following: Chino M6.7, Newport-Inglewood M7.2 Northern Epicenter, Newport-Inglewood M7.2 Southern Epicenter, Palos Verdes M7.7, Puente Hills M7.1. Maps of each of the earthquake scenarios are visualized in the maps below.

FIGURE 27 - CHINO M6.7 SCENARIO SHAKE MAP*

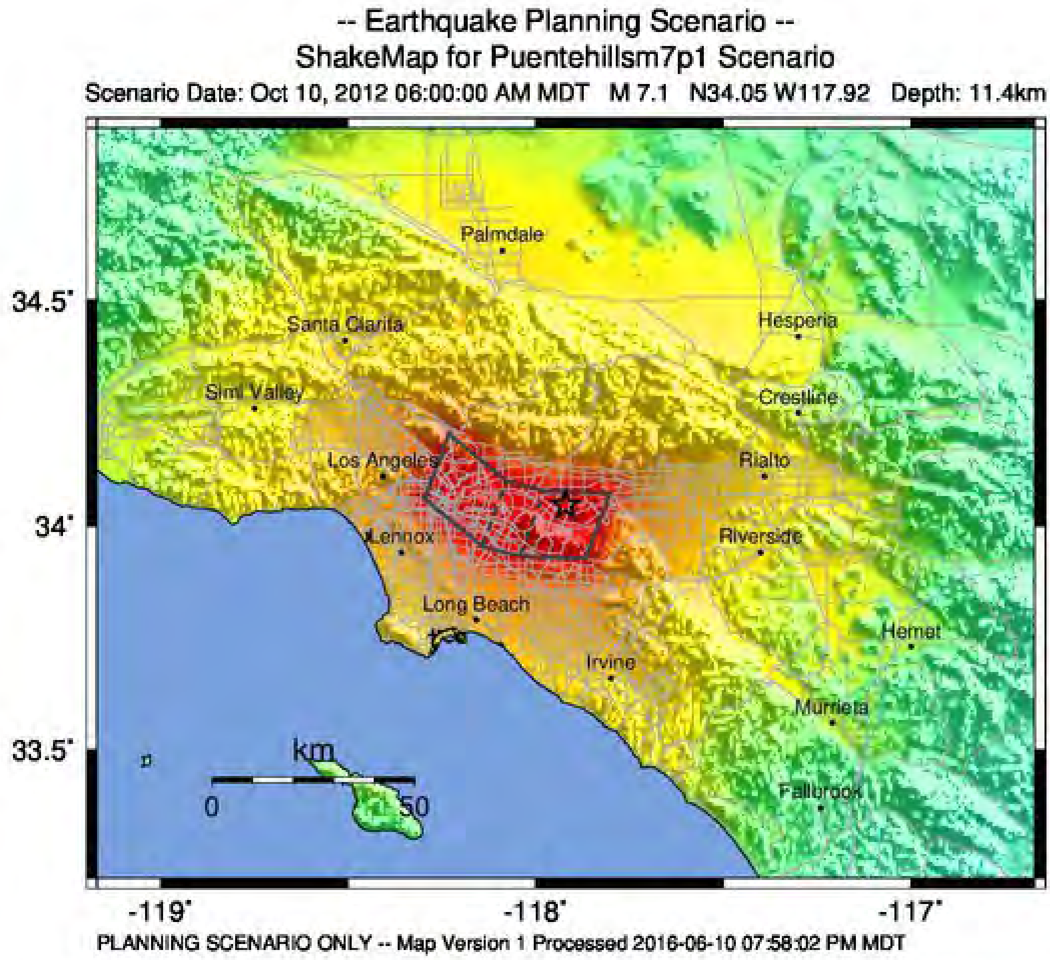


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

*Shake Map for this scenario was produced in 2012 and reflects best available data.

[30] What is Hazus? | FEMA.gov https://www.fema.gov/flood-maps/tools-resources/flood-map-products/hazus/about

FIGURE 28 - PUENTE HILLS M7.1 SCENARIO SHAKE MAP*

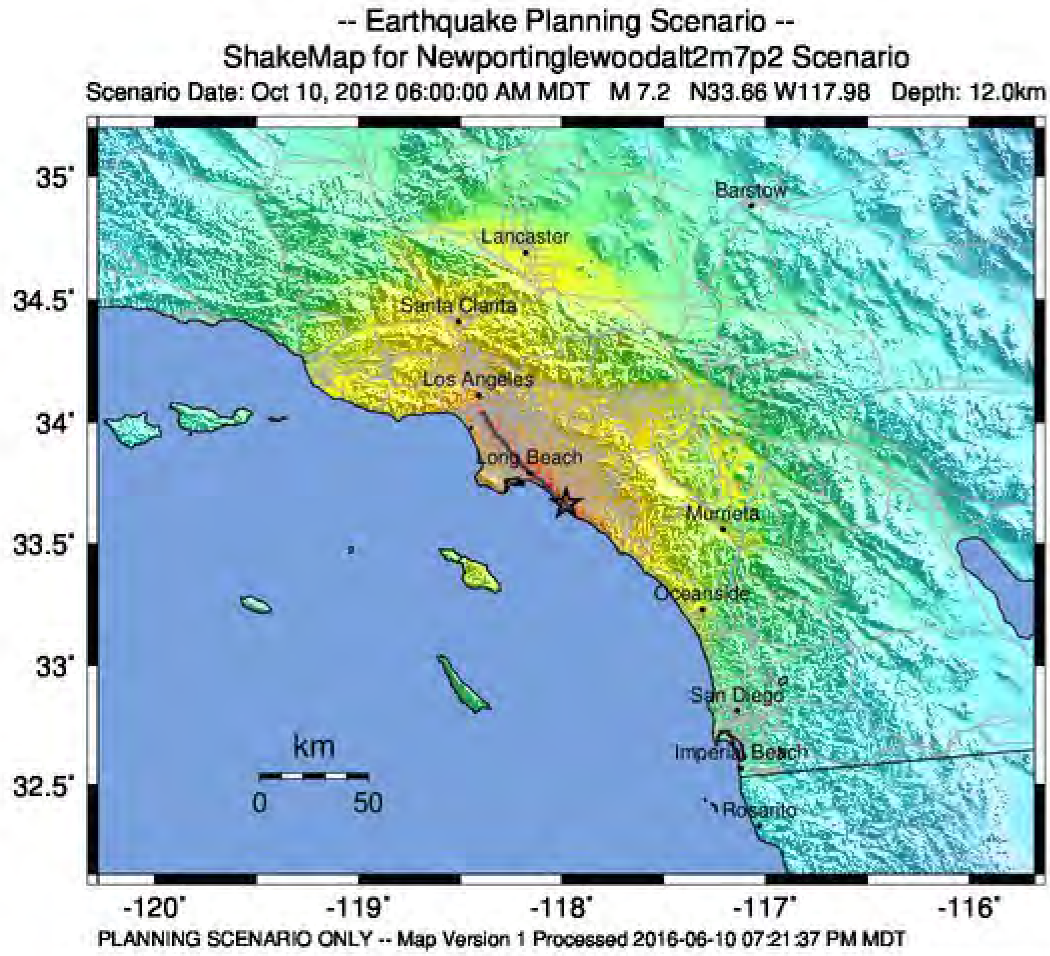


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

*Shake Map for this scenario was produced in 2012 and reflects best available data.

FIGURE 29 - NEWPORT-INGLEWOOD M7.2 (NORTHERN EPICENTER) SCENARIO SHAKE MAP*



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

*Shake Map for this scenario was produced in 2012 and reflects best available data.

FIGURE 30 - CITY OF CARSON NEWPORT-INGLEWOOD M7.2 EARTHQUAKE SCENARIO PRODUCED IN 2017

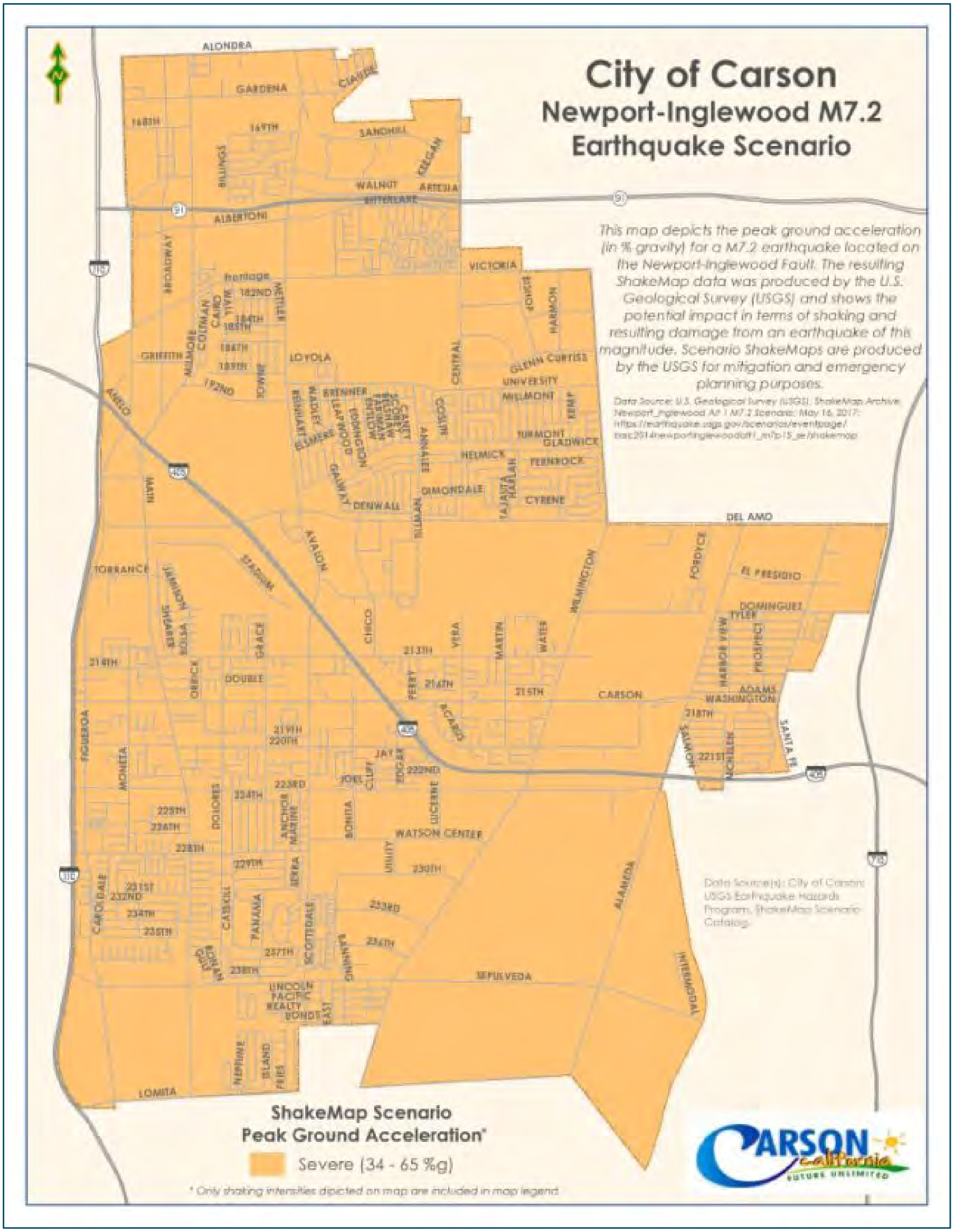
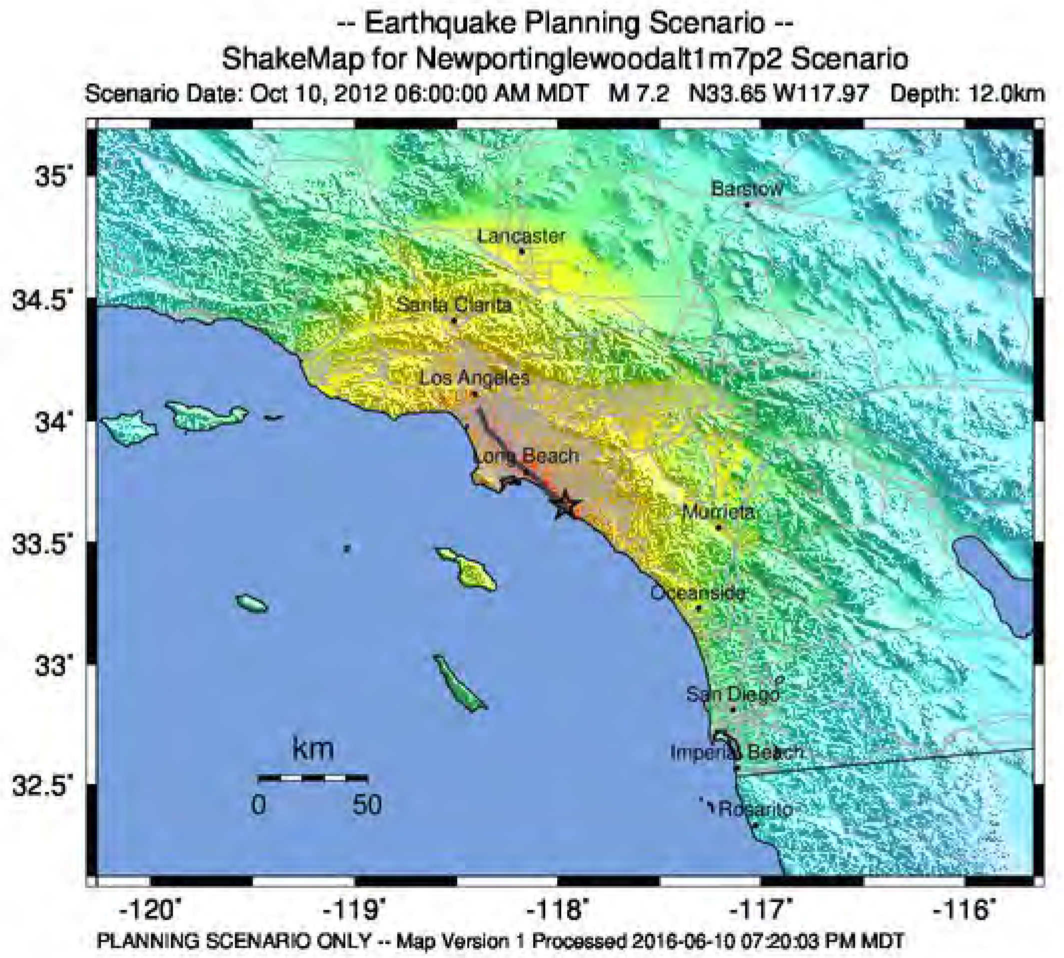


FIGURE 31 - NEWPORT-INGLEWOOD (NORTHERN EPICENTER) SCENARIO SHAKE MAP*

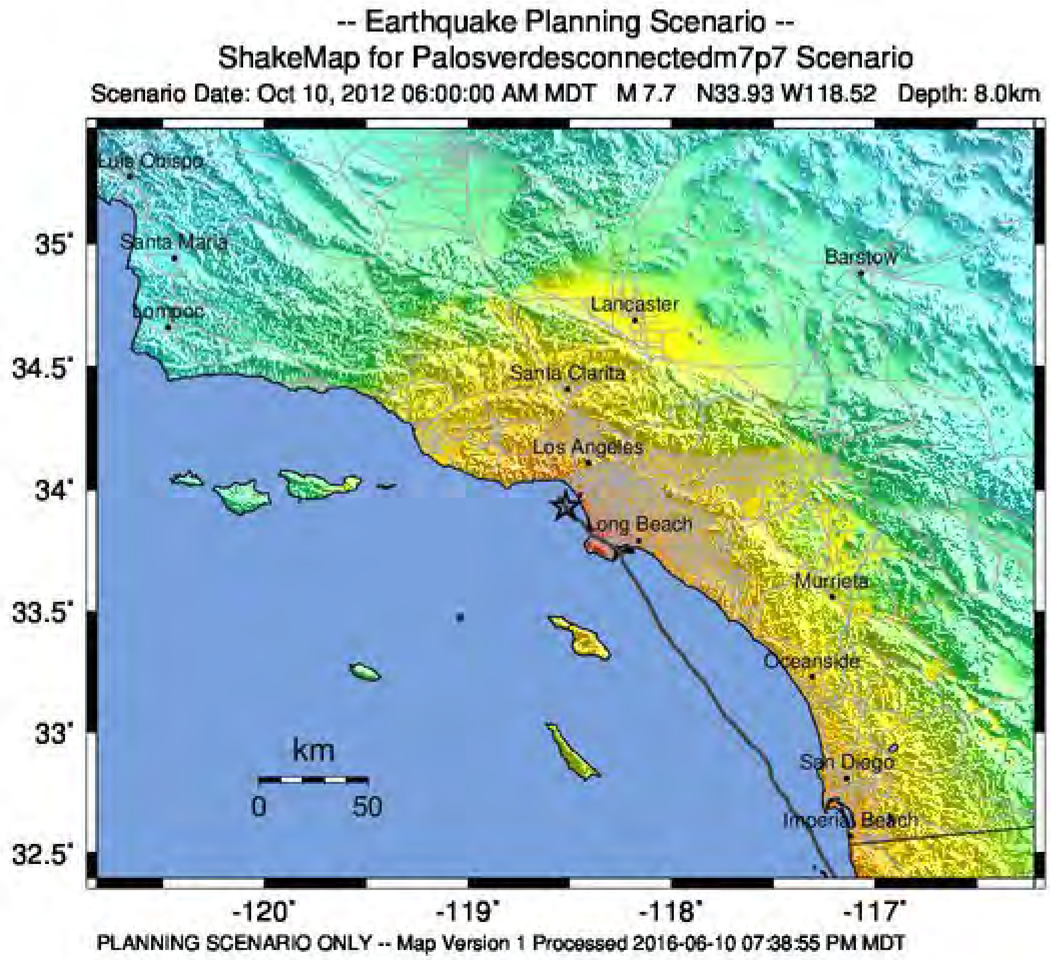


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

*Shake Map for this scenario was produced in 2012 and reflects best available data.

FIGURE 32 - PALOS VERDES M7.7 SCENARIO SHAKE MAP*



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

*Shake Map for this scenario was produced in 2012 and reflects best available data.

(2) People

The Centers for Disease Control and Prevention (CDC) developed a tool called the Social Vulnerability Index (SVI) to identify and quantify social needs of vulnerable communities at the state, county, and census tract level for public health emergencies. The SVI tool can be used to understand disaster impacts and can assist public officials, planners, and emergency managers to better prepare and respond to emergency events. The SVI score is comprised of 15 indicators and categorized under 4 main topics: Socioeconomic Status, Household Characteristics, Racial and Ethnic Minority Status, and Housing Type and Transportation.

The economic impact of a major earthquake on Carson's properties can be substantial. Residential and commercial property owners may face high costs for repairs and rebuilding, while insurance claims and processing may add to the complexity. The local economy could suffer due to the temporary closure of businesses, loss of inventory, and disruption of services. Recovery efforts may be prolonged and expensive, requiring significant resources from local and state governments, as well as private sector contributions.

The psychological impact on residents following a major earthquake should not be underestimated. The loss of homes and community landmarks can have a profound emotional effect, leading to a sense of loss and uncertainty. In the aftermath, community cohesion and support will be crucial for recovery. Efforts to rebuild will need to consider not just the physical restoration of properties, but also the emotional and social recovery of the community.

Chino M6.7

Based on the M6.7 Chino Earthquake Scenario, shown in the map below, HAZUS estimates that eight households will be displaced as a result of the earthquake and five people will temporarily seek public shelters. Regarding casualties and injuries in this scenario, HAZUS estimates that the most dangerous time of day for an earthquake to occur would be 2pm. In this scenario, it is likely that more injuries than deaths would occur and likely only require medical attention but not necessarily need prompt hospitalization.

Newport-Inglewood (Northern Epicenter) M7.2

Based on the M7.2 Newport-Inglewood Earthquake Scenario, HAZUS estimates that 540 households will be displaced as a result of the earthquake and 351 people will seek temporary public shelter. Regarding casualties and injuries in this scenario, HAZUS estimates that the most dangerous time of day for an earthquake to occur would be 2pm. Compared to the M6.7 Chino Earthquake Scenario, this earthquake scenario would cause significantly more casualties. HAZUS estimates about 1,021 casualties during 2pm compared to an estimated 187 at 2am and 619 at 5pm.

Newport-Inglewood (Southern Epicenter) M7.2

Based on the M7.2 Newport-Inglewood Earthquake Scenario, HAZUS estimates that 632 households will be displaced as a result of the earthquake and 409 people will seek temporary public shelter. Regarding casualties and injuries in this scenario, HAZUS estimates that the most dangerous time of day for an earthquake to occur would be 2pm. Compared to the M7.7 Newport-Inglewood (Southern Epicenter) Earthquake Scenario, this earthquake scenario would cause significantly more casualties. HAZUS estimates about 1,155 casualties during 2pm compared to an estimated 215 at 2am and 702 at 5pm.

Palos Verdes M7.7

Based on the M7.7 Palos Verdes Earthquake Scenario, HAZUS estimates that 466 households will be displaced as a result of the earthquake and 298 people will seek temporary public shelter. Regarding casualties and injuries in this scenario, HAZUS estimates that the most dangerous time of day for an earthquake to occur would be 2pm. Compared to the M6.7 Chino Earthquake Scenario, this earthquake scenario would cause less casualties. HAZUS estimates about 614 casualties during 2pm compared to an estimated 140 at 2am and 378 at 5pm.

Puente Hills M7.1

Based on the M7.1 Puente Hills Earthquake Scenario, HAZUS estimates that 92 households will be displaced as a result of the earthquake and 59 people will seek temporary public shelter. Regarding casualties and injuries in this scenario, HAZUS estimates that the most dangerous time of day for an earthquake to occur would be 2pm. Compared to the M6.7 Chino Earthquake Scenario, this earthquake scenario would cause more casualties but less than the other earthquake scenarios. HAZUS estimates about 132 casualties during 2pm compared to an estimated 40 at 2am and 82 at 5pm.

(3) Structures and Systems

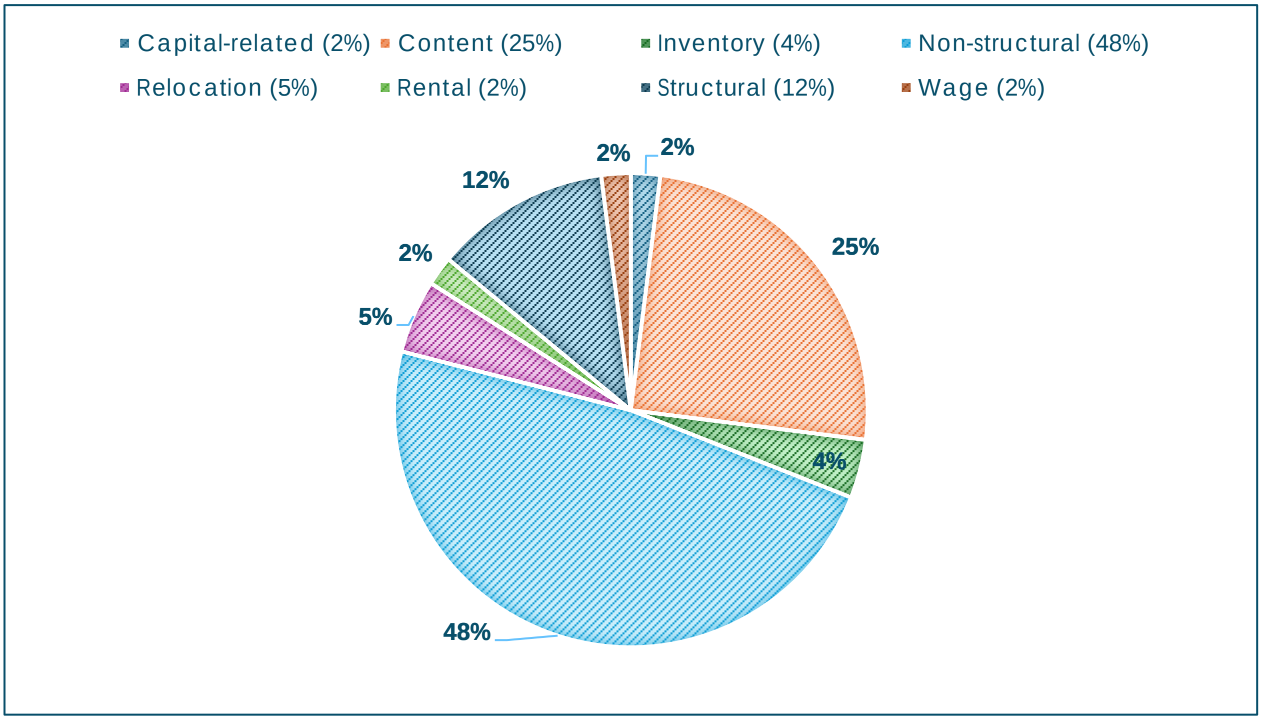
In the event of a major earthquake, the City of Carson could face significant structural damage to properties. Buildings, especially older structures not designed to current seismic standards, are at risk of partial or complete collapse. This structural vulnerability poses a direct threat to the safety of residents and can lead to injuries or worse. Residential areas, particularly those with older housing stock, may experience considerable damage, including foundation cracks, broken windows, and collapsed roofs. Additionally, there is a gap in knowledge about standard homeowners and renters' insurance policies and as don't typically cover earthquake damage. Hazard Mitigation Planning Team members expressed concern over the recent change to earthquake insurers as many of them are removing themselves from earthquake insurance coverage due to the high probability of earthquakes and property damage cost.

Building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Businesses interruption loses also include the temporary living expenses for those people displaced from their home because of the earthquake.

Chino M6.7

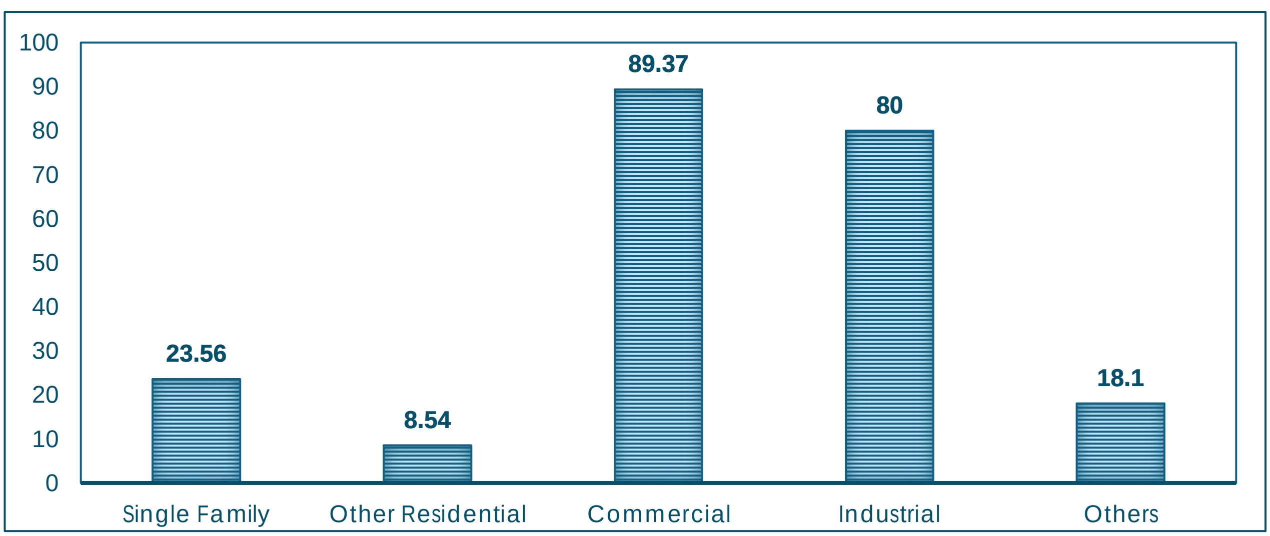
A summary of the earthquake losses by loss type and by occupancy type are described in the figures below. In summary, the estimated total building-related losses for this scenario are 219,580,000 dollars. An estimated 11 percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 15 percent of the total loss.

FIGURE 33 - CHINO M6.7 ESTIMATED EARTHQUAKE LOSSES BY TYPE (IN $ MILLIONS) AS OF 2024



Source: HAZUS

FIGURE 34 - CHINO M6.7 ESTIMATED EARTHQUAKE LOSSES BY OCCUPANCY TYPE (IN $ MILLIONS) AS OF 2024

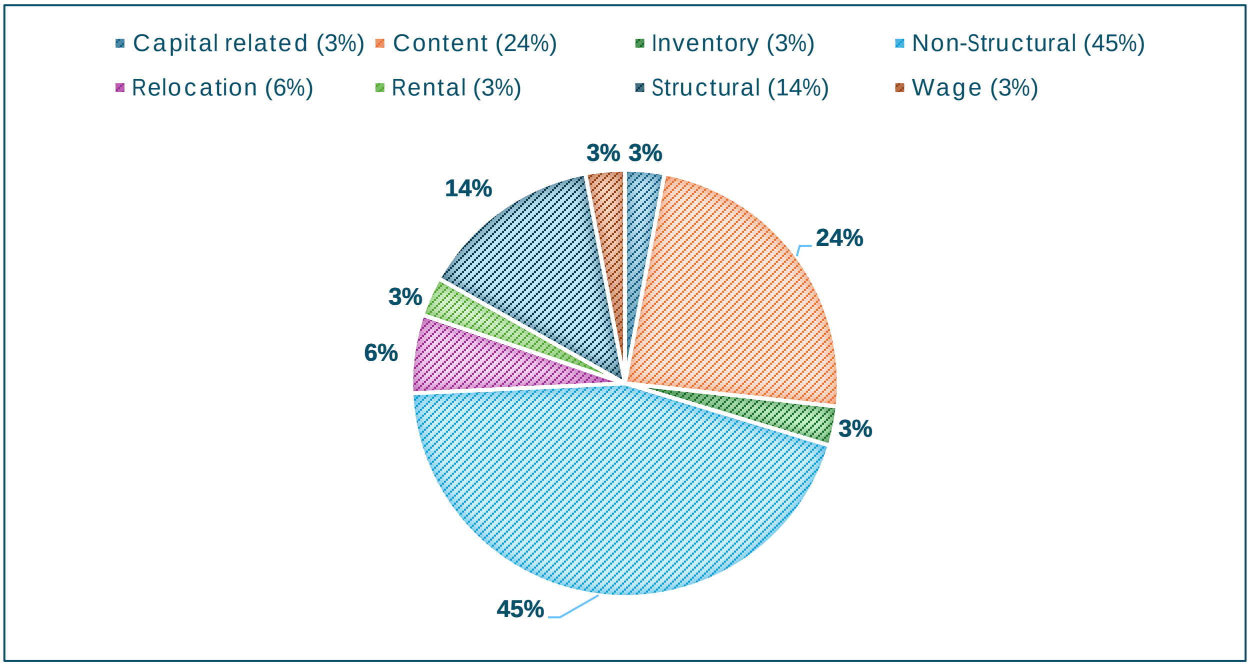


Source: HAZUS

Newport-Inglewood (Northern Epicenter) M7.2

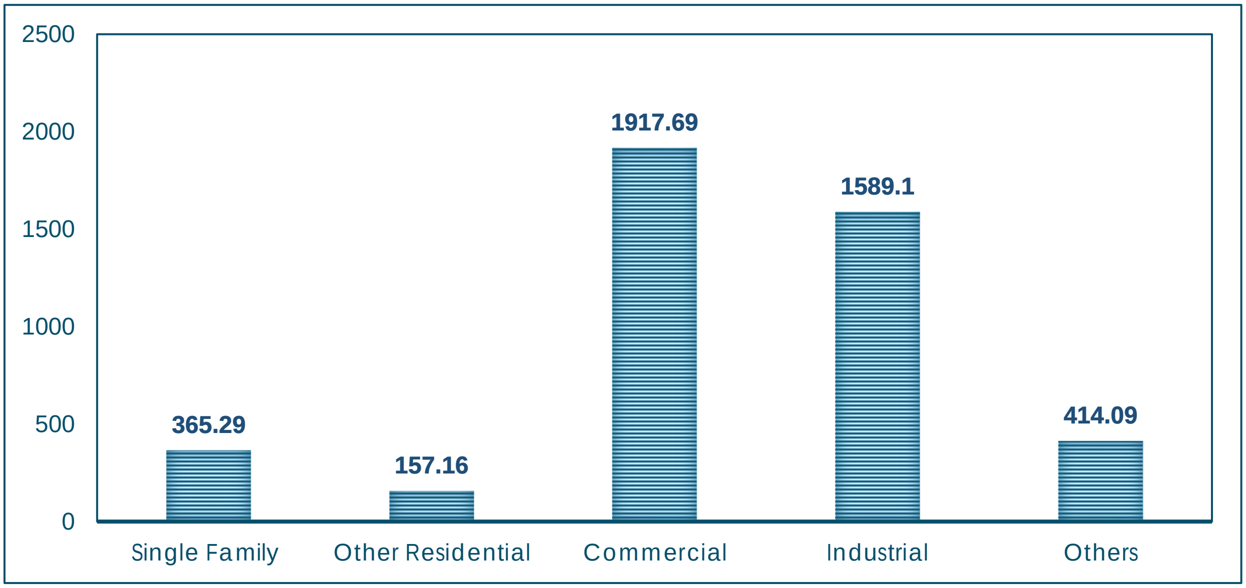
A summary of the earthquake losses by loss type and by occupancy type are described in the figures below. In summary, the estimated total building-related losses in this scenario are 4,443,330 dollars. An estimated 14 percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 12 percent of the total loss.

FIGURE 35 - NEWPORT-INGLEWOOD M7.2 (NORTHERN EPICENTER) ESTIMATED EARTHQUAKE LOSSES BY TYPE ($ MILLIONS) AS OF 2024



Source: HAZUS

FIGURE 36 - NEWPORT-INGLEWOOD M7.1 (NORTHERN EPICENTER) ESTIMATED LOSSES BY OCCUPANCY TYPE ($ MILLIONS) AS OF 2024

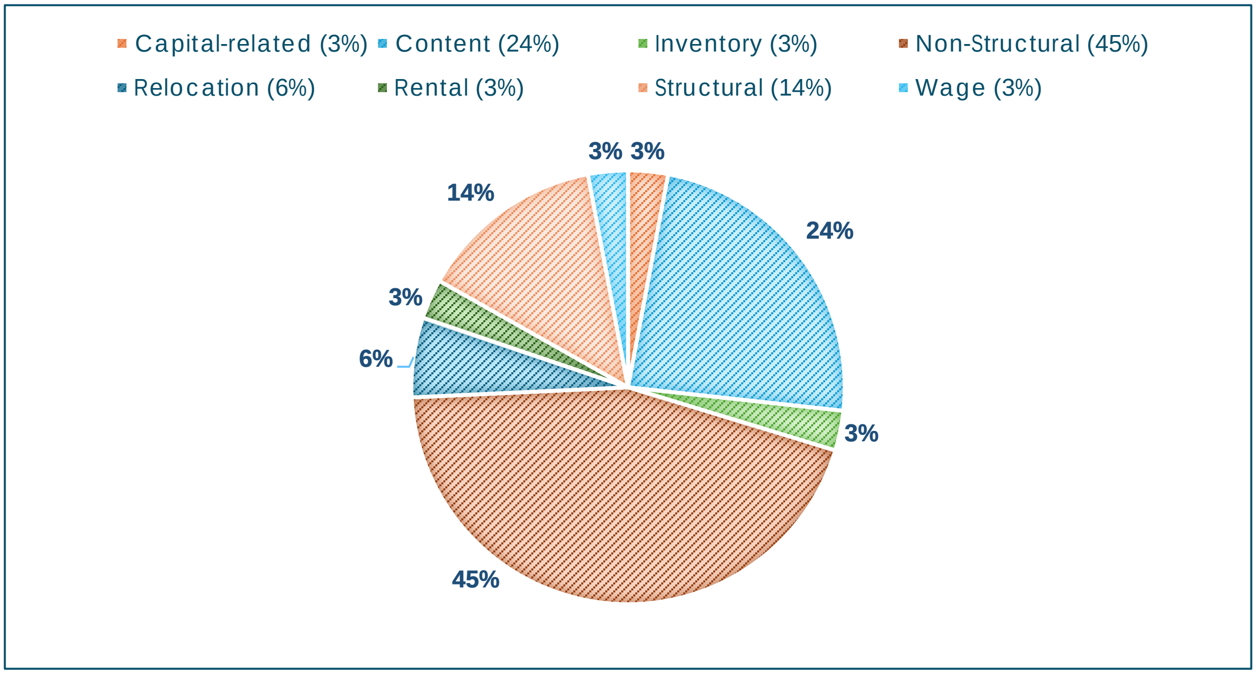


Source: HAZUS

Newport-Inglewood (Southern Epicenter) M7.2

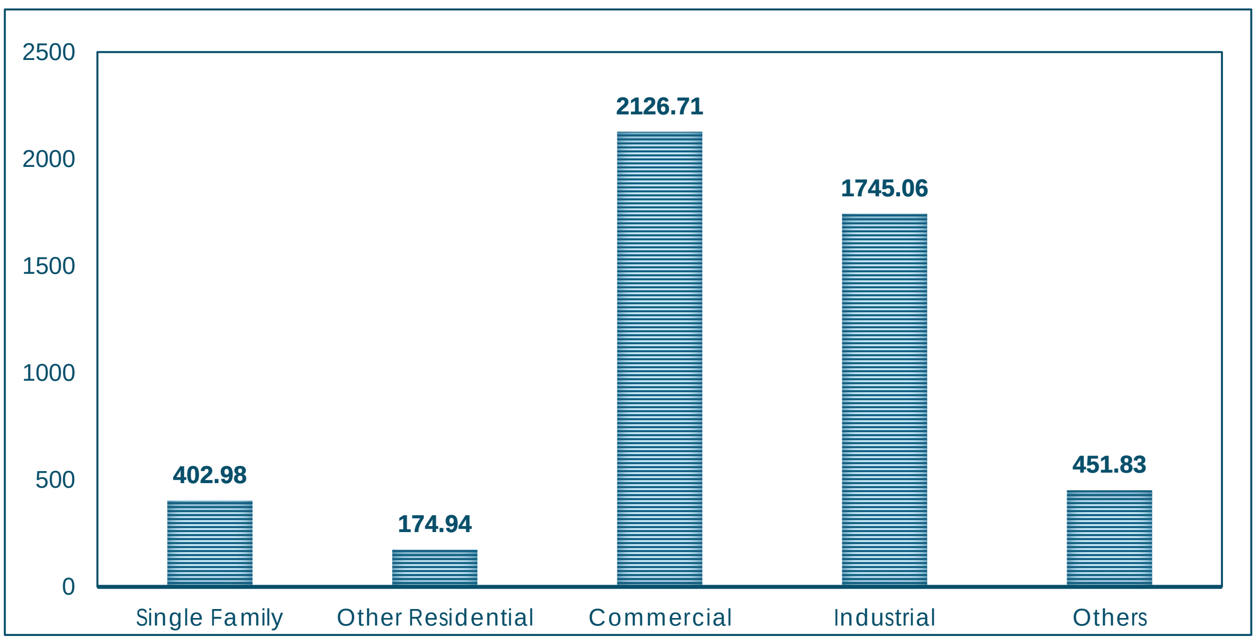
A summary of the earthquake losses by loss type and by occupancy type are described in the figures below. In summary, the estimated total building-related losses for this scenario are 4,901,520 dollars. An estimated 14 percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 12% of the total loss.

FIGURE 37 - NEWPORT-INGLEWOOD (SOUTHERN EPICENTER) M7.2 ESTIMATED EARTHQUAKE LOSSES BY LOSS TYPE ($ MILLIONS) AS OF 2024



Source: HAZUS

FIGURE 38 - NEWPORT-INGLEWOOD (SOUTHERN EPICENTER) M7.2 ESTIMATED EARTHQUAKE LOSSES BY OCCUPANCY TYPE ($ MILLIONS) AS OF 2024

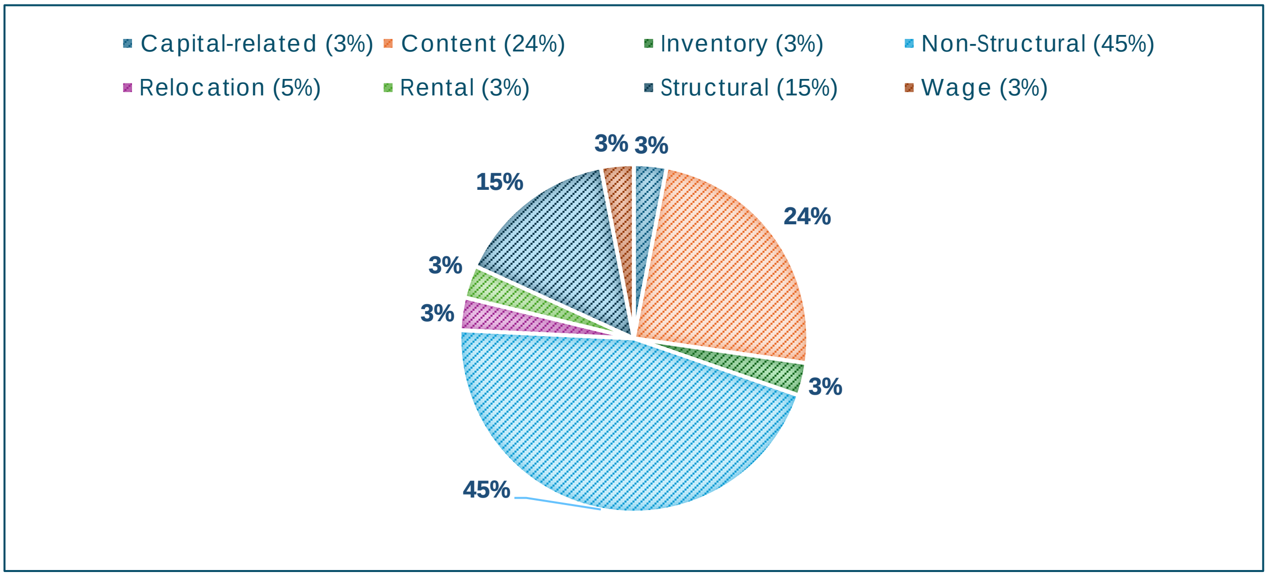


Source: HAZUS

Palos Verdes M7.7

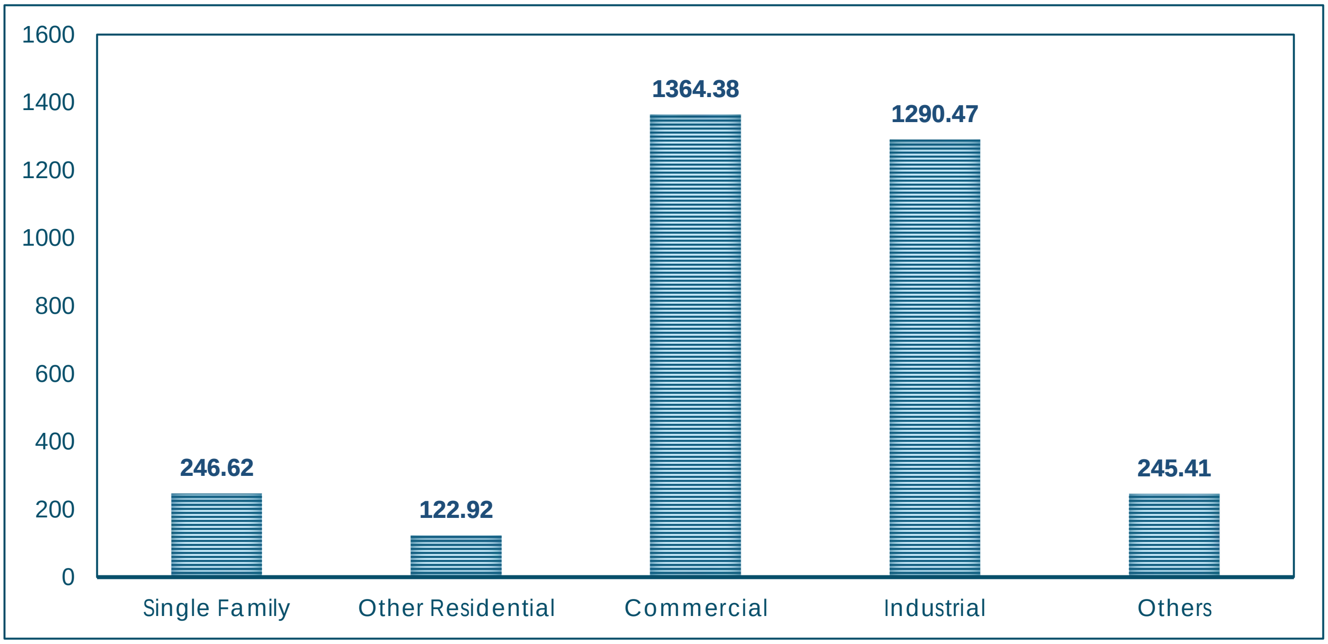
A summary of the earthquake losses by loss type and by occupancy type are described in the figures below. In summary, the estimated total building-related losses in this scenario are 3,269,800 dollars. An estimated 14 percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 11 percent of the total loss.

FIGURE 39 - PALOS VERDES M7.7 ESTIMATED EARTHQUAKE LOSSES BY LOSS TYPE ($ MILLIONS) AS OF 2024



Source: HAZUS

FIGURE 40. PALOS VERDES M7.7 ESTIMATED EARTHQUAKE LOSSES BY OCCUPANCY TYPE ($ MILLIONS) AS OF 2024

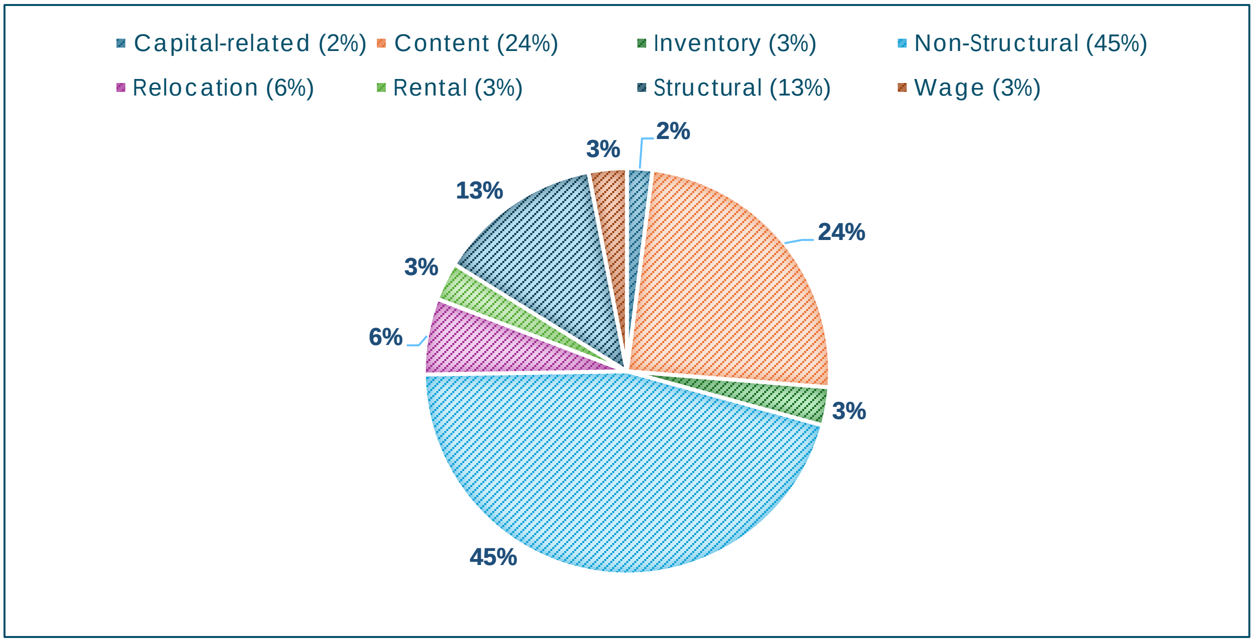


Source: HAZUS

Puente Hills M7.1

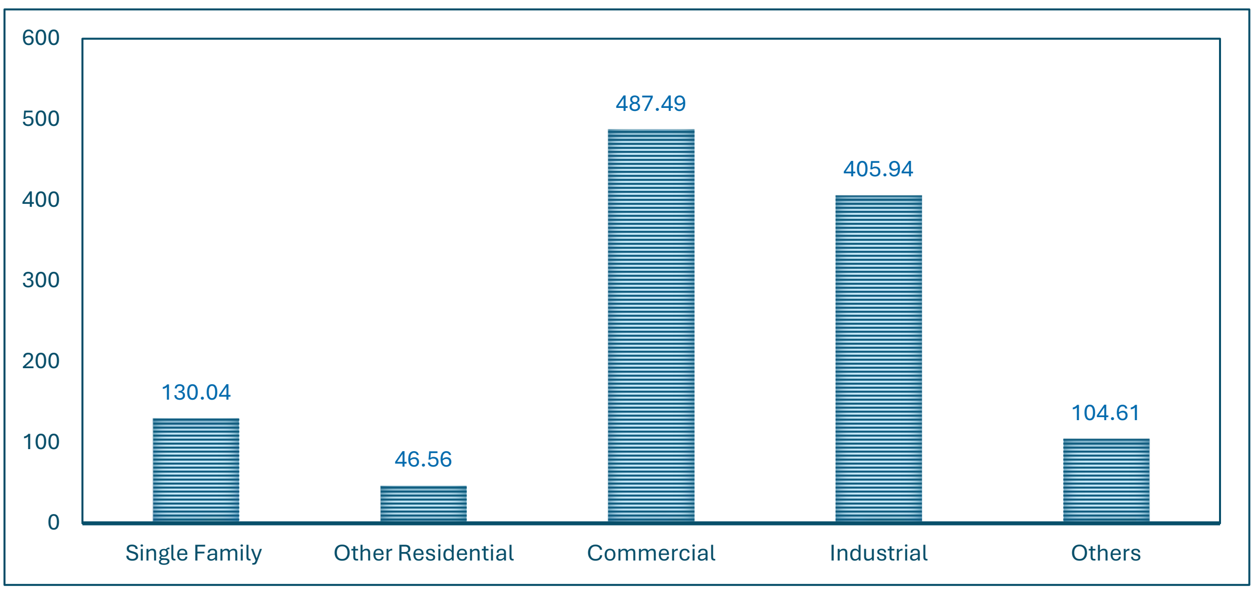
A summary of the earthquake losses by loss type and by occupancy type are described in the figures below. In summary, the estimated total building-related losses in this scenario are 1,174,640 dollars. An estimated 14 percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 15 percent of the total loss.

FIGURE 41. PUENTE HILLS M7.1 ESTIMATED EARTHQUAKE LOSSES BY LOSS TYPE ($ MILLIONS) AS OF 2024



Source: HAZUS

FIGURE 42. PUENTE HILLS M7.1 ESTIMATED EARTHQUAKE LOSSES BY OCCUPANCY TYPE ($ MILLIONS) AS OF 2024



Source: HAZUS

(4) Critical Facilities

Beyond individual buildings, the city's infrastructure is likely to be heavily impacted. Essential services such as water, gas, and electricity may be disrupted for extended periods, affecting daily life, and hindering emergency response efforts. Roadways and bridges, crucial for transportation and evacuation, might suffer from cracks, breaks, or complete failures, severely impacting mobility, and rescue operations. These disruptions not only pose immediate challenges but also have long-term economic and social repercussions. According to FEMA, critical facilities are defined as those structures from which essential services and functions for victim survival, continuation of public safety actions, and disaster recovery are performed or provided. Shelters, emergency operation centers; public health, public drinking water, sewer and wastewater facilities are all examples of critical facilities.

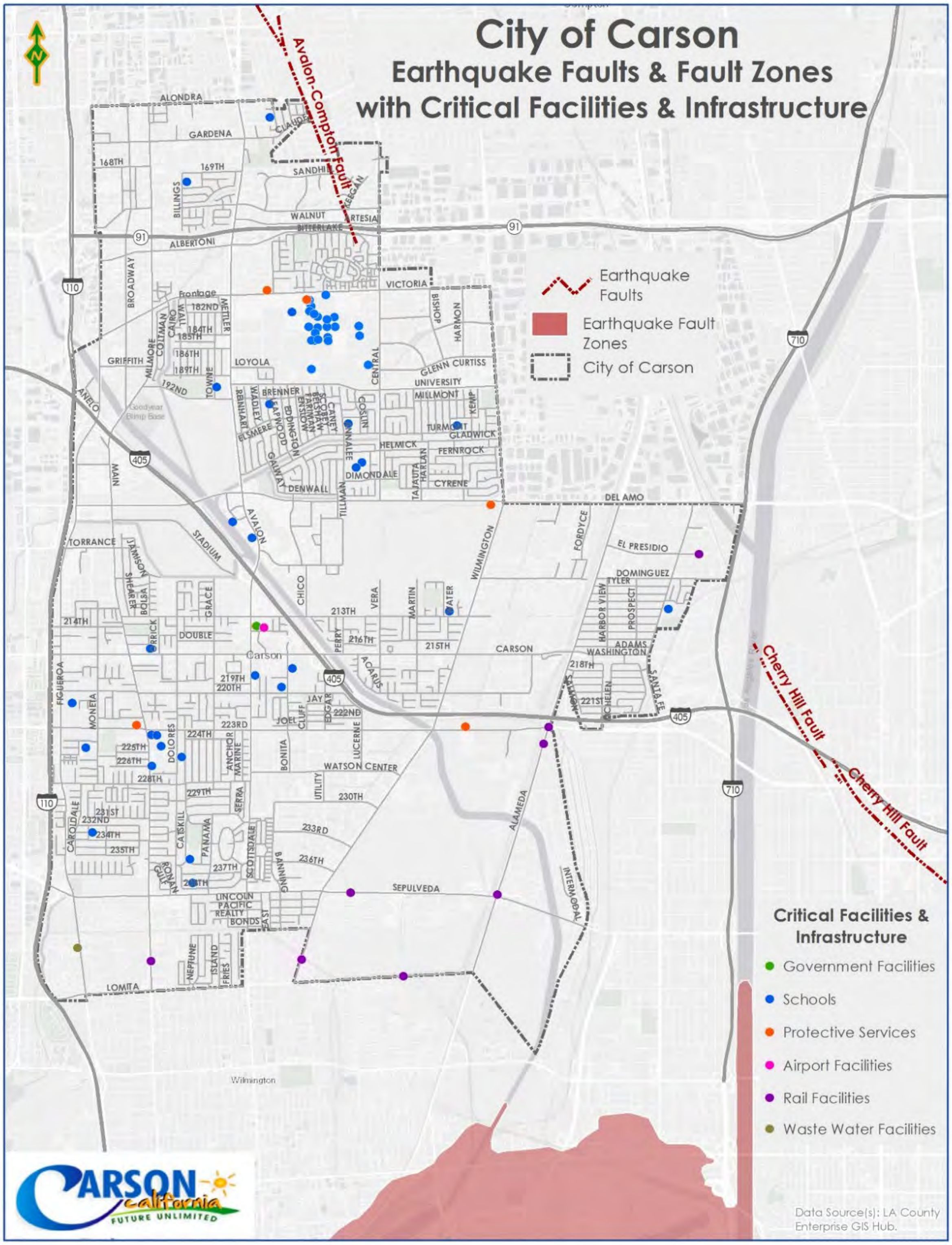
There are two earthquake faults within city boundaries or right outside of the jurisdiction. The map below shows the Avalon-Compton Fault and the Cherry Hill Fault and the proximity to the critical facilities which include government facilities, schools, protective services, airport facilities, rail facilities, and wastewater facilities.

FIGURE 43. POTENTIAL VULNERABILITY OF LIFELINES TO AN EARTHQUAKE

LIFELINES	IMPACT TYPE	DESCRIPTION
Water & Wastewater Systems		Earthquakes often damage water lines and sewage systems, leading to water shortages and sanitation issues. Restoring these services is crucial for public health and hygiene.
Food, Hydration, & Shelter		The destruction of homes and businesses can displace people, creating an immediate need for shelter. Additionally, disruptions in supply chains can impact the availability and distribution of food.
Health & Medical		Healthcare facilities might suffer structural damage, and there could be an influx of injured individuals needing medical attention. Disruptions in utility services could also affect the operation of hospitals and clinics.
Energy		Power outages are common following earthquakes due to damage to power stations and distribution lines. This can affect not only homes and businesses but also critical facilities like hospitals and emergency response centers.

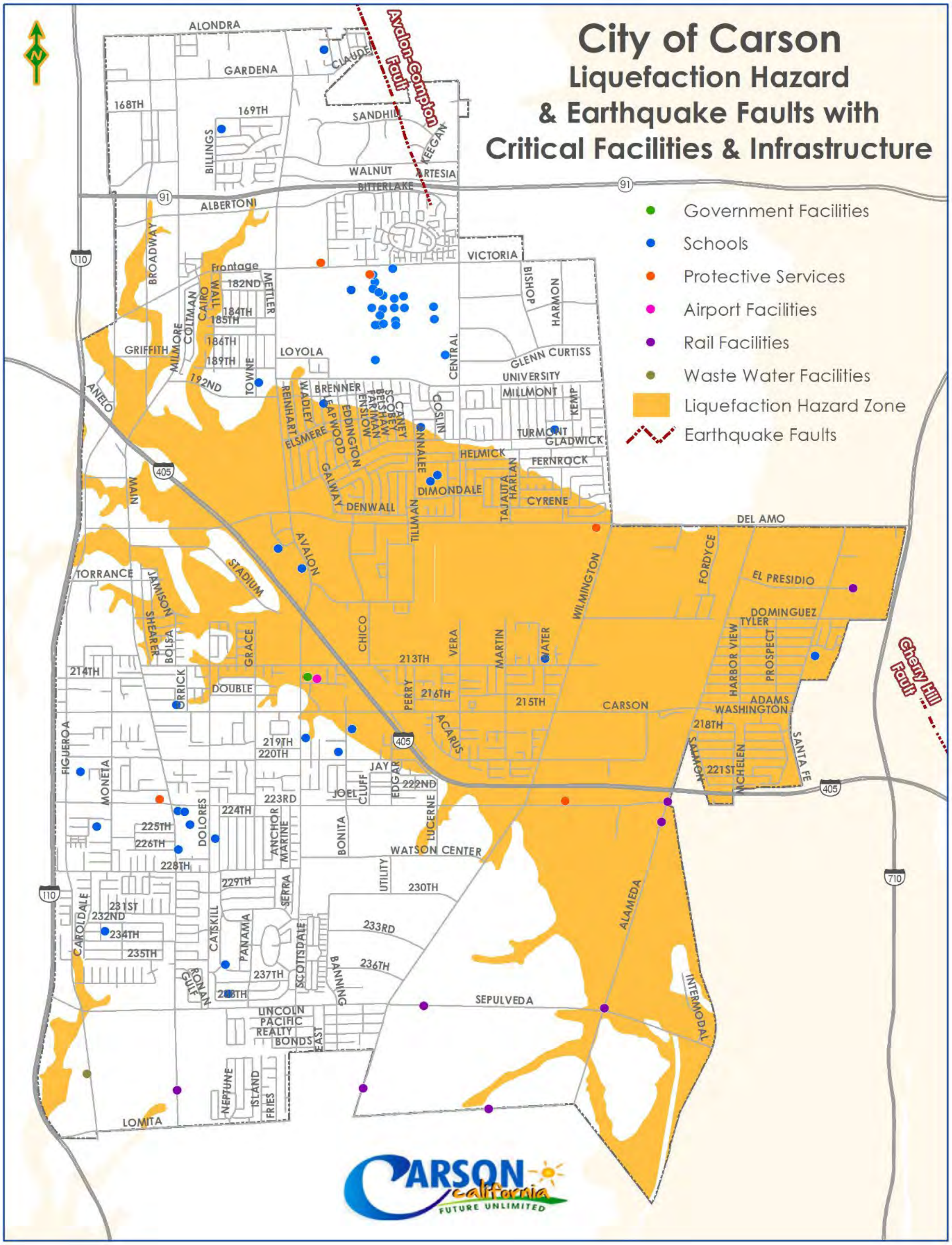
LIFELINES	IMPACT TYPE	DESCRIPTION
Safety & Security		Earthquakes can cause significant damage to infrastructure, leading to hazardous situations like building collapses, gas leaks, and fires. Emergency services such as police, fire, and rescue teams would be heavily involved in immediate response efforts.
Transportation		Earthquakes can damage roads, bridges, and public transportation systems, impeding mobility and rescue efforts. Restoring transportation is vital for response operations and for the community to begin returning to normalcy.

FIGURE 44 - CITY OF CARSON EARTHQUAKE FAULTS & FAULT ZONES WITH CRITICAL FACILITIES & INFRASTRUCTURE AS OF 2024



The entire City of Carson is at the highest risk of seismic activity. Therefore, all critical facilities within the jurisdiction are at risk for impact and damage. However, liquefaction zones are areas of water-logged sediments, at or near the ground, that lose their strength in response to strong ground shaking which can increase the risk from seismic activity. Within the City of Carson, there are 17 critical facilities within the liquefaction hazard zone, described in the map below.

FIGURE 45 - CITY OF CARSON CRITICAL FACILITIES WITHIN THE LIQUEFACTION ZONE AS OF 2024



Damages for a large earthquake in Southern California are likely to run into the billions of dollars. Although building codes are some of the most stringent in the world, tens of thousands of older existing buildings were built under much less rigid codes. California has laws affecting unreinforced masonry buildings (URM's) and although many building owners have retrofitted their buildings, hundreds of pre-1933 buildings still have not been brought up to current standards. The City of Carson does not have any unreinforced masonry buildings.

Chino M6.7

Based on the M6.7 Chino Earthquake Scenario, there will be no significant damage to critical facilities according to the HAZUS analysis described in the table below.

TABLE 22. CHINO M6.7 ESTIMATED CRITICAL FACILITIES DAMAGE

CLASSIFICATION	TOTAL	FACILITIES		
		AT LEAST MODERATE DAMAGE >50%	COMPLETE DAMAGE >50%	WITH FUNCTIONALITY >50% ON DAY 1
Hospitals	0	0	0	0
Schools	31	0	0	31
EOCs	1	0	0	1
Police Station	3	0	0	3
Fire Station	5	0	0	5

*Before the earthquake scenario, the region had 0 hospital beds available for use, therefore on the day of the earthquake scenario, the model estimates that only 0 hospital beds are available for use by patients already in the hospital and those injured by the earthquake.

Newport-Inglewood (Northern Epicenter) M7.2

Based on the M7.2 Newport-Inglewood Earthquake Scenario, HAZUS estimates that most of the damage to critical facilities will impact schools. In fact, 12 schools are estimated to be at least moderately damaged more than 50 percent, described in the table below.

TABLE 23. NEWPORT-INGLEWOOD (NORTHERN EPICENTER) M7.2 ESTIMATED CRITICAL FACILITIES DAMAGE

CLASSIFICATION	TOTAL	FACILITIES		
		AT LEAST MODERATE DAMAGE >50%	COMPLETE DAMAGE >50%	WITH FUNCTIONALITY >50% ON DAY 1
Hospitals	0	0	0	0
Schools	31	12	0	7

CLASSIFICATION	TOTAL	FACILITIES		
		AT LEAST MODERATE DAMAGE >50%	COMPLETE DAMAGE >50%	WITH FUNCTIONALITY >50% ON DAY 1
EOCs	1	0	0	1
Police Station	3	0	0	2
Fire Station	5	0	0	1

*Before the earthquake scenario, the region had 0 hospital beds available for use, therefore on the day of the earthquake scenario, the model estimates that only 0 hospital beds are available for use by patients already in the hospital and those injured by the earthquake.

Newport-Inglewood (Southern Epicenter) M7.2

Based on the M7.7 Newport-Inglewood (Southern Epicenter) Earthquake Scenario, HAZUS estimates that most of the damage to critical facilities will impact schools. In fact, 12 schools are estimated to be at least moderately damaged more than 50 percent, described in the table below.

TABLE 24. NEWPORT-INGLEWOOD (SOUTHERN EPICENTER) M7.2 ESTIMATED CRITICAL FACILITIES DAMAGE

CLASSIFICATION	TOTAL	FACILITIES		
		AT LEAST MODERATE DAMAGE >50%	COMPLETE DAMAGE >50%	WITH FUNCTIONALITY >50% ON DAY 1
Hospitals	0	0	0	0
Schools	31	12	0	4
EOCs	1	0	0	0
Police Station	3	0	0	0
Fire Station	5	0	0	1

*Before the earthquake scenario, the region had 0 hospital beds available for use, therefore on the day of the earthquake scenario, the model estimates that only 0 hospital beds are available for use by patients already in the hospital and those injured by the earthquake.

Palos Verdes M7.7

Based on the M7.7 Palos Verdes Earthquake Scenario, HAZUS estimates that most of the damage to critical facilities will impact schools. In fact, 12 schools are estimated to be at least moderately damaged more than 50 percent, described in the table below.

TABLE 25. PALOS VERDES M7.7 ESTIMATED CRITICAL FACILITIES DAMAGE

CLASSIFICATION	TOTAL	FACILITIES		
		AT LEAST MODERATE DAMAGE >50%	COMPLETE DAMAGE >50%	WITH FUNCTIONALITY >50% ON DAY 1
Hospitals	0	0	0	0
Schools	31	12	0	16
EOCs	1	0	0	1
Police Station	3	0	0	3
Fire Station	5	0	0	5

*Before the earthquake scenario, the region had 0 hospital beds available for use, therefore on the day of the earthquake scenario, the model estimates that only 0 hospital beds are available for use by patients already in the hospital and those injured by the earthquake.

Puente Hills M7.1

Based on the M7.7 Palos Verdes Earthquake Scenario, HAZUS estimates that there will be limited damage to critical facilities. Data on the number of critical facilities damages at least moderately, or completely are described in the table below.

TABLE 26. PUENTE HILLS M7.1 ESTIMATED CRITICAL FACILITIES DAMAGE

CLASSIFICATION	TOTAL	FACILITIES		
		AT LEAST MODERATE DAMAGE >50%	COMPLETE DAMAGE >50%	WITH FUNCTIONALITY >50% ON DAY 1
Hospitals	0	0	0	0
Schools	31	0	0	26
EOCs	1	0	0	1
Police Station	3	0	0	3
Fire Station	5	0	0	5

*Before the earthquake scenario, the region had 0 hospital beds available for use, therefore on the day of the earthquake scenario, the model estimates that only 0 hospital beds are available for use by patients already in the hospital and those injured by the earthquake.

(5) Natural, Cultural, and Historic Resources

Since the entire planning area is at high risk of earthquakes impacts and damage, all 49 identified historical and cultural properties are at risk as well. Individual site assessment of each property to identify the seismic risk of the property would be helpful to understand and prevent damage to properties from earthquakes in the future. Many historic buildings were built before seismic codes were adopted. Although historic and older buildings can be retrofitted to survive earthquakes, the process of doing so much damage or destroying the very features or characteristics of what makes the building so significant. Fortunately, that are many hazard mitigation activities to retrofit buildings that will preserve the building as well. FEMA, the National Parks Service, and other federal agencies have more information on seismic rehabilitation of historic buildings to prevent future damage to the building and people during earthquake events. [31]

(6) Risk Analysis

High - Earthquakes pose a high risk to the planning area. Forecasting the exact severity of casualties, property damage, and cascading effects from future seismic events in the Los Angeles Basin and the City of Carson remains challenging. The impact of earthquakes varies widely, influenced by factors such as the earthquake's intensity, epicenter location, population density, the time of occurrence, soil composition under structures, and building construction quality. Nonetheless, the potential for a major earthquake to significantly affect the city and its community is a constant presence.

Should a major earthquake occur along the fault systems near Carson, the consequences could be profound for both the community and city operations. Such an event would not only cause immediate casualties and damage but also create widespread, long-term impacts across the broader Los Angeles Basin. This would result in an overwhelming demand for critical assistance and strain available emergency resources.

A considerable challenge regarding earthquakes is they generally occur without warning. The fault systems surrounding the region cross major transportation routes potentially reducing the availability of access and the supply chain. The geographic location of the City of Carson is surrounded by areas composed of alluvial soils. In many cases, these sediment-based soils are loose and expose the potential for liquefaction. The majority of the interior Los Angeles Basin has identified a moderate risk of liquefaction including neighborhoods on the north, south, and east of the city. The impacts of such a seismic event would be felt directly in homes and workplaces throughout Carson. In the immediate aftermath, the city might need to independently address critical needs due to the scale of the disaster.

The known fault systems generating the threat to Los Angeles County exist on all sides of the area including near the City of Carson. As such, the proximity and potential for large earthquake development from these surrounding systems expose significant vulnerabilities. The potential for earthquake damaged structures being left uninhabitable, including CSU Dominguez Hills campus residence halls will result in numerous displaced individuals and households. City buildings and equipment will be exposed to significant damage resulting in a reduction of

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[31] Preservation Brief 41: The Seismic Rehabilitation of Historic Buildings (nps.gov) https://www.nps.gov/orgs/1739/upload/preservation-brief-41-seismic-rehabilitation.pdf

services and capabilities of the city to address post incident response and stabilization needs. The lack of earthquake insurance will cause extreme financial burdens on those affected.

Carson's population is particularly susceptible to the far-reaching effects of major ground shaking. Additionally, based on future development trends, it is likely that more people and structures will be at risk of earthquake impacts as the population and housing supply increases. The psychological and social impacts of a significant earthquake can be profound, inducing widespread fear and reluctance to return indoors, especially amidst ongoing aftershocks. These effects are intensified among populations with specific vulnerabilities or access limitations, underscoring the need for comprehensive emergency preparedness and response strategies.

Elements of the vulnerability to a major earthquake in the city will vary depending on when the earthquake were to strike. The primary basis of vulnerability is based on the population affected and the built environment exposed. In general, newer construction will be more earthquake resistant than older buildings as building codes and construction technology have improved. A locally centered earthquake, even from moderate events, would have the potential for more damaging results when associated with the moderate liquefaction zones of the area. This would particularly be seen with greater damage to unreinforced masonry buildings.

E) EXTREME HEAT

i) Hazard Profile

Extreme heat, as per the guidance provided by LA County Ready.gov, encompasses a prolonged period characterized by sweltering temperatures exceeding 90 degrees Fahrenheit coupled with high humidity levels. These episodes, often referred to as, "heat waves," lack a universal definition but are typically delineated by the potential for dangerously hot weather conditions capable of causing heat-related illnesses and even fatalities. [32]

Remarkably, heat-related issues pose a significant threat and constitute one of the foremost weather-related causes of mortality in the United States. Annually, they claim the lives of over a thousand individuals. Those most susceptible to the adverse effects of extreme heat span a diverse spectrum and include, but are not limited to, vulnerable populations such as infants and young children, older adults, individuals with chronic medical conditions, pregnant women, and those with disabilities. [33]

Furthermore, the United States, with particular emphasis on the Los Angeles region, is grappling with worsening conditions regarding extreme heat events. This trajectory is linked to the ongoing and anticipated shifts in our climate. As climate change continues to unfold, it is expected that both the frequency and severity of extreme heat events will escalate, heightening the urgency for proactive measures to reduce risk to communities and mitigate the associated risks. Therefore, it is imperative for regions like Los Angeles to prepare for these impending challenges and enact robust strategies to safeguard the health and well-being of their residents in the face of rising temperatures.

(1) Duration

In recent years, the average heat wave in major U.S. urban areas has been about four days long which is about a day longer than the average heat wave in the 1960's.[34] The figure below shows the increase in the average length of the annual heat wave season (days) as well as the change is frequency, duration, and intensity over the past several decades.

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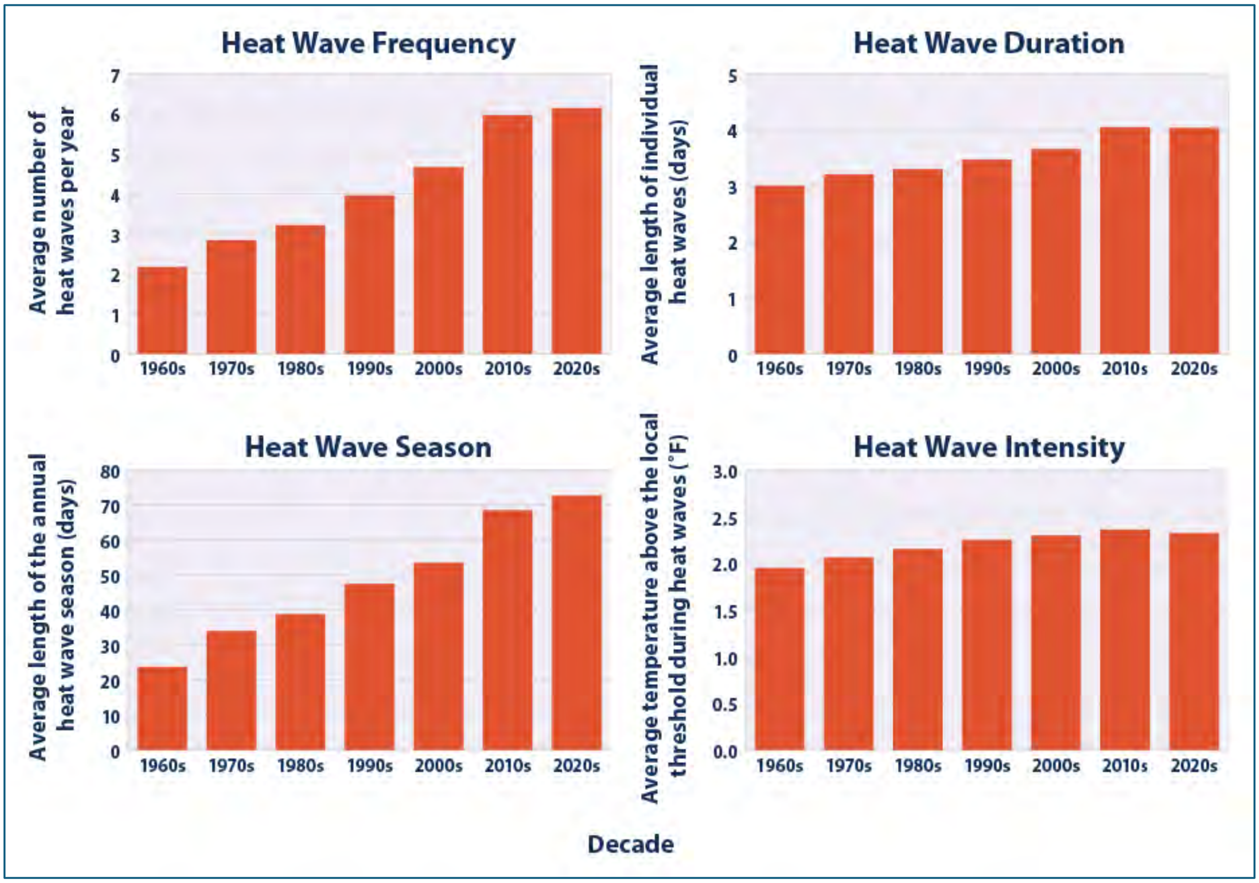
[32] NOAA – National Weather Service. Heat Safety Tips & Resources https://www.weather.gov/safety/heat
[33] SCAG – Extreme Heat & Public Health Report. September 2020 https://scag.ca.gov/sites/main/files/file-attachments/extremeheatpublichealthreportfinal_09302020.pdf?1634674354
[34] Climate Change Indicators: Heat Waves | US EPA https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves

FIGURE 46. HEAT WAVE CHARACTERISTICS IN THE UNITED STATES BY DECADE, 1961-2021, EPA



(2) Seasonality

Extreme heat events are likely to occur in the summer months when temperatures increase, and high pressure develops.

(3) Speed of Onset

Extreme heat events are events that constitute a period of high heat for the region for two to three days. Therefore, the speed of onset for these events takes several days. [35]

(4) Location

Broadly, extreme heat is a hazard which is present across the entirety of the planning area. Minute differences may be present in areas with more shade (such as parks) or where coastal

[35] Extreme Heat | Ready.gov https://www.ready.gov/heat

breezes can flow unobstructed. However, such areas should not be considered less vulnerable to extreme heat for the purposes of mitigation.

ii) Magnitude

The National Weather Service issues heat-related advisories and warnings when there is a potential threat of heat affecting the specified geographical area.

TABLE 27: NATIONAL WEATHER SERVICE HEAT WATCHES AND WARNINGS

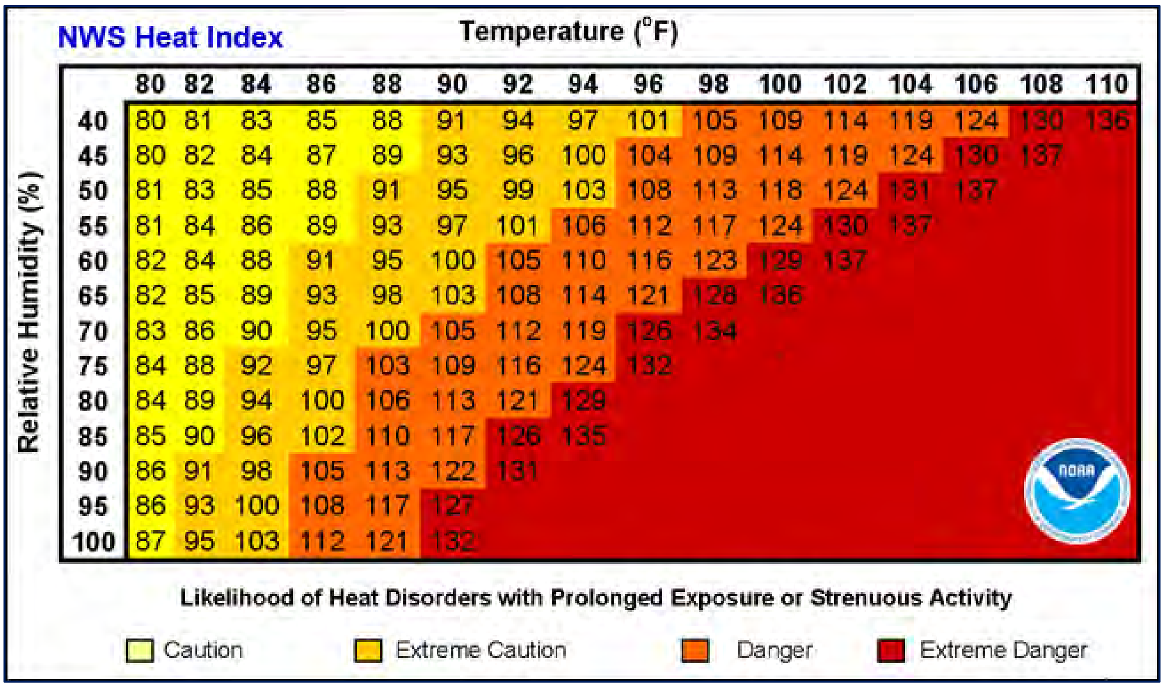
HEAT-RELATED PRODUCT	DESCRIPTION
Excessive Heat Warning (Dark Purple)	An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and night-time air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas not used to extreme heat conditions. If you don't take precautions immediately when conditions are extreme, you may become seriously ill or even die.
Excessive Heat Watches (Dark Red)	Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.
Heat Advisory (Orange)	A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Advisory is when the maximum heat index temperature is expected to be 100° or higher for at least 2 days, and night-time air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas that are not used to dangerous heat conditions. Take precautions to avoid heat illness. If you don't take precautions, you may become seriously ill or even die.
Excessive Heat Outlooks (Light Yellow)	The outlooks are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead-time to prepare for the event.

Source: National Weather Service (NWS)

(1) Heat Index

The Heat Index is a metric that considers both the actual air temperature and the relative humidity, providing a more accurate reflection of how hot it feels. Relative humidity represents the amount of moisture in the air compared to what it would contain if fully saturated, which depends on both moisture content and temperature. There exists a clear correlation between air temperature, relative humidity, and the heat index, such that as air temperature and relative humidity rise, the heat index follows suit, and conversely, it drops when they decrease. The National Weather Service has created a Heat Index Chart, shown below, which illustrates how the Heat Index classifications change and intensify from "Caution" to "Extreme Danger" as both temperature and relative humidity increase.[36]

FIGURE 47: NATIONAL WEATHER SERVICE - HEAT INDEX



Source: National Weather Service (NWS) 2024

The classifications of the Heat Index describe the risk of heat disorders with prolonged exposure or strenuous activity. As the heat index increases the heat index classification increases as well and darkens from light yellow to red. This also increases the likelihood for individuals to experience adverse effects on the body. The description of the heat index can affect the body is described in the table below.

TABLE 28: HEAT INDEX CLASSIFICATIONS & EFFECTS ON THE BODY

CLASSIFICATION	HEAT INDEX	EFFECT ON THE BODY
Caution (Light Yellow)	80F-90F	Fatigue possible with prolonged exposure and/or physical activity

[36] NOAA – National Weather Service. What is Heat Index? https://www.weather.gov/ama/heatindex

Extreme Caution (Yellow)	90F-103F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger (Orange)	103F-124F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged and/or physical activity
Extreme Danger (Dark Red)	125F or higher	Heat stroke highly likely

Source: National Weather Service (NWS)

(2) Wet Bulb Globe Temperature

The Wet Bulb Globe Temperature (WBGT) is a comprehensive meteorological metric that encompasses several vital weather parameters, including temperature, humidity, wind, solar radiation, and more. This multi-faceted index plays a pivotal role in assessing the risk of heat stress, particularly for populations engaging in outdoor activities, such as outdoor workers and athletes.

WBGT serves as a crucial tool for making informed decisions when it comes to safeguarding individuals or entire communities during hot and potentially hazardous weather conditions. Its application extends to various scenarios, where mitigating the effects of extreme heat is paramount.

For instance, in the context of outdoor work, WBGT can guide recommendations for necessary modifications. These may involve advising outdoor laborers to curtail strenuous activities during periods of elevated WBGT, suggesting shifts that begin earlier or later in the day when conditions are less oppressive, and ensuring the availability of shaded areas to allow for periodic relief from the heat.

(3) Heat Risk

The National Weather Service (NWS) HeatRisk prototype is a color-numeric-based index that provides a forecast of the potential level of risk for heat-related impacts to occur over a 24-hour period. That level of risk is illustrated by a color/number along with identifying the groups potentially most at risk at that level. Each HeatRisk level is also accompanied by recommendations for heat protection and can serve as a useful tool for planning for upcoming heat and its associated potential risk. Based on the NWS high resolution national gridded forecast database, a daily HeatRisk value is calculated for each location from the current date through seven days in the future.

The HeatRisk prototype takes into consideration:

- How unusually above normal the temperatures are at your location (is it warmer than the top 5% of hottest days in the period of record for this date?).

- The time of the year (for example, is this early season heat that you likely haven't become used to, typical mid-summer heat, or late season heat that you may have become more used to?).
- The duration of unusual heat (for example, are temperatures overnight at levels that would lower heat stress, maintain it, or will unusually warm overnight low temperatures add to heat stress into the next day).
- If those temperatures are at levels that pose an elevated risk for heat complications, such as heat stress, based on peer-reviewed science and heat-health thresholds supported by the Centers for Disease Control and Prevention (CDC) national data sets.

The Heat Risk tool can be used to enhance the wellbeing of communities and individuals by reducing potential risks of extreme heat. Adverse impacts from weather events generally affect historically underserved communities and the Heat Risk tool seeks to provide support for those communities and be better prepared. Groups that are heat-sensitive or heat vulnerable face a higher risk of heat-related illnesses and adverse impacts than others. These groups include:

- The elderly and very young
- People experiencing homelessness.
- Individuals on certain medications and/or those with pre-existing conditions increase heat sensitivity.
- Outdoor workers, especially new workers, temporary workers, workers that are not yet accustomed to working outdoors, and those working in non-cooled spaces.
- Individuals exercising or engaging in strenuous activities outdoors during the heat of day, especially those that are not accustomed to the level of heat, not drinking enough fluids, and those new to that type of activity.
- Individuals without adequate cooling mechanisms or proper hydration
- Individuals not acclimated to the level of heat expected, especially those that are new to a warmer climate.
- Individuals are sensitive to poor air quality, which can be exacerbated by heat waves.
- Individuals living in low-income communities.

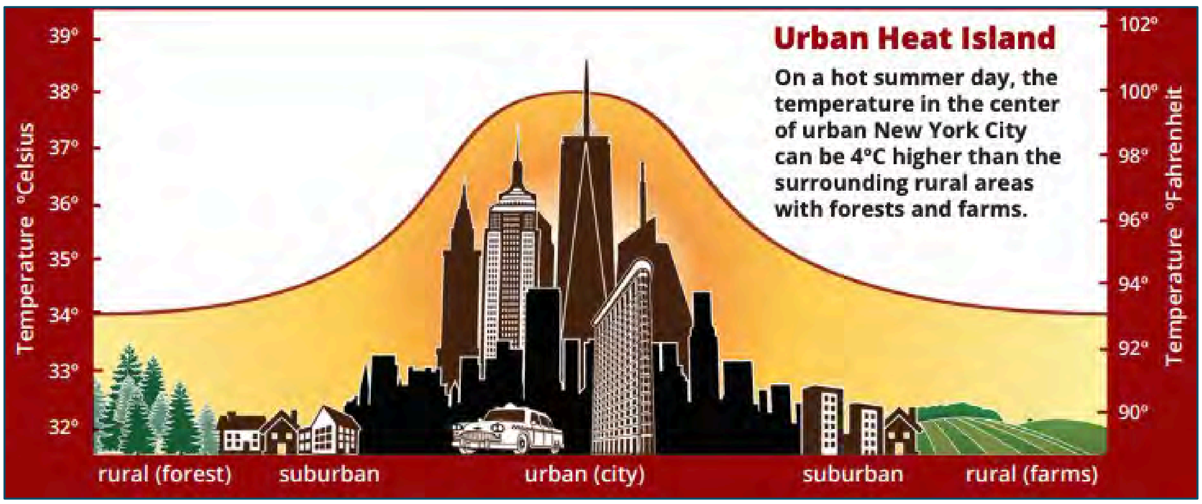
(4) Heat Tools and the National Weather Service Heat Products

The National Weather Service (NWS) uses the various tools described including the Wet Bulb Globe Temperature tool, Heat Risk tool, and the Heat Index to inform the issuance of NWS official heat watches, warnings, and advisories. Each tool provides a different perspective beyond what the actual air temperature is and can provide a deeper level of understanding.

(5) Urban Heat Islands

A review of research studies and data found that in the United States, the heat island effect results in daytime temperatures in urban areas about 1–7°F higher than temperatures in outlying areas and nighttime temperatures about 2–5°F higher. Humid regions (primarily in the eastern United States) and cities with larger and denser populations experience the greatest temperature differences. Research predicts that the heat island effect will strengthen in the future as the structure, spatial extent, and population density of urban areas change and grow. The image below depicts the differences in temperatures between urban and rural areas.

FIGURE 48: URBAN HEAT ISLAND



Source: Climate at a Glance 2024

Large urban areas, like the City of Carson, often experience higher temperatures than rural areas. This phenomenon is known as the Urban Heat Island and can increase the retention of heat and heat exposure to a population. In urban settings this occurs when natural vegetation is replaced with urban development such as roads and buildings. According to the City of Carson General Plan, Carson typically experiences a mild climate to its close location to the coastline, however due to urban development and concentrations in heat-absorbing surfaces, the city experiences increasing temperatures.

Higher concentrations in Land Surface Temperatures, shown below, are in the northern and east-central part of the city. Vegetation tends to provide a cooling effect to an environment, also shown is the existing tree canopy cover in the City of Carson. Most of the areas with tree canopy are limited to parks, some major streets, and certain residential neighborhoods. The Land Surface Temperature map and the Tree Canopy map show that areas with higher tree canopy coverage correspond with areas that have cooler temperatures despite surrounding heat pockets.[37]

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[37] City of Carson General Plan 2040

FIGURE 49: LAND SURFACE TEMPERATURE HEAT MAP AS OF 2024

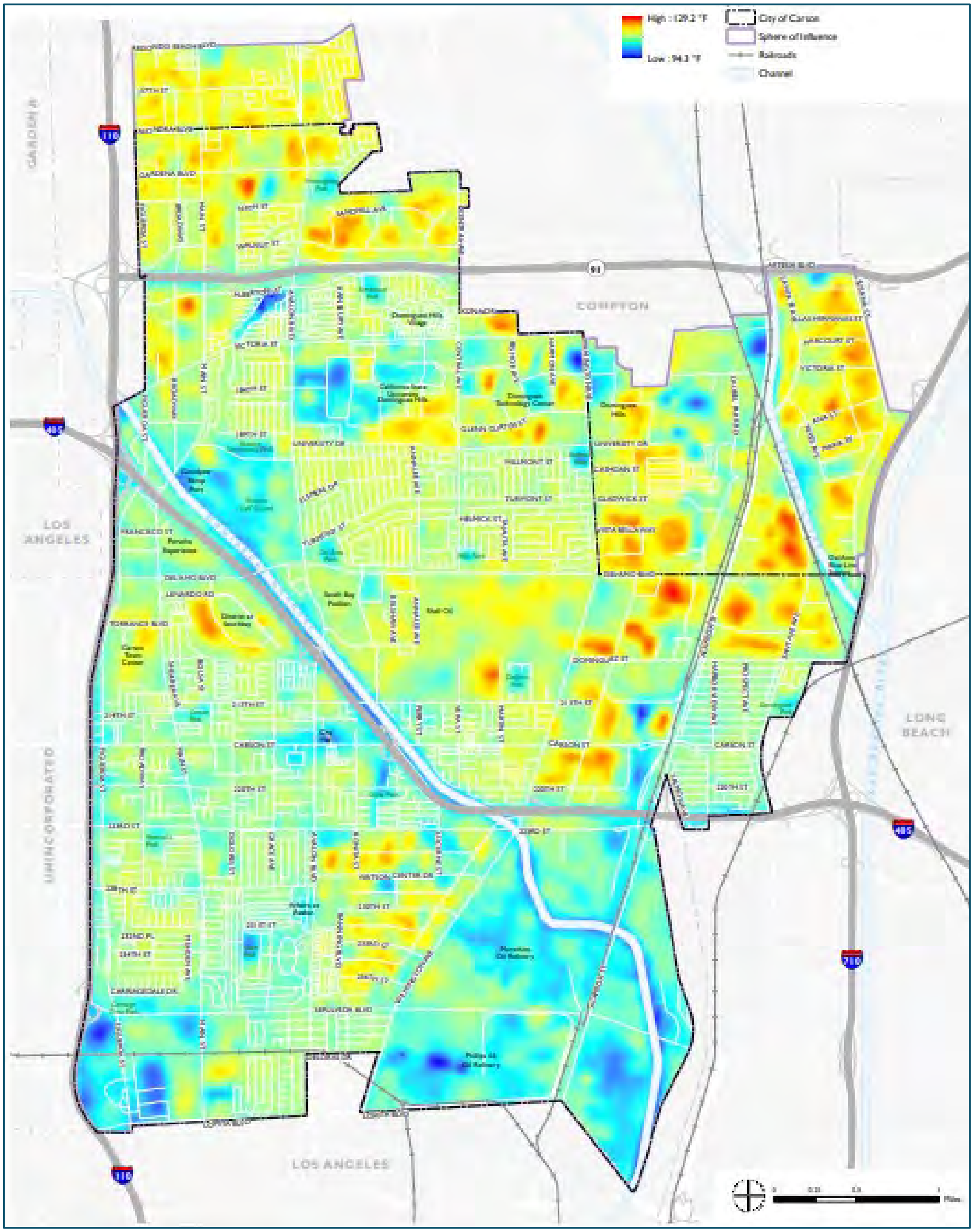
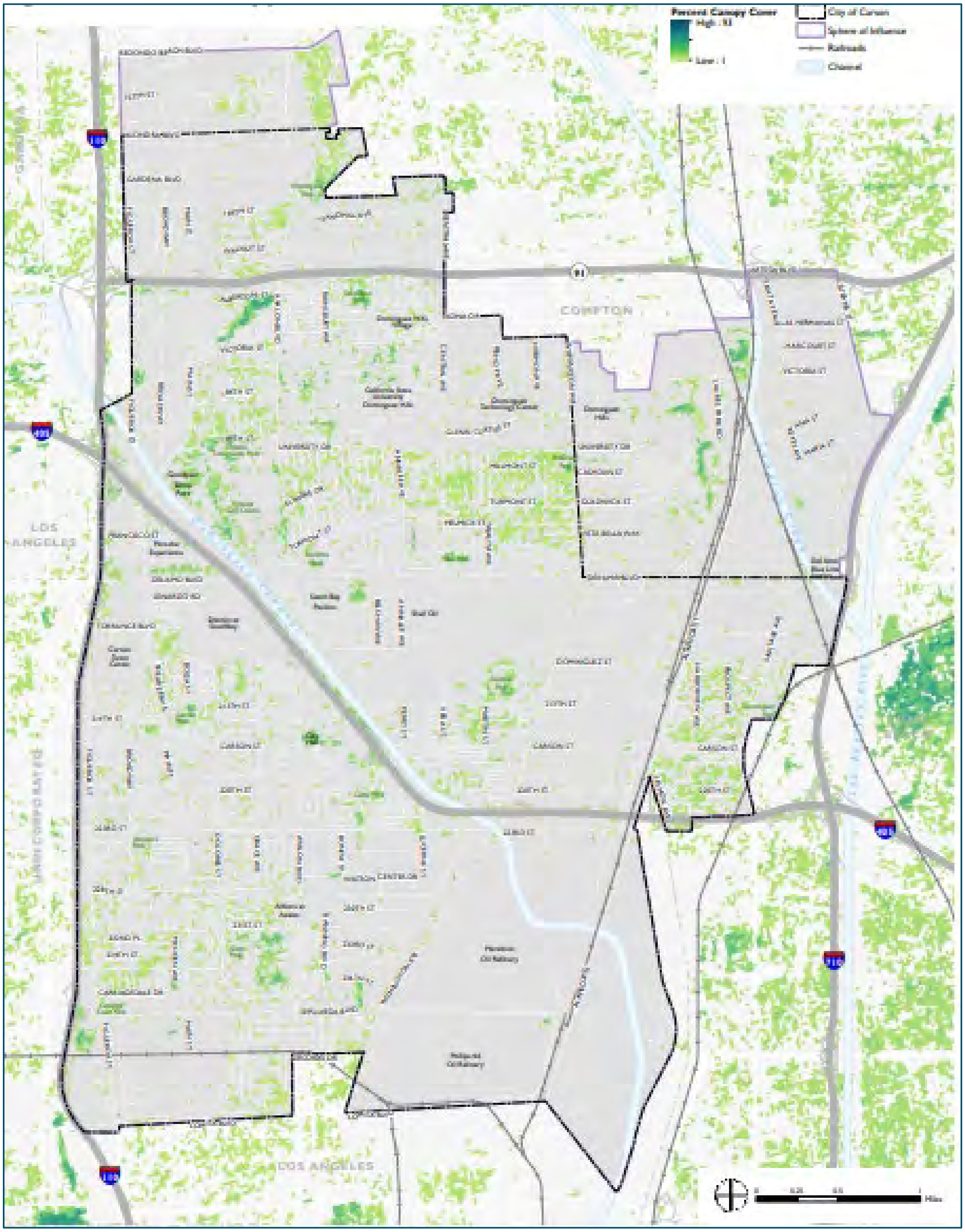


FIGURE 50: TREE CANOPY COVER IN THE CITY OF CARSON AS OF 2024



iii) Extent

Large - Across the State of California, and notably in Southern California, the region is grappling with the far-reaching consequences of extreme heat. This pressing issue has repercussions that extend beyond immediate discomfort, affecting various aspects of life and the environment. Furthermore, the specter of extreme heat is poised to become a greater challenge in the years ahead, with its frequency, duration, and intensity projected to intensify significantly.

The City of Carson, situated within this dynamic Southern Californian landscape, is not immune to the escalating threat of extreme heat. As a result of climate change and global warming trends, the region is slated to experience more frequent, prolonged, and severe heat waves. This unwavering trend underscores the need for the City of Carson to be proactive in addressing the ongoing and future impacts of extreme heat.

Mitigating the effects of extreme heat entails a multifaceted approach that encompasses various sectors, including public health, infrastructure, and cultivating community resilience. It involves strategies such as implementing heat action plans, enhancing cooling centers, and promoting public awareness and preparedness. By acknowledging the increasing significance of extreme heat and taking proactive measures, the City of Carson can work toward ensuring the safety and well-being of its residents in the face of this growing climate challenge.

iv) Past Occurrences

Little data exists on historical occurrences of extreme heat events in the City of Carson. However, Historical extreme heat events in Los Angeles County have shown a notable increase since the mid-20th century.

NOAA Storm Events Database contains the records of significant weather events to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Additionally, the database captures events that are rare and unusual, and other significant meteorological events. The database archives data since January 1950.

Since 1950, there has been a significant rise in extremely hot days and nights, with nighttime heat waves becoming more frequent since the mid-1970s. The warm months in California, including those impacting Los Angeles County, have become increasingly hotter over the past decades. The number of extreme heat events, the hottest days, and nights, has particularly risen in the last 30 years, with nights warming more than days.[38]

The data reveals that since 1950, the total extreme heat days between April and October at various weather stations statewide have increased at a rate of about one extreme heat day per year. More dramatically, extreme heat nights have increased at a rate of 11 extreme heat nights

[38] NOAA, NCEI, Storm Events Database

per year, with both extreme heat days and nights increasing at a faster rate over the last 30 years than the long-term trend.[39]

One of the most notable extreme heat events occurred in 2006 when a record-breaking heat wave resulted in over 16,000 emergency room visits, more than 1,100 hospitalizations, and at least 140 deaths. This event underscores the severe impact such extreme temperatures can have on public health.[40]

As per the California State Hazard Mitigation Plan, which encompasses all counties, including Los Angeles County, where the City of Carson is situated, it is worth noting that since 2018, there have been two notably significant extreme heat events that have directly affected Los Angeles County. The last of which occurred in early September 2022.

TABLE 29: EXTREME HEAT EVENTS IN THE CITY OF CARSON

HAZARD	DATE	DEATHS, INJURIES, DAMAGES	DESCRIPTION
Extreme Heat	9/23/2007	No Data Available for City of Carson**	The heat wave which started at the end of August continued into the first few days of September. The combination of above normal temperatures and relative humidity continued to produce excessive heat conditions across sections of Southern California. At the end of the heat wave, 18 heat-related deaths were reported across Los Angeles County.
Extreme Heat	09/7/2022	No Data Available for City of Carson**	In early September 2022, a long-lasting heat dome settled over the U.S. West and brought scorching temperatures that set record highs. The extreme heat fueled wildfires and stressed the power grid before an eastern Pacific tropical storm moved into the region and broke the warm spell. On September 7, 2022, more than 61 million people were under active extreme heat advisories, watches, and warnings, according to the National Weather Service.

Source: NOAA NCEI Storm Events Database

[39] California Office of Environmental Health Hazard Assessment. https://oehha.ca.gov/epic/changes-climate/extreme-heat-events

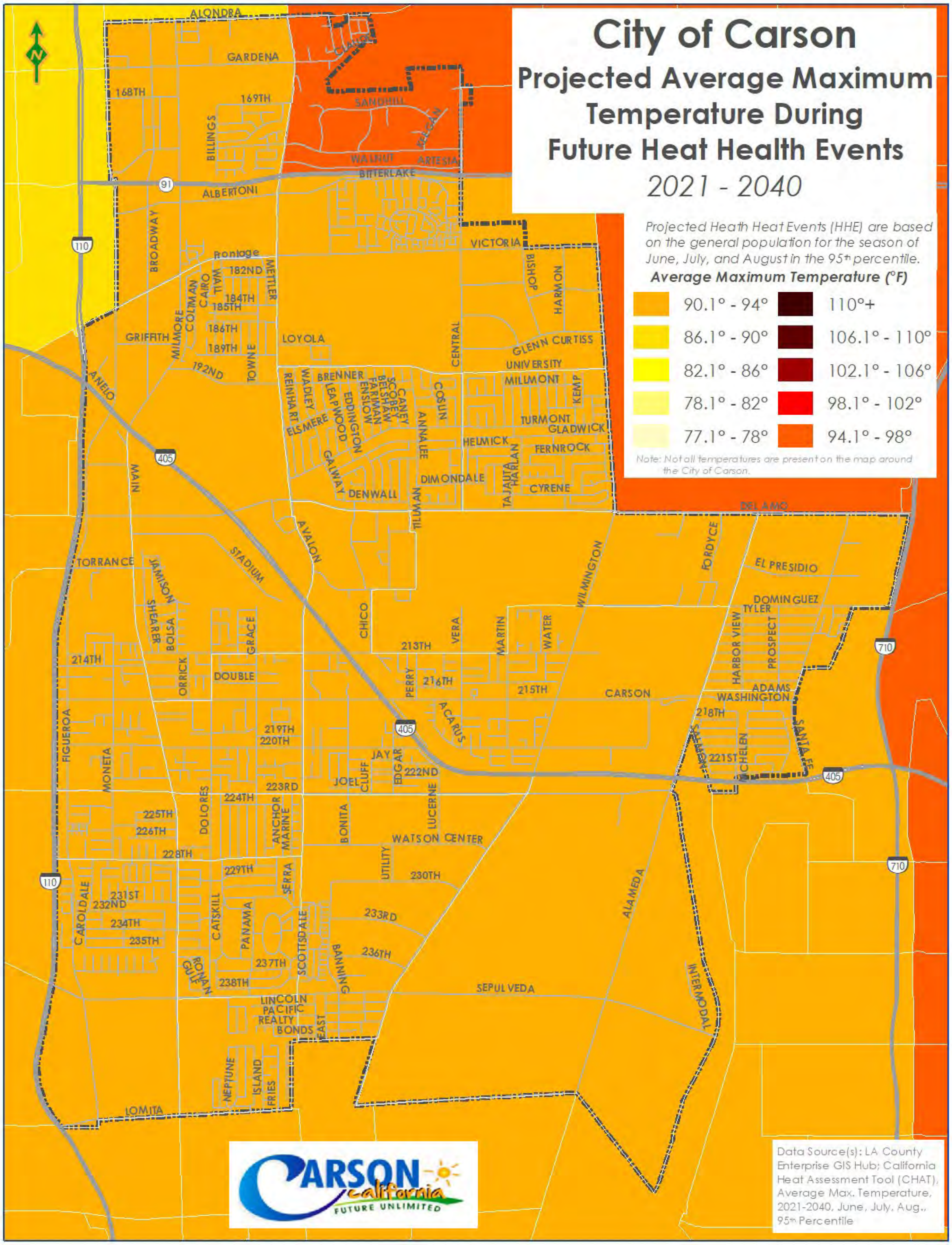
[40] Extreme heat events | OEHHA (ca.gov) https://oehha.ca.gov/epic/changes-climate/extreme-heat-events

v) Future Probability

Highly Likely - Temperatures in the State of California are projected to increase overall. As a part of the California's Changing Climate 2018 report, by 2100 the average annual maximum daily temperature is projected to increase by 5.6-8.8 degrees Fahrenheit. As a result, heat waves are expected to increase in frequency, duration, and magnitude. Los Angeles County will experience an average of nine days of extreme heat per year, growing to 12 days per year, by the final decades of the century.

The California Heat Assessment Tool (CHAT) was funded and developed to better understand heat vulnerability driven by climate changes to support mitigating public health impacts of extreme heat events in the future. According to CHAT, the projected Average Maximum Temperature during future Heat Health Event (HHEs) for the City of Carson is projected to reach 94-98 degrees Fahrenheit, below.

FIGURE 51 - CITY OF CARSON PROJECTED AVERAGE MAXIMUM TEMPERATURE DURING FUTURE HEAT HEALTH EVENTS (2021-2040)



vi) Secondary Hazards

Extreme heat can cause secondary hazards to occur including but not limited to poor air quality, power outages, and wildfires. Additional information about secondary hazards to extreme heat is described in the table below.

TABLE 30. SECONDARY HAZARDS FROM EXTREME HEAT

SECONDARY HAZARD	DESCRIPTION
Power Outage	Heat waves can put stress on the power grid, as the usage of air conditioning increases to keep people cool around the same time, which can have devastating impacts. During the heat wave in September of 2022, over 100,000 customers in the Los Angeles area were left without power from different power providers. Power outages can quickly lead to heat-related illnesses or even death. For example, individuals that rely on electrically powered medical equipment will not be able to use their equipment during a power outage and at increased risk.[41] The U.S. Department of Health & Human Services (HHS) developed the emPOWER map to identify areas of individuals who are electricity dependent (i.e., use durable medical and assistive equipment and devices to live independently in their homes). The 90745-zip code in Carson has a high number of individuals who are electricity-dependent and may be at risk during a power outage.
Air Quality[42]	Air pollutants such as ozone and particulate matter (PM) increase the amount and seriousness of lung and heart disease and other health problems. Carson is near major sources of pollution due to nearby ports, oil refineries, rail yards, and major freeways. Because of this, the City of Carson is at risk of air pollution and the subsequent adverse health impacts. The California Communities Environmental Health Screening Tool: CalEnviroScreen 4.0 was released in October 2021 and helps identify communities that are disproportionately burdened by multiple sources of pollution. According to the tool, the City of Carson is in an area with a higher percentile of toxic air release from facilities. Existing sources of pollution in the area can exacerbate poor air pollution days due to extreme heat and can pose a risk for the city and its residents.

[41] Scientific American. Increasing Power Outages Don't Hit Everyone Equally. https://www.scientificamerican.com/article/increasing-power-outages-dont-hit-everyone-equally1/

[42] US EPA Research on Health Effects from Air Pollution. https://www.epa.gov/air-research/research-health-effects-air-pollution

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets to better understand and mitigate risk from hazards.

Extreme heat events have no defined geographic boundaries and can affect the entire City of Carson. Located in Southern California's Los Angeles County, Carson experiences a Mediterranean climate characterized by warm, dry summers and mild winters. However, climate change and urban heat island effects have increased the frequency and intensity of extreme heat events in the region. All existing buildings, infrastructure, and critical facilities in Carson are exposed to extreme temperatures, but they are unlikely to sustain significant physical damage solely due to heat. Therefore, estimated property losses from extreme heat are minimal. **Nevertheless, the impact on public health and safety can be significant.**

Vulnerability of Populations

Extreme heat poses a substantial risk to the health and well-being of Carson's residents. Vulnerable populations include:

- Elderly Residents: Approximately 12.9% of Carson's population is aged 65 and over. The elderly are more susceptible to heat-related illnesses due to physiological factors and may have underlying health conditions that exacerbate the effects of heat.
- Young Children: Children under the age of 5 comprise about 5.7% of the population. They are less able to regulate their body temperature and rely on caregivers to protect them from heat exposure.
- Low-Income Households: An estimated 9.5% of Carson's residents live below the poverty level. These individuals may lack access to air conditioning or be unable to afford increased energy costs during heat waves.
- Outdoor Workers: A significant portion of the workforce in Carson is employed in industries that require outdoor labor, such as construction, landscaping, and logistics. These workers face increased risk due to prolonged exposure to high temperatures.
- Medically Fragile Individuals: People with chronic illnesses, disabilities, or who are medically underserved are at heightened risk during extreme heat events.

Public Health Impacts

Heat-related illnesses can range from mild conditions like heat cramps to severe, life-threatening conditions such as heatstroke. Symptoms may include dizziness, nausea, headaches, rapid heartbeat, and, in severe cases, loss of consciousness. Without prompt treatment, heatstroke can be fatal. During extreme heat events, mortality from all causes can increase, with heat acting as a contributing factor to deaths from cardiovascular, respiratory, and other illnesses.

Secondary Impacts

Extreme heat can lead to a variety of secondary impacts:

- Increased Energy Demand: High temperatures drive up the use of air conditioning, leading to peak energy demand. This can strain the electrical grid, potentially resulting in power outages or rolling blackouts, which further endanger vulnerable populations.
- Infrastructure Stress: Prolonged heat can cause roads to buckle and asphalt to soften, affecting transportation. Electrical infrastructure may also be stressed, leading to equipment failures.
- Wildfire Risk: Extreme heat conditions, especially when combined with low humidity and high winds, can increase the risk of wildfires in surrounding areas, which may impact air quality in Carson.
- Air Quality Degradation: High temperatures can exacerbate air pollution by increasing ground-level ozone formation, leading to smog and respiratory issues for residents.
- Water Supply Concerns: Heat waves can intensify drought conditions, affecting water availability for both residential and industrial use.

(1) People

Exposure to extreme heat is a critical health hazard, leading to illnesses, hospitalizations, and deaths. Conditions like heat exhaustion and heat stroke are direct threats, while extreme temperatures also contribute to cardiovascular diseases, causing heart attacks and strokes. The U.S. Centers for Disease Control and Prevention (CDC) indicates that heat exhaustion contributed to approximately 4.2 deaths per 1 million Californians last year, making extreme heat the deadliest weather hazard in the United States. This risk affects diverse populations disproportionately.

Athletes are particularly vulnerable due to their exposure to high temperatures, physical exertion, and often wearing heat-trapping gear, especially in direct sunlight or areas with poor air quality. Children, reliant on adults for their safety, may lack access to adequate cooling in places like schools or daycares, increasing their risk. Older adults, especially those with cardiovascular issues or other medical conditions, are more susceptible to the effects of extreme heat. This group is also at a disadvantage during power outages that accompany heat events, particularly those reliant on life-sustaining devices or who are socially isolated.

Workers, both outdoor[43] (like those in agriculture, construction, and emergency response) and indoor workers without access to cooling, face heightened risks of heat-related illnesses and injuries. Pregnant women are at an increased risk of complications like preterm birth, low birth weight, fetal death, and infant mortality due to extreme heat.[44] About one in four adults in the United States has a disability. Data from the American Community Survey indicates that in 2023 approximately one in eight non-institutionalized adults in the City of Carson has a disability. Therefore, there is a large population that can experience significant adverse impacts, even death, from extreme heat. They may also face challenges in accessing emergency warnings and accessible cooling shelters. Furthermore, access to green spaces which may provide some relief from extreme heat is not widely available. According to the U.S. Climate and Economic Screening Justice Tool, multiple census tracts within the City of Carson are among the lowest 10% of all U.S. census tracts regarding access to green space. However, this information draws upon information from 2010, and some areas within the City of Carson may have expanded access to green space since that time.

People experiencing homelessness, particularly in regions like the Los Angeles and South Coast area and the San Francisco Bay Area, are at a higher risk for heat-related issues due to a lack of reliable shelter. In Los Angeles County alone, home to more than 40 percent of California's unhoused population, the risks are exacerbated by high living costs and insufficient affordable housing. Additionally, people with chronic health conditions, such as heart disease, mental illness, poor blood circulation, and obesity, are more susceptible to heat-related illnesses, with certain medications potentially worsening the effects of extreme heat.

(2) Structures and Systems

Extreme heat events pose a substantial risk to properties and infrastructure within the City of Carson, as they have the potential to cause a range of adverse impacts. With rising temperatures and climate change projections indicating an increase in the frequency and severity of extreme heat events, it is essential to conduct a comprehensive vulnerability assessment to better understand and address the associated risks.

Properties within the City of Carson may face various vulnerabilities during extreme heat events. Vulnerable factors can include building materials, insulation, and roofing that may not be adequately designed to withstand prolonged high temperatures. This can lead to increased energy consumption for cooling, potential structural damage, and even health risks for occupants. Moreover, properties lacking sufficient vegetation or green spaces may experience

[43] National Integrated Heat Health Information System (NIHHIS) Who is most at risk to extreme heat? https://www.heat.gov/pages/who-is-at-risk-to-extreme-heat

[44] Kuehn, L., and S. McCormick, 2017: Heat Exposure and Maternal Health in the Face of Climate Change. Int. J. Environ. Res. Public Health, 14(8), 853, doi:10.3390/ijerph14080853.

amplified heat effects, contributing to the urban heat island effect and exacerbating local temperature disparities.

Critical facilities within the City of Carson are vital components of the community's infrastructure, providing essential services such as hospitals, emergency response centers, power substations, and water treatment plants. Given the increasing frequency and severity of extreme heat events due to climate change, it is imperative to conduct a comprehensive vulnerability assessment to evaluate the potential impacts on these critical facilities and develop effective mitigation strategies.

Extreme heat events can pose significant challenges to critical facilities. High temperatures can strain electrical grids, potentially leading to power outages, which can disrupt critical services and affect public safety. Air conditioning and cooling systems may be pushed to their limits, risking equipment failure and service interruptions. Moreover, extreme heat can adversely affect the health and well-being of facility staff, hampering their ability to provide essential services.

TABLE 31. POTENTIAL VULNERABILITY OF LIFELINES TO AN EXTREME HEAT EVENT

Lifelines	Impact Type	Description
Water & Wastewater Systems		During heatwaves, there can be an increased demand for water, potentially leading to shortages or water conservation measures.
Food, Shelter, & Housing		Extreme heat can render homes uninhabitable without adequate cooling, leading to a need for emergency shelters. Heatwaves can impact food storage and spoilage.
Health & Medical		Extreme heat can lead to a surge in health-related emergencies, such as heatstroke, dehydration, and respiratory conditions. Healthcare facilities might face increased demand, and the need for medical supplies and services may rise sharply.
Energy		High demand for cooling during extreme heat events can strain power grids, leading to outages. Fuel supply lines for these systems could also be impacted.

Lifelines	Impact Type	Description
Safety & Security		Emergency services may be in high demand, and there can be increased risks of accidents and injuries due to heat-related conditions. For example, heatwaves can exacerbate conditions like droughts, leading to wildfires.
Transportation		Extreme heat can affect transportation infrastructure. Heat can cause roads and railways to buckle.

(3) Natural, Cultural, and Historical Resources

Extreme temperatures could have significant impacts on the City of Carson's cultural and historic properties. There are 49 identified historical and cultural properties within the City of Carson. Several ways in which extreme temperatures could impact these properties include physical damage to artifacts and artwork, thermal stress, mold and pest infestation, energy costs, limited visitor access, outdoor cultural spaces, community events, historical landscapes, and damage to archives and records.

(4) Risk Analysis

High - Extreme heat events pose a high risk to the planning area. Extreme heat can cause significant impacts to infrastructure, the environment, and public health. Extreme temperatures can stress electrical grids causing loss of electricity, worsen air quality, and increase the risk of heat related illnesses. Extreme heat has been the greatest weather-related cause of deaths in the U.S. for the past 30 years. The City of Carson, situated in a region susceptible to increasing temperatures due to climate change, faces significant risks from extreme heat events. These risks manifest in various dimensions, impacting public health, infrastructure, local economy, and the environment. The most immediate and concerning risk is to public health. Extreme heat events can lead to heat-related illnesses such as heat exhaustion, heatstroke, and dehydration, especially among vulnerable groups like the elderly, children, and those with pre-existing health conditions. The increase in temperatures can exacerbate respiratory problems and could lead to higher mortality rates during prolonged heatwaves. Additionally, based on future development trends, it is likely that more people and structures will be at risk of drought impacts as the population and housing supply increases. An increase in population will likely increase the demand on the healthcare system as extreme heat events increase the risk of heat-related illnesses.

Economically, the city could face increased costs related to emergency response services, healthcare, and infrastructure maintenance. Businesses, particularly those reliant on outdoor activities or those without adequate cooling systems, may suffer reduced productivity and revenue losses during heat events.

In conclusion, the risk analysis for Carson City in the context of extreme heat events highlights the multifaceted threats posed by such phenomena. Addressing these risks requires a comprehensive approach involving public health planning, infrastructure resilience enhancement, economic support mechanisms, and environmental conservation strategies. Active engagement and preparedness at all levels – governmental, community, and individual – are essential to mitigate these risks effectively.

F) EXTREME COLD / WINTER WEATHER

i) Hazard Profile

What is considered an excessively cold temperature varies according to the normal climate for that region. However, when temperatures are far below normal, with higher wind speeds, heat leaves the human body more rapidly, which increases the possibility of negative effects from these extreme temperatures.[45]

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. When someone is suffering from hypothermia, body temperatures can become so low that they affect the brain, making it difficult for the victim to think clearly or move well. In the case of frostbite, the frozen tissue becomes numb, and the victim may be unaware that anything is wrong until someone else notices.[46] This makes hazards from extreme cold particularly dangerous, as people may not understand what is happening to them or know what to do about it.

The primary hazards from extreme cold are frostbite and hypothermia. Frostbite is caused by freezing of the skin and underly tissue. It causes a loss of feeling and color in the affected areas of the body, and most often affects the nose, chin, fingers, or toes.[47] It can be permanently damaging if not treated promptly and can lead to infection, nerve damage, or amputation in severe cases.[48] The risk of frostbite is increased in people with preexisting conditions, the elderly, people with reduced blood circulation, and people who are not dressed warmly enough for the conditions.

Hypothermia occurs when the body loses heat faster than it can produce heat, causing a dangerously low body temperature. A normal body temperature is around 98.6° F. Hypothermia occurs when your body temperature falls below 95° F.[49] As this happens, the heart and other essential organs cannot work properly. If hypothermia is not treated, it can lead to heart failure, respiratory failure, and eventually to death.

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[45] National Weather Service. *Stay Safe in the Extreme Cold.* Retrieved 12.07.23from: https://www.weather.gov/dlh/extremecold

[46] Centers for Disease Control and Prevention. *Extreme Cold: A Prevention Guide to Promote Your Personal Health and Safety.* Retrieved 12.07.23 from: https://www.cdc.gov/nceh/toolkits/winterweather/default.html

[47] Mayo Clinic. *Frostbite: Overview.* Retrieved 12.07.23 from: https://www.mayoclinic.org/diseases-conditions/frostbite/symptoms-causes/syc-20372656

[48] Ibid.

[49] Mayo Clinic. *Hypothermia: Overview.* Retrieved 12.07.23 from https://www.mayoclinic.org/diseases-conditions/hypothermia/symptoms-causes/syc-20352682

Excessive or extreme cold can accompany severe winter weather, or it can occur without severe weather. For this reason, extreme cold is considered a separate hazard from severe winter storms.

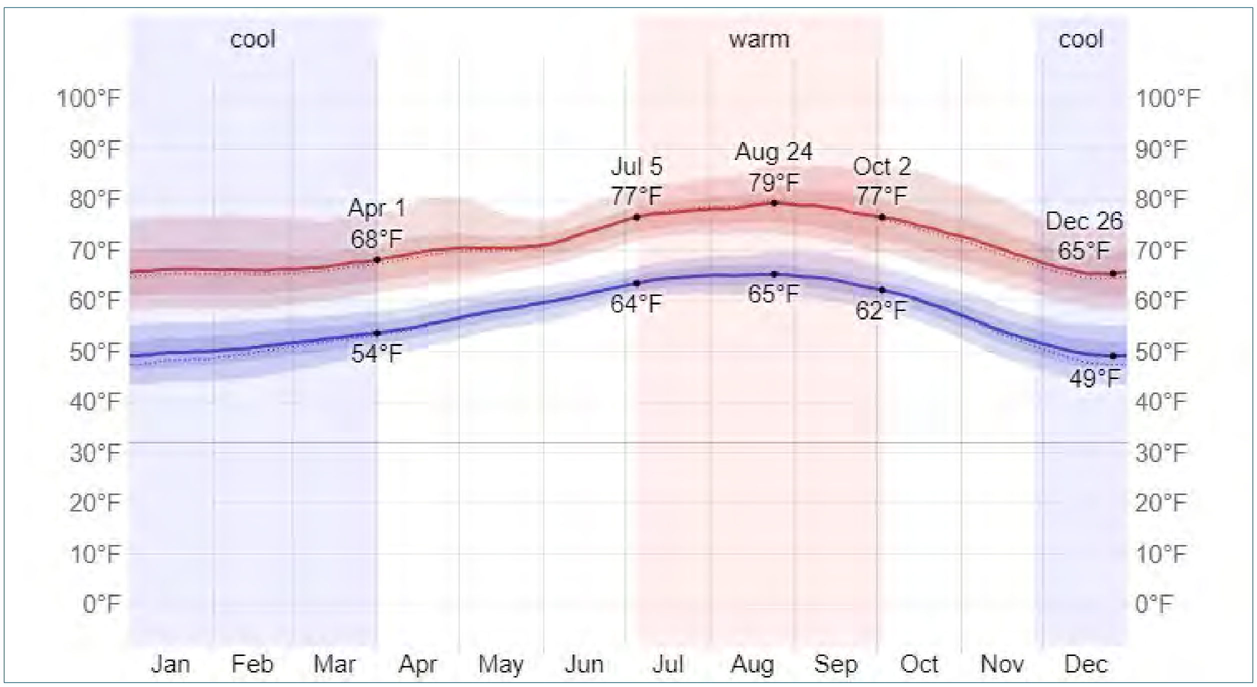
(1) Duration

A major storm can last for several days depending on the severity of the storm.

(2) Seasonality

Winter weather and cold temperatures typically occur in the fall and winter months. Based on previous occurrences, winter weather events are likely to occur in the months of December, January, and February. The average temperature in the winter months ranges from 50 to 62 degrees Fahrenheit. The monthly average for the City of Carson is described in the figure below.

FIGURE 52. MONTHLY AVERAGE FOR THE CITY OF CARSON



Source: Climate-Data.org, 2024

(3) Speed of Onset

Winter storms form when moist air rises into the atmosphere, which is necessary for cloud information and precipitation just like other types of storms. Additionally, winter storms need cold air, below freezing temperatures in the clouds and near the ground to produce snow and/or ice. To accurately forecast winter weather, a network of observing systems such as satellites, doppler radars and automated surface observing systems are used by computer forecast models to estimate future weather forecasts. Winter storms that impact California usually move in from the Pacific Ocean and can take a couple of days before making landfall in the planning area.

(4) Location

The entirety of the planning area is considered vulnerable to extreme cold and winter weather.

ii) Magnitude

(1) Winter Weather

Depending on the magnitude of the winter storm, the National Weather Service will issue either a Winter Weather Advisory, Winter Storm Watch, or a Winter Storm Warning, shown in the table below.

TABLE 32. NWS WINTER WEATHER PRODUCTS

WINTER STORM PRODUCT	DESCRIPTION
Winter Weather Advisory (Light Purple)	Wintry weather expected. Light amounts of wintry precipitation or patchy amounts of wintry precipitation or patchy blowing snow will cause slick conditions and could affect travel if precautions are not taken.
Winter Storm Watch (Light Blue)	Snow, sleet, or ice possible. Confidence is medium that a winter storm could produce heavy snow, sleet, or freezing rain and cause significant impacts.
Winter Storm Warning (Pink)	Snow, sleet, or ice expected. Confidence is high that a winter storm will produce heavy snow, slight, or freezing rain and cause significant impacts.

Source: National Weather Service (NWS)

Winter weather can vary by types including blizzards, ice storms, snow squalls, heavy snow, and sleet or freezing rain, described in more detail below:

- **Blizzards**: defined by the National Weather Service, blizzards are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for 3 hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills. Ground blizzards can develop when strong winds lift snow off the ground and severely reduce visibilities.
- **Ice Storm**: occurs when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into the warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or

cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface. The U.S. National Weather Service defines an ice storm as a storm which results in the accumulation of at least .25 inch of ice on exposed surfaces. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Ice accumulations can lead to downed trees, utility poles and communication towers. Ice can disrupt communications and power while utility companies repair significant damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

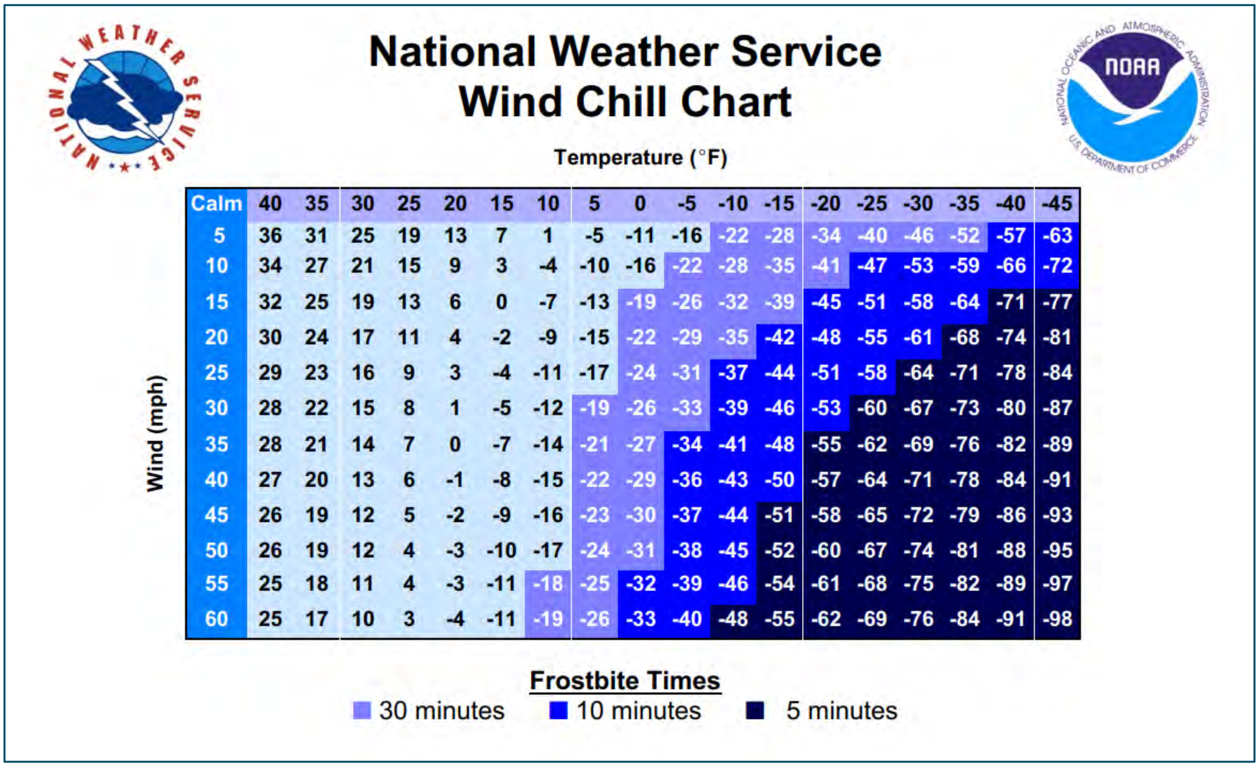
- **Snow Squalls**: often associated with strong cold fronts, are a key wintertime weather hazard. They move in and out quickly, and typically last less than an hour. The sudden white-out conditions combined with falling temperatures produce icy roads in just a few minutes. Squalls can occur where there is no large-scale winter storm in progress and might only produce minor accumulations. Snow squalls can cause localized extreme impacts to the traveling public and to commerce for brief periods of time. Unfortunately, there is a long history of deadly traffic accidents associated with snow squalls. Although snow accumulations are typically an inch or less, the added combination of gusty winds, falling temperatures and quick reductions in visibility can cause extremely dangerous conditions for motorists.
- **Heavy Snow**: in large quantities, may fall during winter storms. Six inches or more in 12 hours or eight inches or more in 24 hours constitute conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves falls from the trees in the fall or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages.
- **Sleet or Freezing Rain**: sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Heavy sleet is a relatively rare event, defined as ice pellets covering the ground to a depth of a one- half inch or more. Freezing rain falls as a liquid but freezes into glaze upon contact with the ground.

(2) Extreme Cold

Extreme cold has a wide range of extent and severity markers and characteristics. Average nighttime winter temperatures in the City of Carson are typically in the high 40s. The National Weather Service Issues Extreme Cold Warnings when the temperature feels like it is -30 degrees Fahrenheit or colder across a wide area for a period of at least several hours. When possible, these advisories are issued a day or two in advance of the conditions.

The most common extent/severity marker for extreme cold is the Wind Chill scale. The figure below depicts the National Weather Service's methodology for determining the wind chill, using wind speed and actual temperature. Although wind chill is not necessarily related to extreme cold as a single cause, the advisory system that the NWS currently uses relies on wind chill to relay warning and advisory information to the public. Extreme cold severity is a function of wind chill and other factors, such as precipitation amount (rain, sleet, ice, and/or snow).

FIGURE 53: NATIONAL WEATHER SERVICE WIND CHILL CHART



National Weather Service
Wind Chill Chart

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

Source: National Weather Service (NWS), 2024

The National Weather Service (NWS) developed the Wind Chill Temperature (WTC) index to provide a formula to calculate the dangers from winter winds and freezing temperatures shown in the figure below. Additionally, the NWS produces frost and freeze advisory, watch, and warnings to communicate when temperatures can pose a risk.

TABLE 33: NATIONAL WEATHER SERVICE FROST ADVISORIES

NWS PRODUCT	DESCRIPTION
Frost Advisory (Light Blue)	A frost advisory means areas of frost are expected or occurring, posing a threat to sensitive vegetation.
Freeze Watch (Blue)	NWS issues a freeze watch when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.

NWS PRODUCT	DESCRIPTION
Freeze Warning (Dark Blue)	When temperatures are forecasted to go below 32°F for a long period of time, NWS issues a freeze warning. This temperature threshold kills some types of commercial crops and residential plants.
Hard Freeze Warning (Light Purple)	NWS issues a hard freeze warning when temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants.

Source: National Weather Service (NWS)

iii) Extent

Large - Extreme cold events and winter weather are non-spatial hazards and may occur throughout the City of Carson.

iv) Past Occurrences

Based on data gathered from the National Centers for Environmental Information (NCEI) Storm Events Database, Los Angeles County has experienced two frost/freeze events, one in December 1998 and one in January 2007, but no extreme cold hazards. Records for this hazard were first recorded in 1996. However, it is unclear if the City of Carson experienced wintry weather or exclusively rainfall from these events. It is likely that since the planning area is close in proximity to the coast, they would have experienced precipitation from these winter storms in the form of rain.

NOAA Storm Events Database contains the records of significant weather events to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Additionally, the database captures events that are rare and unusual, and other significant meteorological events. The database archives data since January 1950.

According to the Storm Events Database, the Los Angeles County Coasts Including Downtown Los Angeles Zone, which encompasses the City of Carson, has experienced four winter storm/winter weather events, shown in the table below. There were no events for Blizzard, Cold/Wind Chill, Extreme Cold/Wind Chill, Ice Storm, or Sleet.

TABLE 34: WINTER WEATHER & EXTREME COLD EVENTS IN THE CITY OF CARSON

Event Type	Date	Deaths, Injuries, or Damage	Description
Winter Storm	12/21/1996	0	A major winter storm system produced significant rainfall and blizzard like conditions across Southern California. Rainfall totals up to two inches were measured along the coast while mountain areas below

Event Type	Date	Deaths, Injuries, or Damage	Description
			6000 feet received. up to 5 inches of rain. Mudslides closed Interstate 14 near Santa Clarita. At elevations above 6000 feet, strong winds of 40 to 50 MPH combined with snow to produce blizzard-like conditions. Snow accumulations up to six inches were reported at higher elevations.
Winter Storm	1/12/1997	0	A cold Pacific storm system produced a mixed bag of weather across Southern California. Over the coasts and valleys, the storm dumped between 0.50 and 1.50 inches of rain. The rain caused mudslides in Playa del Rey and numerous urban flooding. In Anaheim, the rain collapsed the roof of an office building. In the mountains, snow combined with west winds of 25 to 35 mph to produce blizzard conditions. Mount Wilson reported 10 inches of snowfall while Crystal Lake reported 6 inches.
Winter Storm	2/17/1997	0	A potent winter storm moved across Southern California producing a variety of weather. Strong northwest winds gusting up to 65 mph caused scattered power outages. Scattered thunderstorms also formed across the Southland producing intense winds brief heavy rain and hail. In Chatsworth one-half inch hail was reported. In the San Fernando Valley dime size hail to a depth of one and one-half inches was reported.
Winter Weather	1/9/1998	0	A Pacific storm brought rain and snow to Central and Southern California. Rainfall totals were one to two inches with up to four inches in the mountains. Minor urban and small stream flooding was reported. At higher mountain elevations four to eight inches of snowfall was reported.

Source: NOAA NCEI Storm Events Database

Frequency

Based on previous occurrences, there have been four events in the past 73 years. Based on previous occurrences, the frequency rate is 0.05 percent which is very low. However, there have not been any recorded events since the 1990’s in the NOAA Storm Events Database, therefore there may be limitations in historical data regarding cold and winter weather events.

v) Future Probability

Unlikely - The City of Carson has experienced winter storms and winter weather events but has not experienced an extreme cold event, according to the NOAA Storm Events Database. Additionally, based on NOAA data, Los Angeles County does not have any recorded extreme cold events on record since 1950. Due to the City's location and its temperate climate, it is unlikely that this hazard will occur annually. Researchers have found that winter are becoming increasingly shorter in the mountainous western U.S., as snow is disappearing earlier in the year. In fact, the whole winter season is shortening as winter's are starting later and ending earlier. Atmospheric Rivers bring large amounts of precipitation (i.e., rain and snow) to the state. Warmer weather and changes in Atmospheric Rivers intensity could affect how much snow they bring as well as affecting existing snowpack on the ground. Scientists anticipate that atmospheric rivers will become even more significant flood risk as global warming trends increase their intensity. While there may be few direct impacts on winter and cold weather within the City of Carson, statewide changes in snowpack will cause secondary impacts that may be felt in the planning area, in the form of drinking water. [50]

vi) Secondary Hazards

There are several secondary hazards that pose a risk to the planning area resulting from flooding which includes power outages and transportation distributions. The table below describes these hazards in more detail.

TABLE 35: SECONDARY HAZARDS TO EXTREME COLD AND WINTER WEATHER

SECONDARY HAZARD	DESCRIPTION
Power Outage	Extreme cold temperatures, snow, and ice can put stress and damage the power infrastructure, which can have devastating impacts. Power outages can quickly lead to hyperthermia or even death. For example, individuals that rely on electrically powered medical equipment will not be able to use their equipment during a power outage and at increased risk.[51] The U.S. Department of Health & Human Services (HHS) developed the emPOWER map to identify areas of individuals who are electricity dependent (i.e., use durable medical and assistive equipment and devices to live independently in their homes). The 90745-zip code in Carson has a high number of individuals who are electricity-dependent and may be at risk during a power outage.

[50] FAQ: Climate Change in California | Scripps Institution of Oceanography (ucsd.edu) https://scripps.ucsd.edu/research/climate-change-resources/faq-climate-change-california

[51] Scientific American. Increasing Power Outages Don't Hit Everyone Equally. https://www.scientificamerican.com/article/increasing-power-outages-dont-hit-everyone-equally1/

SECONDARY HAZARD	DESCRIPTION
Transportation Disruptions	Icy roads and reduced visibility due to winter weather conditions can lead to hazardous driving conditions. This may result in increased road accidents, delays in emergency response times, and challenges in daily commuting for residents and service providers.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

While the City of Carson is located in Southern California and is known for its mild climate, extreme cold and freeze events can still occur and have significant impacts on the community. These events, though infrequent, can lead to health risks, economic costs, and disruptions in transportation, energy, and infrastructure. The city's infrastructure and population may not be as prepared for cold weather extremes compared to regions where such temperatures are common, making the effects more pronounced when they do occur.

Risks Associated with Extreme Cold or Freeze Events

The City of Carson faces several risks during extreme cold or freeze events, which can last several days:

- Power Failures and Icy Conditions: Extremely cold temperatures can strain the electrical grid due to increased heating demands, potentially leading to power outages. Any precipitation during cold snaps can result in icy roads and sidewalks, increasing the risk of traffic accidents and falls. Bridges can become icy more quickly than surface roads because the gap underneath a bridge allows for the structure to be cooled from both sides.
- Inadequate Heating: Some residents may have inadequate heating in their homes due to power failures, insufficient heating systems, or the inability to afford higher heating costs. This can lead to health risks, especially among vulnerable populations.
- Increased Fire and Carbon Monoxide Risks: The use of space heaters, fireplaces, and other alternative heating methods can raise the risk of household fires and carbon monoxide poisoning if not used properly.
- Health Risks to Vulnerable Populations: Sustained lower-than-normal temperatures can pose significant health risks, including hypothermia and frostbite, particularly to vulnerable populations such as the elderly, young children, individuals experiencing homelessness, and those with pre-existing health conditions.

- Agricultural Impacts: While Carson is primarily urban, nearby agricultural areas may suffer crop damage due to freezing temperatures during winter and spring growing seasons, affecting local food supply and economy.

(1) People

Extreme cold and harsh winter weather pose significant health risks to the residents of Carson, particularly to vulnerable groups such as the elderly, young children, and individuals with pre-existing health conditions. A 2023 American Community Survey report estimated that the City of Carson was home to 17,189 individuals aged 65 or older and another 18,013 aged 18 or younger. The drop in temperatures can lead to an increase in respiratory problems, hypothermia, and frostbite, especially for those without adequate heating or shelter. Homeless individuals are particularly at risk, as they may not have access to warm, indoor spaces during cold spells.

Severe winter weather can disrupt the daily life of Carson's residents. Power outages, often caused by heavy snowfall or ice accumulation on power lines, can lead to loss of heating and lighting in homes. This not only makes staying warm a challenge but can also disrupt communication and access to online resources. Transportation can be severely impacted, with icy roads and reduced visibility leading to hazardous driving conditions, public transport delays, and school closures.

Businesses in Carson might face challenges during extreme cold events, including reduced foot traffic, difficulties in maintaining regular operations, and potential damage to premises and inventory. These disruptions can have a ripple effect on the local economy, affecting both business owners and employees. Additionally, increased heating costs during cold spells can strain household budgets, particularly for low-income families.

(2) Structures and Systems

Extreme cold and harsh winter conditions can pose significant challenges to the structural integrity and functionality of properties in Carson. Residential and commercial buildings may face issues such as frozen pipes, which can burst and cause water damage. Roofs and exteriors may be susceptible to damage from heavy snowfall or ice accumulation, leading to potential leaks or structural weakening. Public infrastructure, including roads, bridges, and utility systems, is also at risk, with the potential for increased wear and tear or damage from freezing temperatures.

The need for continuous heating during extreme cold spells can put a strain on both the energy systems of individual properties and the city's overall energy grid. This heightened demand can lead to higher utility bills for residents and businesses, and in some cases, may result in power outages if the local grid is overwhelmed.

Property owners in Carson may face increased maintenance and repair costs following winter weather events. Addressing issues such as insulation, repairing damage from frozen pipes, and ensuring the structural soundness of buildings can lead to significant expenses. For municipal properties and public spaces, the city may incur additional costs in maintaining and repairing public infrastructure affected by the cold.

Critical Facilities

Critical facilities near Carson, such as hospitals, emergency response centers, utility services, and government buildings, face significant operational challenges during extreme cold and winter weather events. Ensuring continuous operation and service delivery becomes paramount, especially for facilities like hospitals where lives may be at stake. Power outages, heating system failures, or disrupted telecommunications can severely impact these facilities' functionality, necessitating robust contingency plans to maintain operations. Severe winter weather can impact transportation and access to properties. Icy roads and snow accumulation can hinder access to homes and businesses, posing challenges for residents, employees, and service providers. This can affect everything from daily commutes to emergency response times, potentially putting properties and residents at risk.

TABLE 36. POTENTIAL VULNERABILITY OF LIFELINES TO EXTREME COLD EVENT

LIFELINE	IMPACT TYPE	DESCRIPTION
Water & Wastewater Systems		In extreme cold, water lines can freeze and burst, causing significant disruptions.
Food, Shelter, & Housing		Extreme cold can render homes uninhabitable without adequate heating leading to a need for emergency shelters. Cold spells can affect the transportation and delivery of food supplies, while heatwaves can impact food storage and spoilage.
Health & Medical		Extreme cold can lead to a surge in health-related emergencies, such as hypothermia, and respiratory conditions. Healthcare facilities might face increased demand, and the need for medical supplies and services may rise sharply.

LIFELINE	IMPACT TYPE	DESCRIPTION
Energy	Energy (Power & Fuel)	High demand for heating during extreme cold events can strain power grids, leading to outages. Fuel supply lines for heating systems could also be impacted, especially during cold spells.
Safety & Security	Safety and Security	Emergency services may be in high demand, and there can be increased risks of accidents and injuries due to cold-related conditions. For example, cold spells can lead to increased incidents of fires from heating devices
Transportation	Transportation	Extreme cold can affect transportation infrastructure. Cold can lead to icy conditions and snow accumulation, disrupting road, air, and rail travel.

(3) Natural, Cultural, and Historical resources

Extreme temperatures could have significant impacts on the City of Carson's cultural and historic properties. There are 49 identified historical and cultural properties within the City of Carson. Several ways in which extreme temperatures could impact these properties include physical damage to artifacts and artwork, energy costs, limited visitor access, outdoor cultural spaces, community events, historical landscapes, and damage to archives and records.

(4) Risk Analysis

Low - Winter weather and cold events pose a low risk to the City of Carson. While Carson, California, typically enjoys mild winters, the increasing unpredictability of weather patterns due to climate change raises concerns about the potential for extreme cold and winter weather events. Such events could have significant impacts on the city's population, properties, and critical facilities. However, there have been few events in the past several decades which may be due to the proximity to the coast as winter storms typically impact mountainous areas on the eastern side of Los Angeles County rather than coastal areas.

When dealing with an extreme cold event, the most common impacts are those generally felt by the people living in the targeted area. As discussed, the major human risks associated with extreme cold include frostbite, hypothermia, and in severe cases, death. Based on future development trends, it is likely that more people and structures will be at risk of extreme cold impacts as the population increases. An increase in population could increase the demand on the healthcare system as extreme cold events increase the risk hypothermia and seek medical attention. However, due to Carson's moderate climate, it is unlikely for the city to exhibit extreme cold vulnerabilities.

While risk is low, is it possible that rare winter weather or extreme cold events may significantly disrupt city services and operations and pose a risk to human safety. The city should prepare for such an event to reduce risk to residents, properties, and critical facilities.

G) FLOOD

i) Hazard Profile

Floods are characterized by the rising and overflowing of excess water from a water source such as a stream, river, lake, canal, or coastal body onto an area of normally dry floodplain. A floodplain is a lowland area downstream and adjacent to water bodies that are subject to flood events. Flooding is a naturally occurring event that becomes hazardous when populations and property are affected. A flood occurs when the existing channel of a stream, river, canyon, or other watercourse cannot contain excess runoff from rainfall or snowmelt, resulting in overflow onto adjacent lands.

Flooding can result from excessive precipitation from weather systems generating prolonged rainfall, excessive snowmelt from watersheds upstream from the floodplain, infrastructure failure, exceeding the capacity of dams or levees, tidal influences, or a combination from any of the previous factors.

Floods represent one of the costliest and most frequent natural disasters that influences human suffering and economic impact in the United States. Flooding will likely result in significant damage to structures, infrastructure, utilities, landscapes, and the environment. Erosion of stream banks, roadways, and other features may result from the movement of flood waters. The saturated ground resulting from standing flood waters may cause ground instability, collapse, erosion, or other damages. Further, floods will often generate substantial debris that will accumulate and be deposited throughout the flooded areas.

(1) Duration

Generally, floods can take hours or even days to develop, which can be critical in providing residents time to prepare or evacuate to seek safety. Alternatively, some flood events can occur very quickly, for example a dam breach can cause flooding at a rapid rate and cause devastating impacts.

(2) Seasonality

Flood events in Los Angeles County typically occur during the fall and winter months as the region experiences more rainfall and snowfall patterns. During the El Nino phase, the jet stream is located south through California, prompting warmer temperatures causing heavy rains to occur. Rain and snow amount are typically higher than average in the state during El Nino winters.

(3) Speed of Onset

Floods can be either slow-rise or rapid onset floods. With the slow rise floods, there is often warning preceding water rise by hours or days before dangerous conditions present themselves. Slow rise floods that are expected to enter populated areas generally allow for some time to initiate evacuation and sand bagging efforts. Flooding that occurs rapidly conversely are water events that present with extremely limited warning times and a limited ability to take response actions until flooding has already begun to occur.

Flooding may take on different forms:

- **Flash Flooding:** flash flooding is typically characterized by a rapid rise, short duration, and large volume of water in a localized area. Heavy rainfall in areas that have limited drainage capacities often contributes to flash flooding conditions. These flooding events frequently occur with limited notice requiring immediate evacuation or rapid response efforts such as sand bagging. Flash flooding may occur with fast moving water creating added hazardous conditions.
- **Riverine Flooding:** Riverine flooding is usually caused by prolonged rainfall or rainfall combined with heavy snowmelt. When soil is already saturated, the ability for the ground to absorb water is minimized. In a riverine flood, the water way exceeds channel capacity and extends into areas outside of the channel, often in developed communities. In California, riverine flooding is most likely to occur from November through April. The duration of riverine floods may vary from a period of hours to weeks.
- **Localized Flooding:** localized flooding is commonly the result of stormwater drainage systems being overwhelmed by unusually heavy rainfall. These flooding events frequently occur in areas that are urbanized or developed with greater amounts of impervious surfaces not allowing ground absorption. This generates added runoff into the drainage systems and onto roadways creating backups.
- **Infrastructure Failure:** failures of dams or levees presents a serious flooding concern for areas downstream from the compromised structure. This situation may result in a catastrophic flood with limited warning time and widespread areas affected.
- **Coastal Flooding:** coastal flooding can occur in multiple areas along the California coastline. Flooding may result from intense storms coming from the Pacific Ocean that generate elevated water levels or storm surge. The size, duration, winds generated, and intensity of the storm will influence the effect the waves will have on the shoreline. Periods of high tide can aggravate the conditions allowing greater wave impingement into coastal areas.

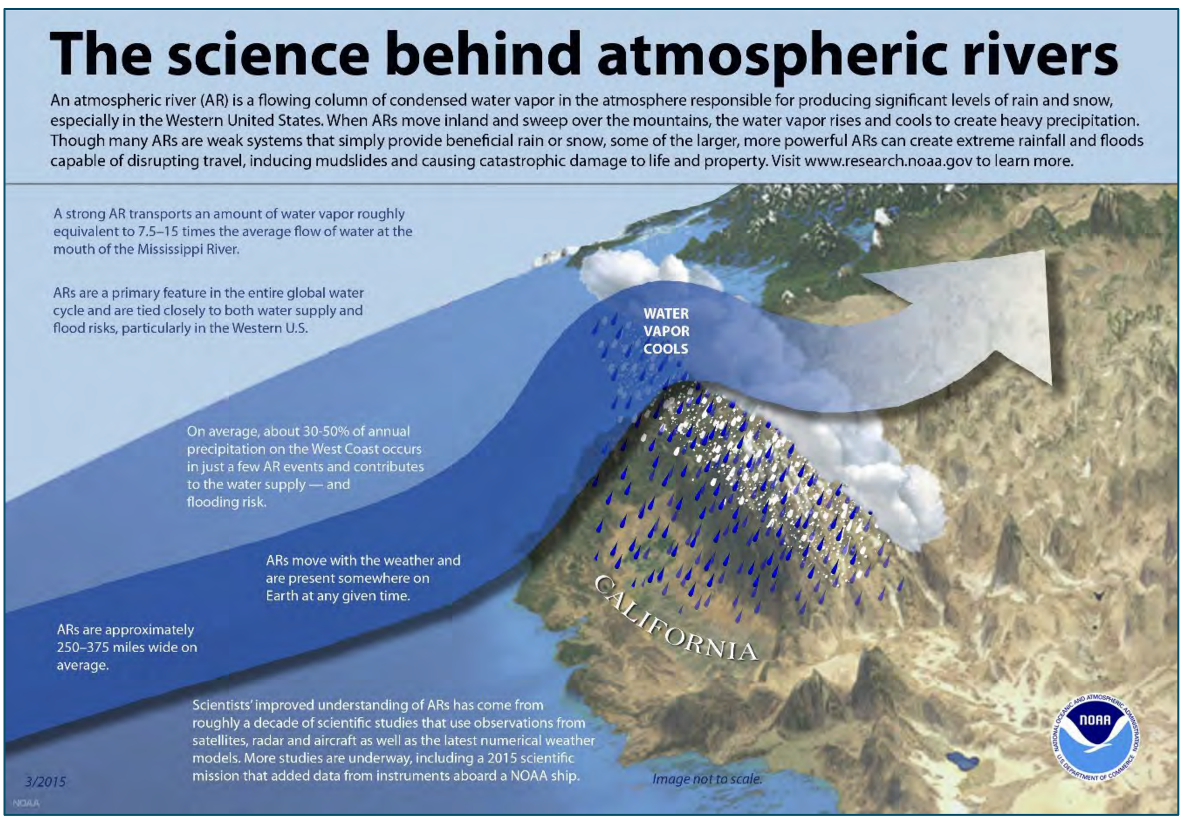
(4) Atmospheric River

California, including the location of this city, is subject to the effects of a phenomenon referred to as atmospheric rivers. These weather events consist of long, narrow regions in the atmosphere transporting tremendous amounts of water vapor from the tropics, shown in the figure below. These weather regions behave like rivers in the sky. They can carry heavy volumes of water vapor compared to the amount of water flowing at the mouth of the Mississippi River. As these atmospheric rivers arrive in California, they tend to generate significant rain and snow.

Atmospheric rivers can arrive in many different shapes and sizes. The larger events can generate extreme rainfall amounts resulting in flooding. They can stall over watersheds vulnerable to flooding, often saturated with heavy snow amounts. The atmospheric rivers known as a “Pineapple Express” coming from the tropics and arriving with warmer air may produce heavy rains that will melt ground snow adding to the water volume that will be added in the flood runoff.

These events can produce heavy amounts of precipitation creating extensive damage. However, these events may present as weaker systems that produce precipitation that is enough to be beneficial for the local water supply. At the higher elevations in the California mountains, these events have the potential to generate a tremendous snowpack providing a source of water during the dry summer months.

FIGURE 54: THE SCIENCE BEHIND ATMOSPHERIC RIVERS[52]



Source: NOAA, 2024

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[52] National Oceanic and Atmospheric Administration. *What are Atmospheric Rivers?* Retrieved 12.13.2023 from: https://www.noaa.gov/stories/what-are-atmospheric-rivers

(5) Location

The entirety of the planning area is considered vulnerable to flooding. In particular, urban flooding as a result of severe weather can quickly become a hazard in virtually any part of the City of Carson.

ii) Magnitude

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) which is a program that provides insurance coverage, floodplain management, and creates Flood Insurance Rate Map (FIRM). FIRM identifies flood hazards within a community to assist flood risk reduction and management. Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and sound floodplain management. NFIP regulations (44 Code of Federal Regulations (CFR) Chapter 1, Section 60, 3) require that all new construction in floodplains must be elevated at or above base flood level.

Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS) Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by FEMA which delineates Special Flood Hazard Areas (SFHA) in communities where NFIP regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply. [53] The table below outlines the various types of flood zone designations which are used to determine flood regulations.

TABLE 37: FLOOD ZONE DESIGNATIONS AND DESCRIPTIONS

ZONE DESIGNATION	PERCENT ANNUAL CHANCE OF FLOOD	DESCRIPTION
Zone V	1%	Areas along coasts subject to inundation by the 1% annual chance of flooding with additional hazards associ ated with storm-induced waves. Because hydraulic analyses have not been performed, no base flood elevations (BFEs) or flood depths are shown.

[53] Flood Maps | FEMA.gov https://www.fema.gov/flood-maps

Zones VE and V1-30	1%	Areas along coasts subject to inundation by the 1% annual chance of flooding with additional hazards associated with storm-induced waves. BFEs derived from detailed hydraulic analyses are shown within these zones. (Zone VE is used on new and revised maps in place of Zones V1-30.)
Zone A	1%	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or BFEs are. shown within these areas.
Zone AE	1%	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. In most instances, BFEs derived from detailed analyses are shown at selected intervals within these zones.
Zone AH	1%	Areas with a 1% annual chance of flooding where shallow flooding (usually areas of ponding) can occur with average depths between 1 – 3 feet.
Zone AO	1%	Areas with a 1% annual chance of flooding, where shallow flooding average depths are between 1 – 3 feet.
Zone X (shaded)	0.2%	Represents areas between the limits of the 1% annual chance of flooding and 0.2% chance of flooding.
Zone X (unshaded)	Undetermined	Areas outside of the 1% annual chance floodplain and 0.2% annual chance floodplain; areas of 1% annual chance sheet flow flooding where average depths are less than one (1) foot; areas of 1% annual chance stream flooding where the contributing drainage area is less than one (1) square mile, or areas protected from the 1% annual chance flood by levees. No BFE or depths are shown within this zone.

Source: FEMA

Several factors determine the severity of floods, including rainfall intensity and duration. A large amount of rainfall over a short time span can result in flash flood conditions. A sudden thunderstorm or heavy rain, dam failure, or sudden spills can cause flash flooding. The National Weather Service's definition of a flash flood is a flood occurring in a watershed where the time of travel of the peak of flow from one end of the watershed to the other is less than six hours.

Flooding is caused by an overflow of water onto normally dry land. The inundation of a normally dry area caused by rising water in an existing waterway, such as a river, stream, or drainage ditch. Ponding of water at or near the point where the rain fell.

The National Weather Service (NWS) provides flood products to communicate and alert the public and impacted communities when there is severe weather that can cause significant damage. The list of NWS flood products is described in the table below.

TABLE 38: NATIONAL WEATHER SERVICE FLOOD PRODUCTS

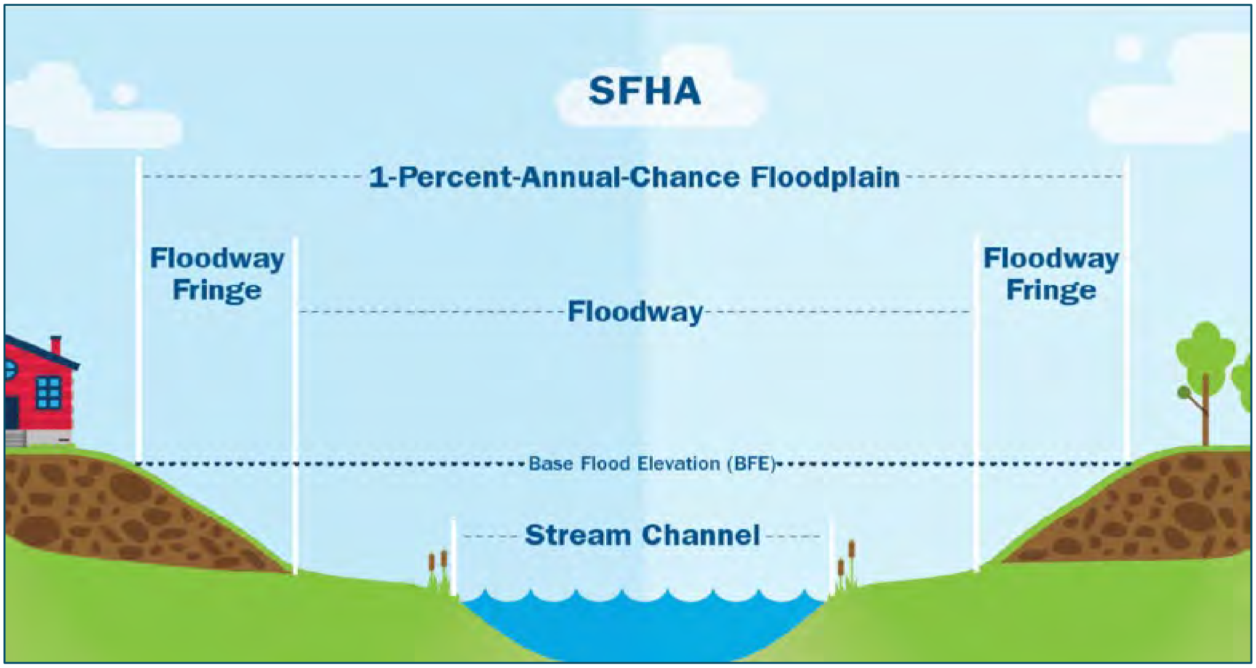
FLOOD-RELATED PRODUCT	DESCRIPTION
Flash Flood Warning (Red)	Issued when a flash flood is imminent or occurring. If you are in a flood prone area move immediately to high ground. A flash flood is a sudden violent flood that can take from minutes to hours to develop. It is even possible to experience a flash flood in areas not immediately receiving rain.
Flood Warning (Green)	Issued when hazardous weather event is imminent or already happening. A Flood Warning is issued when flooding is imminent or occurring.
Flood Watch (Dark Blue)	Issued when a specific weather event that is forecast to occur may become a nuisance. A Flood Advisory is issued when flooding is not expected to be bad enough to issue a warning. However, it may cause significant inconvenience, and if caution is not exercised, it could lead to situations that may threaten life and/or property.
Flood Advisory (Light Blue)	Issued when conditions are favorable for a specific hazardous weather event to occur. A Flood Watch is issued when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible.

Source: National Weather Service (NWS)

iii) Extent

Small - According to the City's General Plan, topography within the City of Carson is generally flat with elevations ranging from sea level elevations to approximately 195 feet above mean sea level (msl) at the top of Dominguez Hills. Carson is divided by the Dominguez Channel which is used for regional flood control. The city has floodplains around the Dominguez Channel. Floodplains are defined as an area of low-lying ground adjacent to a stream or river, stretching from the banks to the outer edges of the valley and subject to flooding. A floodway is the channel of a river or other watercourse and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. The relationship between a floodway and floodplain is shown in the image below. The main source of flooding in Carson is from localized urban flooding caused by severe weather.[54]

FIGURE 55: FLOODPLAIN OVERVIEW



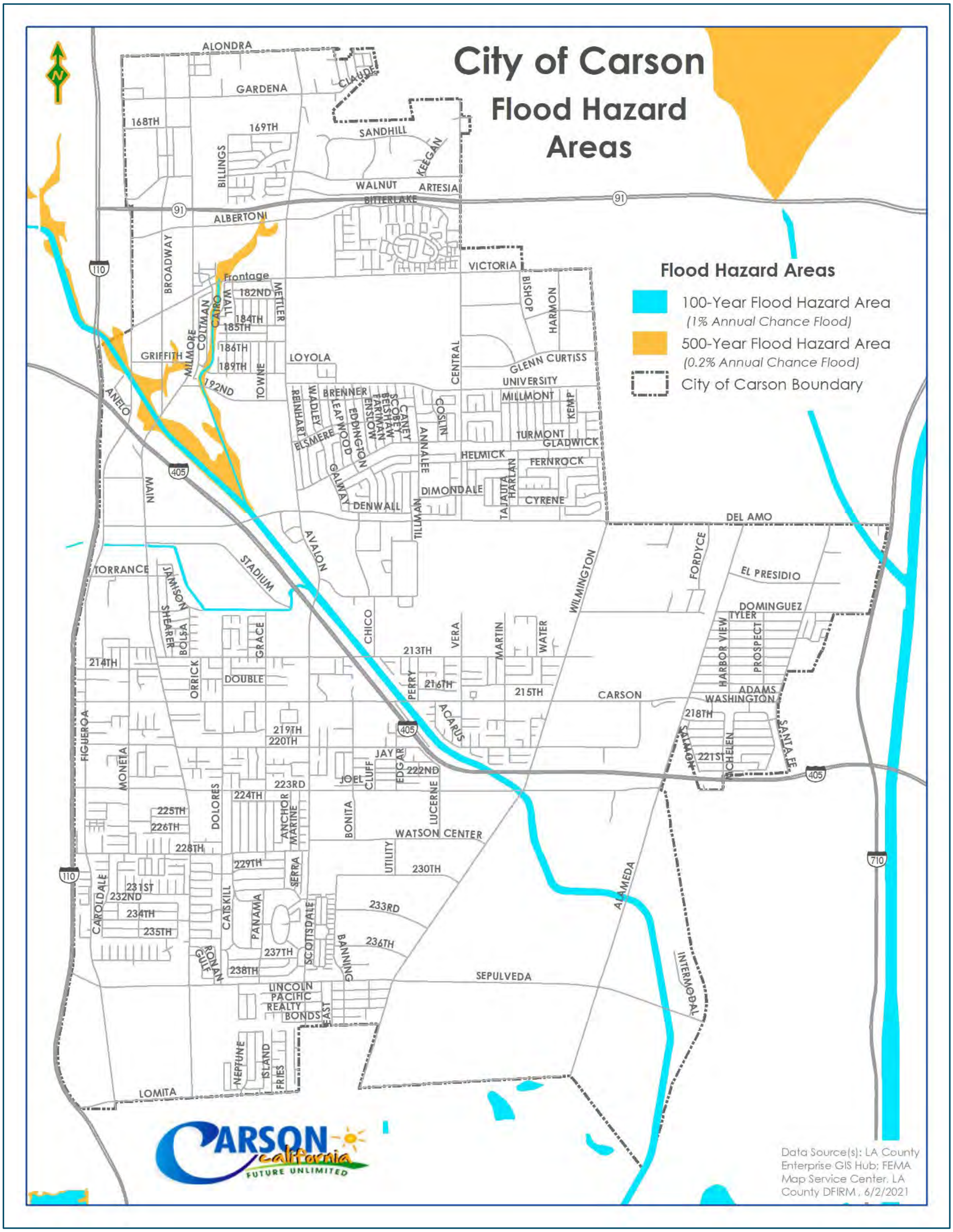
Source: FEMA, 2024

There are several flood control channels along the Los Angeles River and Rio Hondo systems. The Los Angeles River drains the San Gabriel Mountains and much of the Los Angeles Basin south towards Long Beach. Several flood control systems feed into the Los Angeles River. The length of the Los Angeles River from downtown Los Angeles to the outlet into the ocean is a large concrete lined channel. The Dominguez Channel is a flood control and drainage channel ¾ mile southwest of the campus that drains much of the urban water collection of the South Bay communities.

The flood hazard area map, displayed in the map below, shows the 100-Year Flood Hazard Area along a floodway from the Dominquez Channel and another 100-Year Flood Hazard Area stemming from San Pedro Bay crossing Del Amo road on the east side of the city. An area that has both the 100-Year Flood Hazard Area and the 500 Year Flood Hazard Area South of Route 91 (Gardena Freeway), west of Interstate 110 and North of Interstate 405. While there are 100- and 500-year flood areas, the city is identified as Zone X and at reduced risk due to a levee. However, the risk of flooding is not completely removed.

[54] 2023 California State Hazard Mitigation Planhttps://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf

FIGURE 56: MAP OF SPECIAL FLOOD HAZARD AREAS IN CARSON REFLECTING 2021 DFIRM



The City's General Plan states that 80 percent of the city is developed, and the remaining open areas are dispersed throughout the city. Since the City of Carson is mostly developed land, flooding is likely to occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. Due to the high percentage of development, the City of Carson has a high concentration of impermeable surfaces that either collect water or concentrate the flow of water in unnatural channels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

If it were not for flood control systems including concrete lined river and stream beds, flooding would be a much more common occurrence. In-fill building is becoming a much more common practice in many areas. Another potential source of flooding is "asphalt creep." The street space between the curbs of a street is a part of the flood control system. Water leaves property and accumulates in the streets, where it is directed towards the underground portion of the flood control system. The carrying capacity of the street is determined by the width of the street and the height of the curbs along the street. Often, when streets are being resurfaced, a one-to-two-inch layer of asphalt is laid down over the existing asphalt. This added layer of asphalt subtracts from the rated capacity of the street to carry water. Thus, the original engineered capacity of the entire storm drain system is marginally reduced over time. Subsequent re-paving of the street will further reduce the engineered capacity even more.

iv) Past Occurrences

Flooding in Carson and the broader Los Angeles County region has typically occurred during the winter months when Pacific storms are more common. The occurrences of significant flooding typically have been the result of successive intense storms with heavy precipitation. The region has experienced flood events that have caused tens of millions of dollars in damage and casualties. The following provides insight into information of past flooding events that are significant to the City of Carson.

TABLE 39: HISTORIC FLOOD EVENTS IN LOS ANGELES COUNTY[55]

HAZARD	DATE	DECLARATION	LOCATION
Flood	March 1962	DR-122-CA	Countywide
Flood	October 1962	DR-138-CA	Countywide

[55] County of Los Angeles All-Hazards Mitigation Plan. *All-Hazards Mitigation Plan.* Retrieved 12.13.2023 from: https://ceo.lacounty.gov/wp-content/uploads/2022/04/County-of-Los-Angeles-All-Hazards-Mitigation-Plan-APPROVED-05-2020.pdf

HAZARD	DATE	DECLARATION	LOCATION
Flood; Heavy Rains	February 1963	DR-145-CA	Countywide
Flood; Winter Storms	February 1978	DR-547-CA	Countywide
Flood; Winter Storms	February 1980	DR-615-CA	Countywide
Winter Storms	December 1988	DR-812-CA	Countywide
Winter Storms	February 1992	DR-935-CA	Countywide
Winter Storms	January 1993	DR-979-CA	Countywide
Flash Flood; Heavy Rains	January 1995	DR-1044-CA	Countywide
Flash Flood; Heavy Rains	March 1995	DR-1046-CA	Countywide
Flood; Winter Storms	December 1996	DR-1155-CA	Countywide
Flood	January 1997	DR-1155-CA	Countywide
Flood; Winter Storms	February 1998	DR-1203-CA	Countywide
Event	January 2005	DR-1577-CA	Countywide
Flood	February 2005	DR-1585-CA	Countywide
Flood	March 2010	DR-1884-CA	Countywide
Flood; Heavy Rains	January 2017	DR-4305-CA	Countywide
Flood; Winter Storms	January 2023	DR-4683-CA	Countywide

Source: LA County All-Hazards Mitigation Plan

NOAA Storm Events Database contains the records of significant weather events to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Additionally, the database captures events that are rare and unusual, and other significant meteorological events. The database archives data since January 1950.

According to the National Centers for Environmental Information (NCEI) Storm Events Database, there have been four occurrences since 1950. The table below shows the four occurrences that took place in 2001, 2010, 2013, and 2017. The occurrences encompass a combination of flooding and flash flooding events.

TABLE 40. FLOOD EVENTS IN THE CITY OF CARSON

LOCATION	COUNTY	STATE	DATE	TYPE	DAMAGES
Carson	Los Angeles	California	11/24/2001	Flood	N/A
Carson	Los Angeles	California	11/12/2003	Flash Flooding	N/A
Carson	Los Angeles	California	1/19/2010	Flash Flooding	$3.4 million in crop damages *(damages not in Carson)*
Carson	Los Angeles	California	1/22/2017	Flash Flooding	N/A

Source: NOAA NCEI Storm Events Database

Frequency

There have been four occurrences in the past 73 years based on the NOAA Storm Events Database. Based on the previous occurrences there is a .05 percent chance of a flood event occurring in the planning area. Countywide, there have been 18 historic events in the past 61 years, which is about a 30 percent chance of a historic flood occurring in Los Angeles County. While the frequency of flood events occurring in the City of Carson is low, it is possible that data from the Storm Events Database could be incomplete or limited in the full understanding of flood events that have taken place in the city, as there have been no recorded flood events before 2001. Comparing both historic floods events in the County and confirmed flood events in the city, it is possible for flood events to occur in the planning area.

v) Future Probability

Possible - Based on previous occurrences of flood events throughout the state and region, and projected climate change impacts on flood events, it is likely that the risk of flood events will increase as less frequent but more intense precipitation is projected. California has a variable climate, ranging from multi-year droughts to strong storms bringing torrential rains and flooding. Much of the precipitation in California comes from major storms called atmospheric rivers. According to scientists, when the atmosphere increases even by 1 degree, the air's water-holding capacity increases by up to 3.9 percent. Since the industrial revolution, the global average temperature is now more than 2 degrees which is leading to more extreme downpours. [56]

[56] How climate change is projected to alter California flooding, storms - Los Angeles Times (latimes.com) https://www.latimes.com/environment/story/2024-02-08/climate-change-california-flooding-storms

vi) Secondary Hazards

There are several secondary hazards that pose a risk to the planning area resulting from flooding which includes water supply contamination, disease, landslide and erosion, infrastructure damage, and displacement of people. The table below describes these hazards in more detail.

TABLE 41: SECONDARY HAZARDS FROM FLOODING EVENTS IN CARSON

SECONDARY HAZARD	DESCRIPTION
Water Supply Contamination	Floodwater often carries pollutants and sewage, leading to contamination of drinking water sources. In Carson, where the infrastructure might be closely interconnected, floodwaters can easily infiltrate water supply systems, posing health risks.
Disease	As flood waters spreads, it can carry disease. This can lead to outbreaks of deadly diseases from unclean water sources like typhoid, malaria, hepatitis A, and cholera.
Landslide & Erosion	Saturated soil can lead to landslides and erosion, especially in areas with uneven terrain near Carson. This can cause additional damage to property and infrastructure.
Infrastructure Damage	Flooding can weaken or destroy roads, bridges, and other infrastructure elements. In Carson, this might lead to disruptions in transportation and utilities, affecting daily life and the local economy.
Displacement of People	Flooding can render homes uninhabitable, leading to temporary or permanent displacement of residents. In densely populated areas, this can create significant challenges in terms of providing shelter and aid.

(1) The National Flood Insurance Program (NFIP)

The National Flood Insurance Program (NFIP) is managed by FEMA and is delivered to the public as most homeowner insurances do not cover flood damage. Flood Insurance is a separate policy that can cover buildings and their contents.

The NFIP provides flood insurance to:

- Property owners
- Renters
- Businesses

The NFIP works with communities required to adopt and enforce floodplain management regulations that support flood mitigation efforts. FEMA's regulatory flood map products are intended to be used for official actions required by the NFIP. **These regulatory products include:**

- **Flood Insurance Rate Maps:** official community maps that show special flood hazard areas and the risk premium zones.
- **Flood Insurance Study Report:** The report contains detailed flood elevation data in flood profiles and data tables.
- **FIRM Database:** GIS version of the FIRM and most of the quantitative data in the FIS.

For a community to participate in the NFIP, it must adopt and enforce floodplain management regulations that meet or exceed the minimum NFIP standards and requirements. **The NFIP minimum requirements include:**

- Criteria for Land Management and Use
- General Requirements
- Compliance with Floodplain Management Criteria
- Floodplain Management Criteria

The City of Carson is a participating community in the NFIP. Floodplain Ordinances have been adopted into local regulations. However, the City of Carson relies on supported provided by the Los Angeles County Floodplain Manager for all NFIP and floodplain related activities. As depicted in Figure 56, the 100-year floodplain or Special Flood Hazard Area (SFHA) is primarily limited to hardened streambank of the Los Angeles River, which is not under their jurisdictional authority. A single hardened canal collects drainage from residential development and delivers it to the river. Development within the SFHA is not expected.

(2) Community Rating System

As part of the NFIP, the Community Rating System (CRS) is a **voluntary incentive program** that recognizes and encourages community floodplain management practices that **exceed the minimum requirements**.

CRS communities have flood insurance premium rates discounted to reflect reduced flood risk resulting from the community's efforts that address the three goals of the program. **With an updated hazard mitigation plan**, **lower flood insurance premiums will be provided** for the jurisdictions that participate in the National Flood Insurance Program's Community Rating System.

TABLE 42. COMMUNITY RATING SYSTEM CLASSES, DISCOUNTS, AND CREDITS

CRS CLASS	CRS DISCOUNT	CREDIT POINTS REQUIRED
1	45%	4,500+
2	40%	4,000-4,499
3	35%	3,500-3,999
4	30%	3,000-3,499
5	25%	2,500-2,999
6	20%	2,000-2,499
7	15%	1,500-1,999
8	10%	1,000-1,499
9	5%	500-999
10	0%	0-499

Source: FEMA

The flood mitigation activities and their points are listed below. The total number of points will equal to a CRS class and then determine the CRS discount for flood insurance for the community.

TABLE 43. CRS FLOOD MITIGATION ACTIVITIES AND CREDITS

SERIES 300	PUBLIC INFORMATION	MAXIMUM POINTS	AVERAGE POINTS
This series of credits programs advise people about flood hazards, flood insurance, and ways to reduce flood damage. The activities also provide data insurance agents need for accurate flood insurance rating.			
310	**Elevation Certificates** • Have written procedures for managing floodplain-related certificates for new constructions in the floodplain. (at a minimum, a community must maintain certificates for buildings built after the date of its CRS application) • Maintain a rate of 90% accuracy	116	36
320	**Map Information Service** • Provide Flood Insurance Rate Map information to those who inquire, and publicize this service	90	78
330	**Outreach Projects** • Distribute outreach projects with messages about flood hazards, flood insurance, flood protection measures, and/or the natural and beneficial functions of floodplains	350	87

SERIES 300	PUBLIC INFORMATION	MAXIMUM POINTS	AVERAGE POINTS
340	**Hazard Disclosure** • Real estate agents advise potential purchasers of flood-prone property about the flood hazard • Regulations require notice of the hazard	80	15
350	**Flood Protection Information** • The public library and/or community's website maintains references on flood insurance and flood protection	125	48
360	**Flood Protection Assistance** • Give inquiring property owners technical advice on protecting their buildings from flooding and publicize this service	110	59
370	**Flood Insurance Promotion** • Assess flood insurance coverage in the community; promote flood insurance through meetings, technical assistance, brochures, or other means • This series credits programs that limit floodplain development or provide increased protection to new and existing development	220	40
410	**Floodplain Mapping** • Develop new flood elevations, floodway delineations, wave heights, or other regulatory flood hazard data for an area not mapped in detail by the flood insurance study • Have a more restrictive mapping standard	850	78
420	**Open Space Preservation** • Guarantee that currently open public or private floodplain parcels will be kept free from development • Incentivize keeping the floodplain open with zoning restrictions, lot size requirements, or other regulations	2,870	471
430	**Higher Regulatory Standards** • Limit new buildings and/or fill in the floodplain • Require freeboard • Require soil tests or engineered foundations • Require compensatory storage	2,462	272

SERIES 300	PUBLIC INFORMATION	MAXIMUM POINTS	AVERAGE POINTS
	• Require coastal construction standards in AE Zones • Have regulations tailored to protect critical facilities or areas subject to special flood hazards such as alluvial fans, ice jams, subsidence, coastal erosion		
440	**Flood Data Maintenance** • Keep flood and property data on computer records • Use better base maps • Maintain elevation reference marks	222	127
450	**Stormwater Management** • Regulate new development throughout the watershed to ensure that post-development runoff is no greater than pre-development runoff. • Regulate new construction to minimize soil erosion and protect or improve water quality.	755	110

510	**Floodplain Management Planning**
	• Using a standard process, prepare, adopt, implement, and update
	  • A comprehensive flood hazard mitigation plan and/or
	  • Plan to protect natural functions within the community's floodplain and/or
	  • A plan for managing substantial flood damage to properties in the community and/or
	  • A plan to serve and/or recover threatened and endangered species in the floodplain
	• Prepare an analysis of the repetitive flood loss areas within the community
	
	*** relates to hazard mitigation planning
		762	197

520	**Acquisition and Relocation** • Acquire and/or relocate flood prone buildings so that they are out of the floodplain, and the floodplain remains open	2,250	176
530	**Flood Protection**	1,600	64

SERIES 300	PUBLIC INFORMATION	MAXIMUM POINTS	AVERAGE POINTS
	• Protect existing floodplain development by floodproofing, elevation, or minor flood control projects.		
540	**Drainage System Maintenance** • Have a program for and conduct annual inspections of all channels and detention basins; remove debris as needed	470	203
610	**Flood Warning and Response** • Provide early flood warning to the public, and have a detailed flood response plan keyed to flood crest predictions • Incorporate substantial damage assessment into flood operations	365	266
620	**Levees** • Annually inspect and maintain existing levees; have a system for recognizing the threat of levee failure and/or overtopping, disseminating warnings, and providing emergency response; and coordinate with operators of critical facilities	235	111
630	**Dams** • Have a high-hazard potential dam that could affect the community; have a system for recognizing the threat of dam failure, disseminating warnings, planning and practicing emergency responses; and coordinating with operators of critical facilities.	160	38

Source: *FEMA*

(3) Severe Repetitive Loss and Repetitive Loss

According to data provided by the Federal Insurance and Mitigation Administration, there are no non-mitigated repetitive loss (RL) properties located in the City of Carson. As of June 3, 2024, there are 36 active NFIP policies for properties in the City of Carson. The number of properties covered by active policies represents a relatively small portion of the overall stock, and this is consistent with the limited extent of known 100-year and 500-year floodplains in the planning area. Regarding claims, there have been 45 claims made since 1979 (45 years), which is an average of one claim per year. Only 19 claims (42%) were approved for payment, while 26 claims (58%) were closed without payment. The most recent claim occurred in 2019 and was closed without payment. The most recent paid claim occurred in 2017. Of the 19 paid claims, the average payment was approximately $3,300.

TABLE 44. NFIP POLICIES AND CLAIMS INFORMATION

TOTAL ACTIVE POLICIES	TOTAL NUMBER OF CLAIMS (1979 – 2024)	TOTAL NUMBER OF PAID CLAIMS (1979 – 2024)	TOTAL CLAIMS AMOUNT PAID ($)	AVERAGE PAID CLAIM AMOUNT ($)
36	45	19	$62,722.95	$3,301.21

(4) Substantial Damage and Substantial Improvement

The State of California issued Repetitive Flood Damage (Substantial Damage) – local technical code amendments (Part 2 building, Part 10 existing building, Part 2.5 residential) and floodplain management ordinance in August 2020. The City of Carson does not maintain an independent floodplain manager and is reliant on the Los Angeles County Floodplain Manager for assistance in all state and federal NFIP compliance requirements.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets to better understand and mitigate risk from hazards.

Carson is characterized by relatively flat terrain, with elevations ranging from approximately 5 to 40 feet above sea level. The city's proximity to the Dominguez Channel—a crucial component of Los Angeles County's flood control system—plays a significant role in its flood risk profile. The channel, designed to convey stormwater runoff to the Los Angeles Harbor, can become overwhelmed during intense rain events, leading to overflows and flooding of adjacent areas. Additionally, the high degree of urbanization has resulted in extensive impervious surfaces, such as roads, parking lots, and buildings, which reduce natural water infiltration and increase surface runoff.

Several specific areas within Carson are particularly susceptible to flooding:

Neighborhoods Adjacent to the Dominguez Channel

Communities located along the Dominguez Channel are at heightened risk due to potential overtopping or structural failures of the channel during extreme weather events. Areas near Avalon Boulevard, Wilmington Avenue, and University Drive are especially vulnerable. Residential zones in these areas may experience flooding of streets and homes, posing risks to property and personal safety.

Low-Lying Residential Areas

Sections of Carson east of the Harbor Freeway (I-110) and south of the San Diego Freeway (I-405) are prone to surface flooding due to inadequate drainage infrastructure and low elevation. The Del Amo Boulevard corridor has a history of flooding during heavy rains, affecting both residential properties and local businesses.

Industrial and Commercial Zones

The city hosts significant industrial facilities, including oil refineries, chemical plants, and manufacturing centers along Alameda Street and Sepulveda Boulevard. Flooding in these areas not only disrupts economic activities but also poses environmental hazards due to the potential release of hazardous substances.

Mobile Home Parks and High-Density Housing

Mobile home communities such as the Colony Cove Mobile Estates and other high-density housing complexes may be situated in areas with poor drainage, making them more susceptible to flood damage. These residences often lack the structural robustness of traditional homes, increasing their vulnerability.

Specific Populations at Risk

Flooding impacts can disproportionately affect certain demographic groups within the City of Carson.

Low-Income Residents

Approximately 9.5% of Carson's population lives below the poverty line. Low-income households may reside in more affordable, flood-prone areas and often lack the resources to implement protective measures or recover quickly after flood events. Financial constraints can limit access to insurance, adequate housing, and transportation options during emergencies.

Elderly Population

With about 12.9% of residents aged 65 and over, the elderly population is significant. Older adults may have mobility issues, chronic health conditions, or limited social support networks, making evacuation and recovery more challenging. They may also be more susceptible to the health effects of flooding, such as exposure to mold or contaminated water.

Individuals with Disabilities

Residents with physical, sensory, cognitive, or mental health disabilities may face barriers to receiving timely warnings, evacuating safely, or accessing emergency services. Ensuring that emergency communication is accessible and that shelters can accommodate specific needs is crucial.

Non-English Speaking Communities

Carson is ethnically diverse, with significant Filipino (approximately 21%), African American (approximately 24%), and Latino (approximately 37%) populations. Language barriers can impede the effective dissemination of critical information before, during, and after flood events. Culturally appropriate outreach and multilingual communication strategies are essential to ensure all residents receive vital information.

Unhoused Population

Individuals experiencing homelessness are particularly vulnerable during flooding due to exposure to the elements and lack of secure shelter. Encampments located near waterways or low-lying areas are at direct risk from rising waters.

Infrastructure Impacts

Major freeways, including the I-405 and I-110, traverse Carson and are critical for regional mobility. Flooding can lead to road closures, traffic congestion, and accidents, disrupting the flow of goods and services. Surface streets like Carson Street, Main Street, and Alameda Street may become impassable, hindering emergency response and daily commutes.

Public Transit Systems

Bus services operated by the Carson Circuit and Los Angeles Metro rely on accessible roads. Flooded streets can suspend services, affecting those who depend on public transportation, particularly low-income residents and the elderly.

Utilities and Essential Services

Water and Sewage Systems

The city's water distribution and sewage systems can be compromised during floods. Infiltration of floodwaters into sewage lines can cause overflows, leading to sanitary hazards and environmental contamination. Water treatment facilities may struggle to maintain service quality if overwhelmed.

Electrical Grid

Electrical substations and power lines are at risk of damage from floodwaters and debris. Power outages can have cascading effects on other critical infrastructure, including healthcare facilities, communication networks, and traffic control systems.

Healthcare Facilities

While there are several clinics and medical offices within Carson, the primary hospital serving the area is the nearby Harbor-UCLA Medical Center. Flooding can impede access to medical care by blocking roads and causing operational challenges at healthcare facilities due to power outages or water damage.

Educational Institutions

Schools such as Carson High School, Stephen M. White Middle School, and various elementary schools may face closures, property damage, and disruptions to educational services. Flooding can damage facilities, destroy educational materials, and displace students and staff.

Industrial Facilities

The presence of large industrial complexes, including refineries operated by companies like Marathon Petroleum, introduces additional risks. Floodwaters can damage equipment, halt production, and, critically, lead to the release of hazardous substances if containment systems fail. Such incidents can have long-term environmental and public health consequences.

Environmental Impacts

Contamination of Waterways

Floodwaters can mobilize pollutants, including oils, chemicals, heavy metals, and waste materials from industrial sites, residential areas, and roadways. These contaminants can enter the Dominguez Channel and spread to the Los Angeles Harbor and Pacific Ocean, affecting marine ecosystems and water quality.

Habitat Destruction

Natural areas, parks, and green spaces within Carson, such as the Dominguez Rancho Adobe Museum grounds and various community parks, can suffer from erosion, sediment deposition, and vegetation loss. Wildlife habitats may be destroyed or altered, impacting biodiversity.

Soil Erosion and Land Degradation

The force of moving water can erode soil, destabilize slopes, and undermine structures. Erosion can reduce the fertility of soil in landscaped areas and contribute to sedimentation in waterways, exacerbating flood risks in future events.

Air Quality Issues

Flooding can lead to the growth of mold and mildew in buildings, affecting indoor air quality and posing health risks. Additionally, the release of volatile organic compounds (VOCs) from damaged industrial facilities can contribute to air pollution.

(1) HAZUS

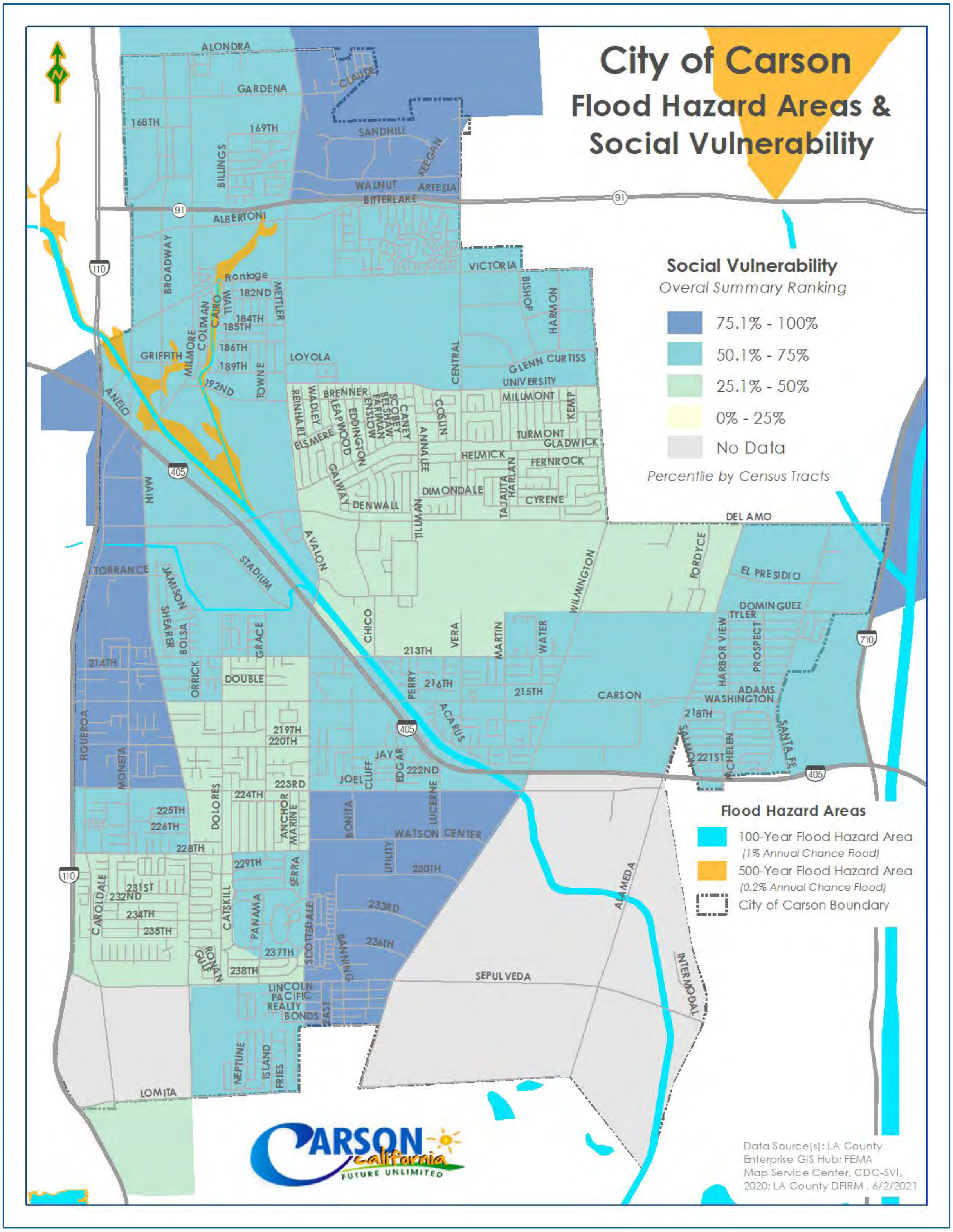
As part of the risk assessment, a flood HAZUS analysis was conducted. HAZUS is a nationally standardized risk modeling methodology and identifies areas with high risk for natural hazards and estimates physical, economic, and social impacts of earthquakes, hurricanes, floods, and tsunamis. The HAZUS program is managed by FEMA's Natural Hazards Risk Assessment Program and partnered with other federal agencies, research institutions, and regional planning authorities, to increase the quality of HAZUS resources by incorporating the latest scientific and technological approaches and meet the needs of the emergency management community. [57] Each section below will provide a summary of the HAZUS analysis conducted for the 100-year and 500-year flood events.

(2) People

Population exposure to floods disproportionately impacts socially vulnerable populations. As flood exposure continues to increase in the United States driven by climate change and changes in precipitation and development. Social vulnerability results when social, political, and economic processes combine to produce heightened susceptibility to hazards for some populations. Within the City of Carson, the census tracts within the flood hazard area have a medium-high social vulnerability index shown in the map below.

[57] What is Hazus? | FEMA.gov https://www.fema.gov/flood-maps/tools-resources/flood-map-products/hazus/about

FIGURE 57 - CITY OF CARSON FLOOD HAZARD AREAS (2021) & CDC SOCIAL VULNERABILITY INDEX (2020)



HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodation in temporary public shelters. The model estimates 11 households, about 33 people, will be displaced due to flooding. Displacement includes households evacuated from within or very near to the inundated area. Of these, 16 people, out of a total population of 103,939, will seek temporary shelter in public shelters. This is the same estimate for the 100-year and the 500-year flood event.

(3) Structures and Systems

Within the City of Carson, there are residential properties that fall within the 100- and 500-year flood hazard area in the northwest portion of the city, where the floodplain overlaps with residential areas. The type of property damage caused by flood events depends on the depth and velocity of the flood water. Faster moving flood waters can wash buildings off their foundations and sweep cars downstream. Pipelines, bridges, and other infrastructure can be damaged when high waters combine with flood debris. Extensive damage can be caused by basement flooding and landslide damage related to soil saturation from flood events. Most flood damage is caused by water saturating materials susceptible to loss (i.e., wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances). In many cases, flood damage to homes renders them unlivable.

Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customers' access to a business as well as close a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

Development Impacts on Flooding

Due to the high percentage of development, the City of Carson has a high concentration of impermeable surfaces that either collect water or concentrate the flow of water in unnatural channels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

When structures or fill are placed in the floodway or floodplain water is displaced. Development raises the river levels by forcing the river to compensate for the flow space obstructed by the inserted structures and/or fill. When structures or materials are added to the floodway or floodplain and no fill is removed to compensate, serious problems can arise. Flood waters may be forced away from historic floodplain areas. As a result, other existing floodplain areas may experience flood waters that rise above historic levels. Displacement of only a few inches of water can mean the difference between no structural damage occurring in each flood event, and the inundation of many homes, businesses, and other facilities. Careful attention should be given to development that occurs within the floodway so that structures are prepared to withstand base flood events. In highly urbanized areas, increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of storm water management systems so that these runoff waters are dealt with effectively. Since Carson is highly urbanized and future development would consist of redevelopment in underperforming areas, it is unlikely that future development would have a negative impact of flooding.

100-Year Flood Event Scenario

HAZUS estimates that are 30,113 buildings in the region which have an aggregate total replacement value of 25,542,649 million dollars. Building exposure by occupancy type for the study region and the 100-year flood scenario is described in the tables below.

TABLE 45. BUILDING EXPOSURE BY OCCUPANCY TYPE FOR THE STUDY REGION ($1000'S)

OCCUPANCY	EXPOSURE ($1000)	PERCENT OF TOTAL
Residential	7,932,621	31.1%
Commercial	8,314,010	32.6%
Industrial	7,045,365	27.6%
Agricultural	19,844	0.1%
Religion	264,240	1.0%
Government	99,024	0.4%
Education	1,866,545	7.3%
Total	**25,541,649**	**100%**

Source: HAZUS, 2024

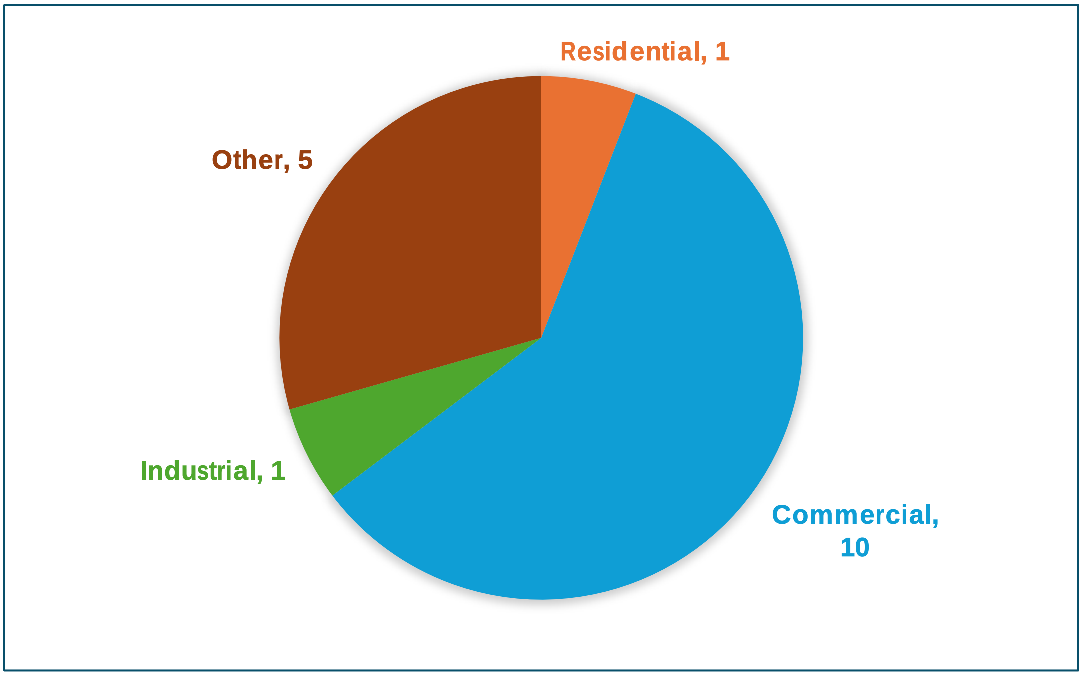
TABLE 46. BUILDING EXPOSURE BY OCCUPANCY TYPE FOR THE SCENARIO (100-YEAR FLOOD EVENT)

OCCUPANCY	EXPOSURE ($1000)	PERCENT OF TOTAL
Residential	217,554	7.7%
Commercial	393,420	13.9%
Industrial	2,142,945	75.5%
Agricultural	1,666	0.1%
Religion	3,934	0.1%
Government	0	0.0%
Education	80,282	2.8%
Total	**2,839,801**	**100%**

Source: HAZUS, 2024

Losses by occupancy types for residential, commercial, industrial, and other occupancy types are described in the figure below. In the 100-year flood event scenario there is an estimated total of 18 million dollars of losses to all identified occupancy types.

FIGURE 58 – FLOOD LOSSES BY OCCUPANCY TYPE - $MILLIONS – 100 YEAR SCENARIO



Source: HAZUS, 2024

500 Year Flood Event Scenario

The HAZUS analysis for the 500-year flood event scenario estimates that there are 30,113 buildings in the region which have an aggregate total replacement value of 25,542,649 million dollars. Building exposure by occupancy type for the planning area and the 100-year flood scenario is described in the tables below.

TABLE 47. BUILDING EXPOSURE BY OCCUPANCY TYPE FOR THE STUDY REGION

OCCUPANCY	EXPOSURE ($1000)	PERCENT OF TOTAL
Residential	7,932,621	31.1%
Commercial	8,314,010	32.6%
Industrial	7,045,365	27.6%
Agricultural	19,844	0.1%
Religion	264,240	1.0%
Government	99,024	0.4%
Education	1,866,545	7.3%
Total	**25,541,649**	**100%**

Source: HAZUS, 2024

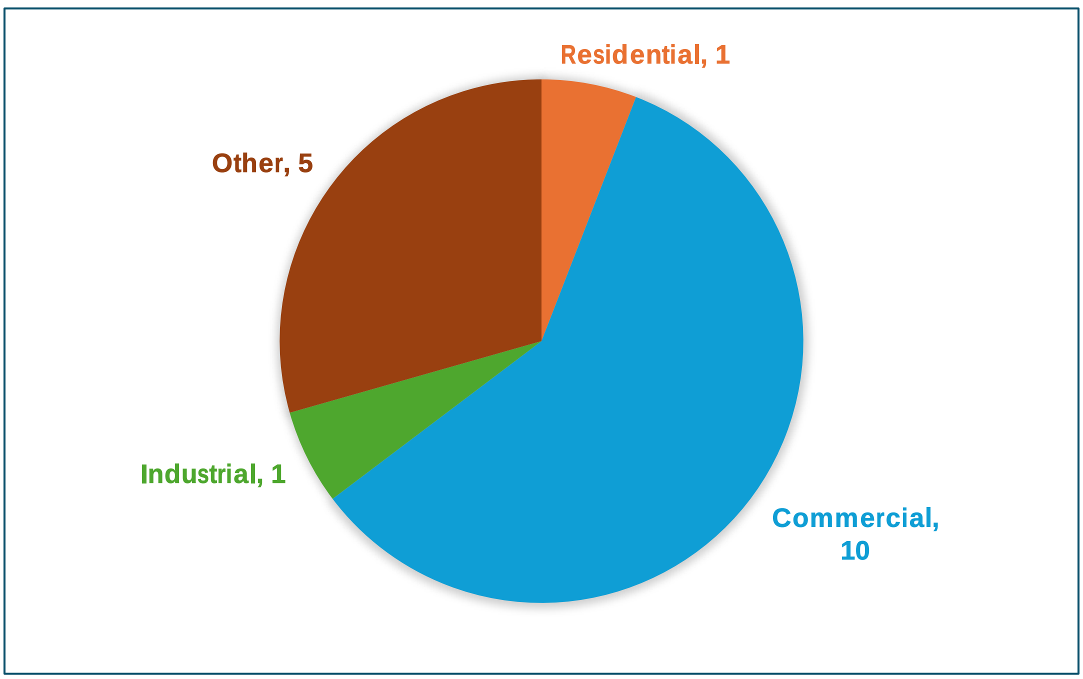
TABLE 48. BUILDING EXPOSURE BY OCCUPANCY TYPE FOR THE 500-YEAR FLOOD EVENT

OCCUPANCY	EXPOSURE ($1000)	PERCENT OF TOTAL
Residential	183,076	4.9%
Commercial	895,675	24.2%
Industrial	2,481,077	67.1%
Agricultural	1,269	0.0%
Religion	3,713	0.1%
Government	0	0.0%
Education	134,410	3.6%
Total	**3,699,220**	**100%**

Source: HAZUS, 2024

Losses by occupancy types for residential, commercial, industrial, and other occupancy types are described in the figure below. In the 500-year flood event scenario there is an estimated total of 18 million dollars of losses to all identified occupancy types.

FIGURE 59 – FLOOD LOSSES BY OCCUPANCY TYPES - $MILLIONS – 500 YEAR SCENARIO



Source: HAZUS, 2024

Critical Facilities

Floods can cause power, water, and gas outages; disrupt transportation routes and commercial supplies; pollute drinking water systems; damage homes, buildings, and roads; and cause severe environmental problems including landslides and mudslides. Flooding can strain transportation networks in both the short- and long-term through transportation delays, infrastructure damage, and recovery, and potentially affect economies. Nearly all transportation modes (e.g., roads, transit, aviation, etc.) are highly dependent on the supporting network of infrastructure and are vulnerable to disasters such as flooding events.

The impacts of flooding provide a glimpse of the vulnerability that the transportation sector faces due to floods. With increases in urbanization and flooding in the future, systems and infrastructure networks in existing and new developments need to be developed for resiliency to future disasters.

Publicly owned facilities are a key component of daily life for all citizens of the county. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services. Government can take action to reduce risk to public infrastructure from flood events, as well as craft public policy that reduces risk to private property from flood events.

During hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. Road systems in the City of Carson are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks often traverse floodplain and floodway areas. Transportation agencies responsible for road maintenance are typically aware of roads at risk from flooding.

Local drainage problems are common throughout the City of Carson. The City of Carson maintenance and operations staff are aware of local drainage threats. The problems are often present where storm water runoff enters culverts or goes underground into storm sewers. Inadequate maintenance can also contribute to flood hazard in urban areas.

Within the City of Carson there are no critical facilities and infrastructure that are within the flood hazard area, shown in the map below. While there are no critical facilities and infrastructure in the flood hazard area, there is still potential for flood risk in the future.

100-Year Flood Event Scenario

According to the HAZUS analysis for the 100-year flood event scenario, zero critical facilities will be damaged at least moderately, substantially, or complete loss of use. Critical facilities in the scenario include emergency operations centers, fire stations, hospitals, police stations, and schools.

500-Year Flood Event Scenario

According to the HAZUS analysis for the 500-year flood event scenario, zero critical facilities will be damaged at least moderately, substantially, or complete loss of use. Critical facilities in the scenario include emergency operations centers, fire stations, hospitals, police stations, and schools.

FIGURE 60 - CITY OF CARSON FLOOD HAZARD AREAS (2021) WITH CRITICAL FACILITIES & INFRASTRUCTURE AS OF 2024

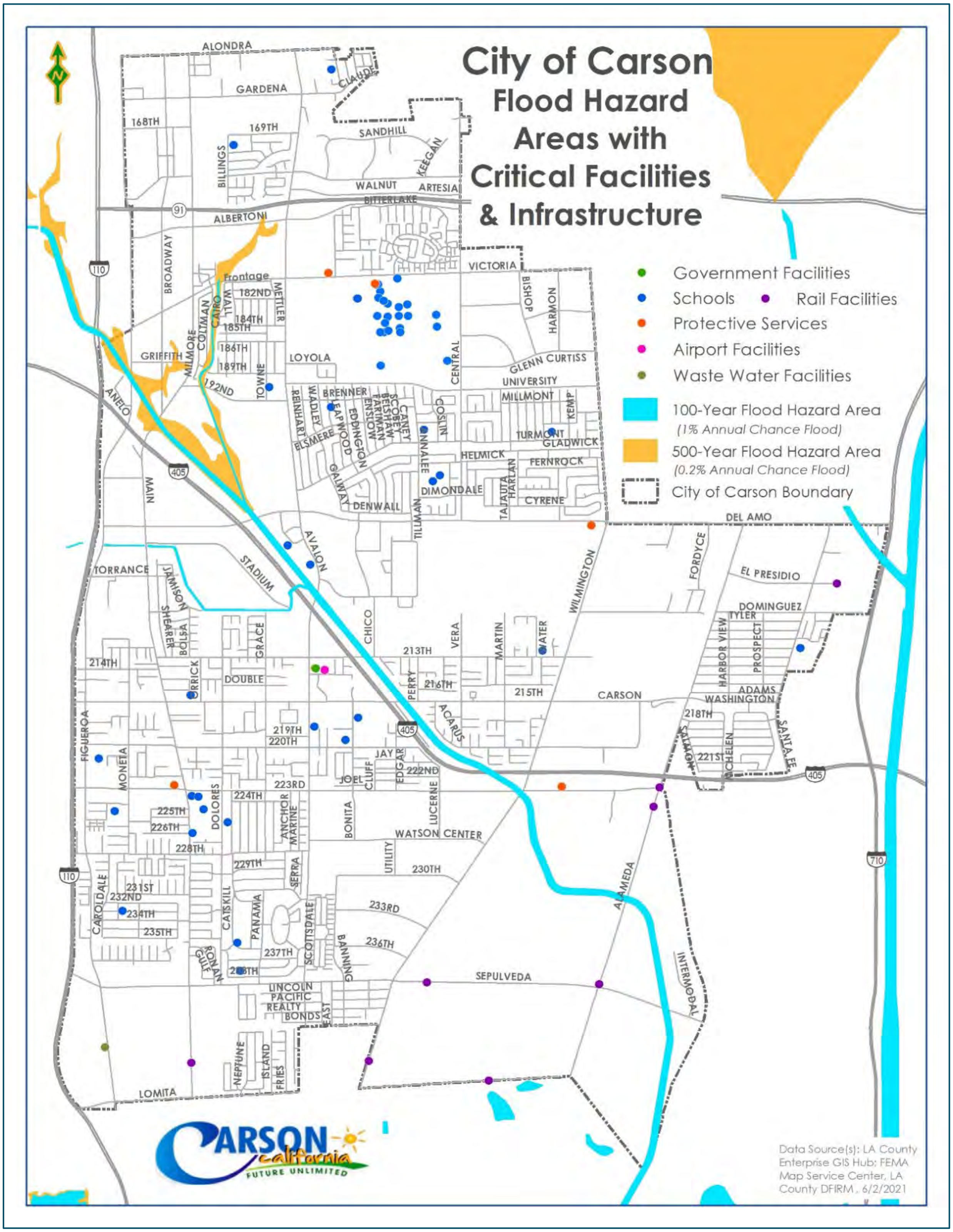


TABLE 49 - POTENTIAL VULNERABILITIES OF LIFELINES TO FLOODING

LIFELINES	IMPACT TYPE	DESCRIPTION
Water & Wastewater Systems		Flooding can contaminate water supplies and damage water infrastructure, leading to shortages and health hazards. Wastewater treatment facilities may also be overwhelmed or damaged, increasing the risk of waterborne diseases.
Food, Shelter, & Housing		Flooding can lead to the displacement of people, necessitating immediate shelter solutions. The disruption in supply chains can affect the availability and distribution of food, especially fresh produce.
Health & Medical		There is a heightened risk of injuries during floods, as well as increased potential for waterborne and vector-borne diseases. Healthcare facilities might be directly affected by floods, impacting their operational capabilities.
Communications		Communication networks may be disrupted, which can hinder the coordination of rescue and relief efforts as well as the dissemination of important information to the public.
Energy		Flooding can cause power outages by damaging electrical infrastructure. Fuel supply may also be disrupted, affecting not just transportation but also heating and power generation.
Safety & Security		Emergency services are crucial during flooding for rescue operations and maintaining public order. Flooding can also increase the risk of accidents and infrastructure failures, such as dam or levee breaches.
Transportation		Floods can damage roads, bridges, and rail lines, severely limiting mobility and access. This disruption impacts not just daily commutes but also the delivery of essential goods and services.

(4) Natural, Cultural, and Historical Resources

There are no cultural or historic properties that are within the floodplain. However, that does not mean that flooding events that impact the community could not occur in the future. Flooding can significantly impact cultural and historic properties due to the floodwaters which can cause water damage and mold.

(5) Risk Analysis

Low - Flooding poses a low risk to the planning area. The land in the City of Carson is generally well-drained with relatively few perched water or artesian areas. According to the FEMA Flood Insurance Risk Maps identifies Special Flood Hazard Areas (SFHAs). However, there is low risk from the floodplains due to the lack on intersect to properties with the City. While the current flood maps display low risk to impacting communities, flood events can still occur. Floods and their impacts will vary by location and severity of any given flood event and will likely only affect certain areas of the county during specific times. It is evident that floods will continue to have potentially devastating economic impacts to certain areas of the city especially as 80 percent of the city is developed and mostly comprised of impermeable spaces which will encourage flood waters to sit on top of the land rather than soaking into the ground through vegetation and green spaces. Previous flood events have impacted the city and are likely to occur again in the future.

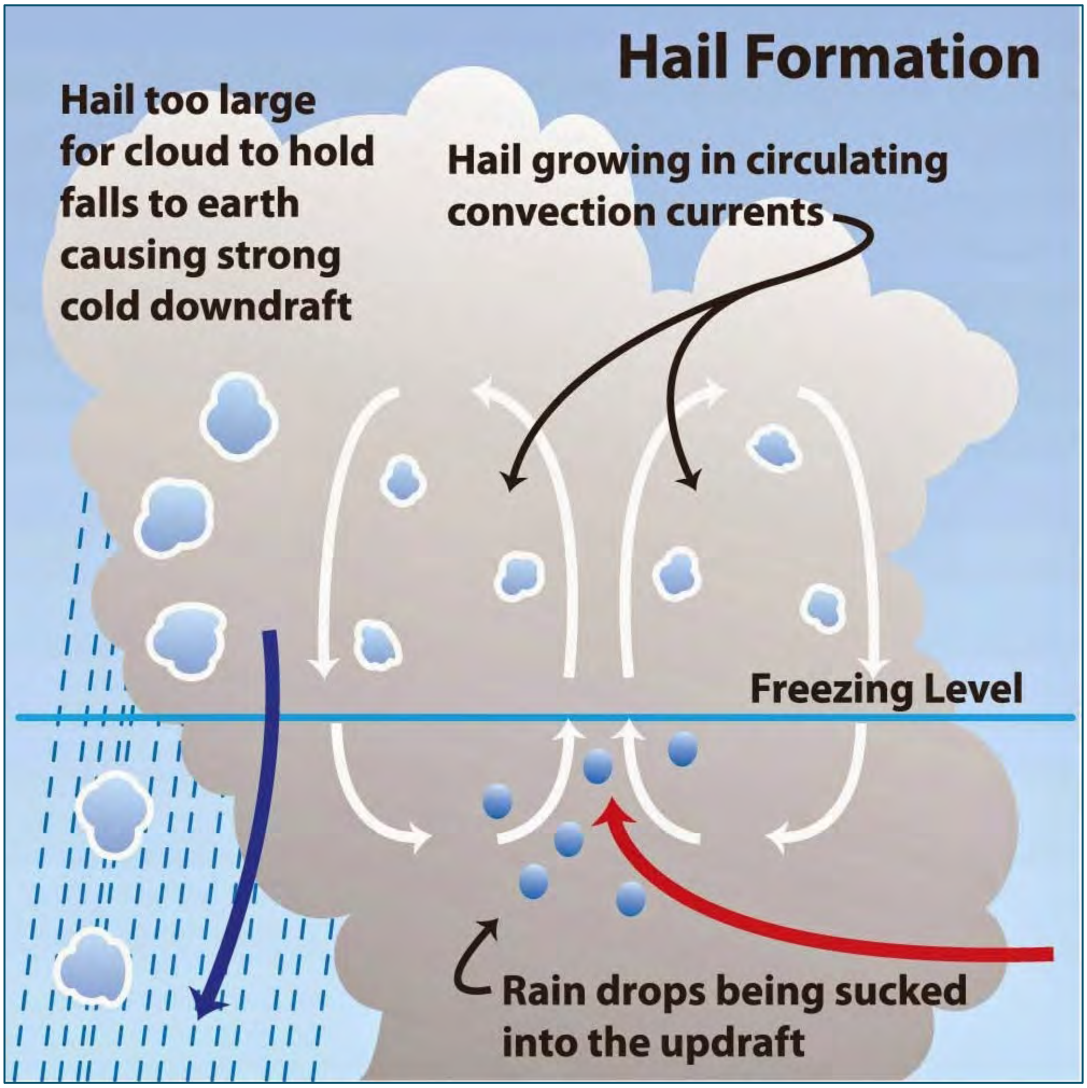
Within the county, there have been several emergency declarations to respond and recover from. The largest impact on communities from flood events is the loss of life and property. During certain years, property losses resulting from flood damage are extensive. Impacts that are not quantified, but can be anticipated in future events, include injury and loss of life, commercial and residential structural damage, disruption of and damage to public infrastructure, secondary health hazards (e.g., mold and mildew), damage to roads/bridges resulting in loss of mobility, significant economic impact (jobs, sales, tax revenue) upon the community, negative impact on commercial and residential property values, significant disruption to students and teachers as temporary facilities will be needed.

H) HAIL

i) Hazard Profile

Hail is the showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud. They are formed when raindrops are carried upward by thunderstorm updrafts into extremely cold areas of the atmosphere and freeze. The hailstones then grow by colliding with liquid water drops that freeze onto the hailstone's surface. Hail falls when the thunderstorm's updraft can no longer support the weight of the hailstone, occurring when the stone becomes large enough or when the updraft weakens, shown in the figure below. Hail events are usually in relatively small coverage area. Large hail can damage structures, break windows, dent vehicles, ruin crops, and injure people.

FIGURE 61. HAIL FORMATION



Source: NOAA, 2024

(1) Duration

Hail events are usually brief, lasting on average 10 to 20 minutes but may last longer with some thunderstorms depending on conditions.

(2) Seasonality

Since hail occurs with the presence of a severe thunderstorm, hail events follow the seasonality of that hazard. Thunderstorms can occur at any time of year, any time of day, but typically occur in the spring and summer months.

(3) Speed of Onset

The size of the hailstone can drive the speed at which the hail falls as well as some other conditions such as the friction between the hailstone and surrounding air, the local wind conditions, and the degree of melting of the hailstone. The expected fall speed seen in a typical severe thunderstorm is between 25 to 40 miles per hour. In supercells that produce some of the largest hail, the expected fall speed is between 25 to 40 miles per hour and may even reach fall at over 100 miles per hour. [58]

(4) Location

The entirety of the City of Carson is considered vulnerable to hail.

ii) Magnitude

Hail can vary in size. Warnings and reports may report hail size through comparison with real world objects (e.g., golf ball size) that correspond to certain diameters. The table below shows the different sizes of hail with their size and real-world object comparison. The larger the hailstone the more damage it can cause to property and people.

TABLE 50. HAIL SIZE

DESCRIPTION[59]	DIAMETER (INCHES)
Pea	0.25
Marble or Mothball	0.50
Penny or Dime	0.75
Nickle	0.88
Quarter	1.00
Half-Dollar	1.25
Walnut or Ping Pont Ball	1.50

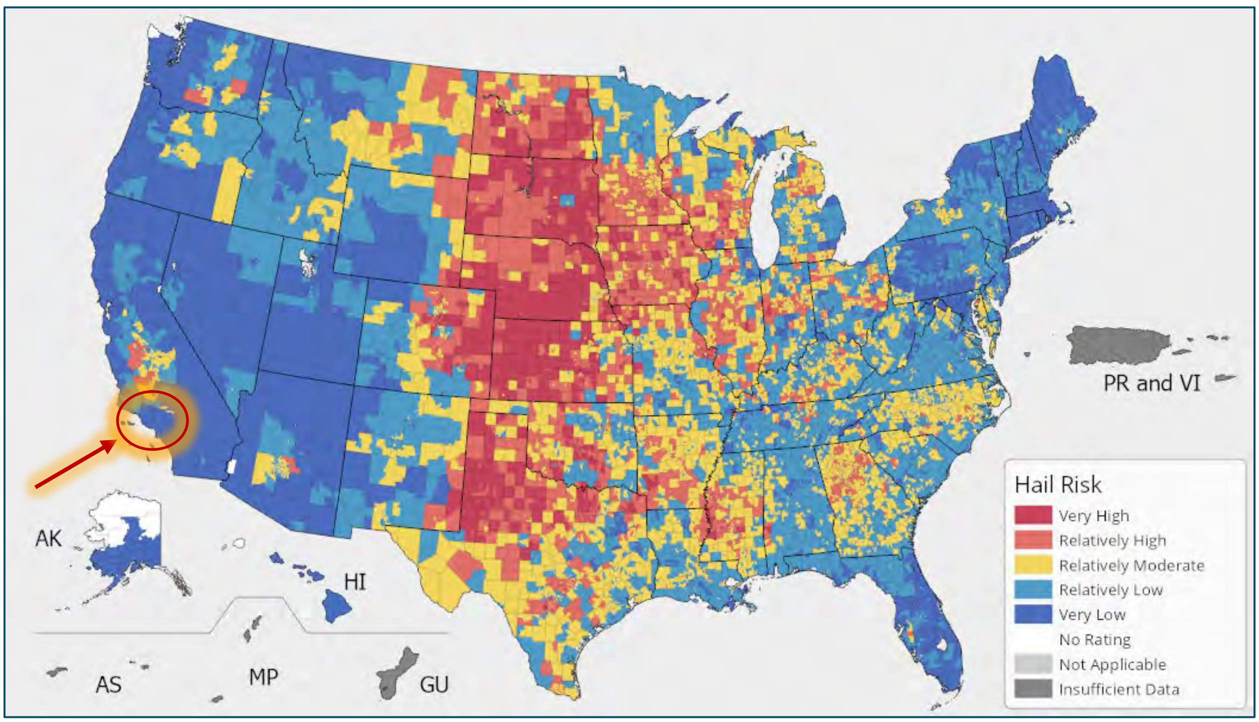
[58] Severe Weather 101: Hail Basics (noaa.gov) https://www.nssl.noaa.gov/education/svrwx101/hail/
[59] NOAA's National Weather Service - Glossary https://forecast.weather.gov/glossary.php?word=HAIL

DESCRIPTION[59]	DIAMETER (INCHES)
Golf ball	1.75
Hen's Egg	2.00
Tennis Ball	2.50
Baseball	2.75
Teacup	3.00
Grapefruit	4.00
Softball	4.50

Source: NOAA

According to FEMA's hail risk index score, presented in the map below, the City of Carson is at low risk for hail events. Hail risk is calculated and represented by a community's relative level of expected building, population, and agriculture loss each year due to Hail when compared to the rest of the United States. [60]

FIGURE 62- FEMA HAIL RISK INDEX SCORE



Source: FEMA NRI, 2024

iii) Extent

Large - Hail can occur as part of severe storms which can impact the entire planning area.

[60] Hail | National Risk Index (fema.gov) https://hazards.fema.gov/nri/hail

iv) Past Occurrences

NOAA Storm Events Database contains the records of significant weather events to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Additionally, the database captures events that are rare and unusual, and other significant meteorological events. The database archives data since January 1950.

According to the Storm Events Database, there have been three hail events since 1950 that were reported within or near the City of Carson, shown in the table below.

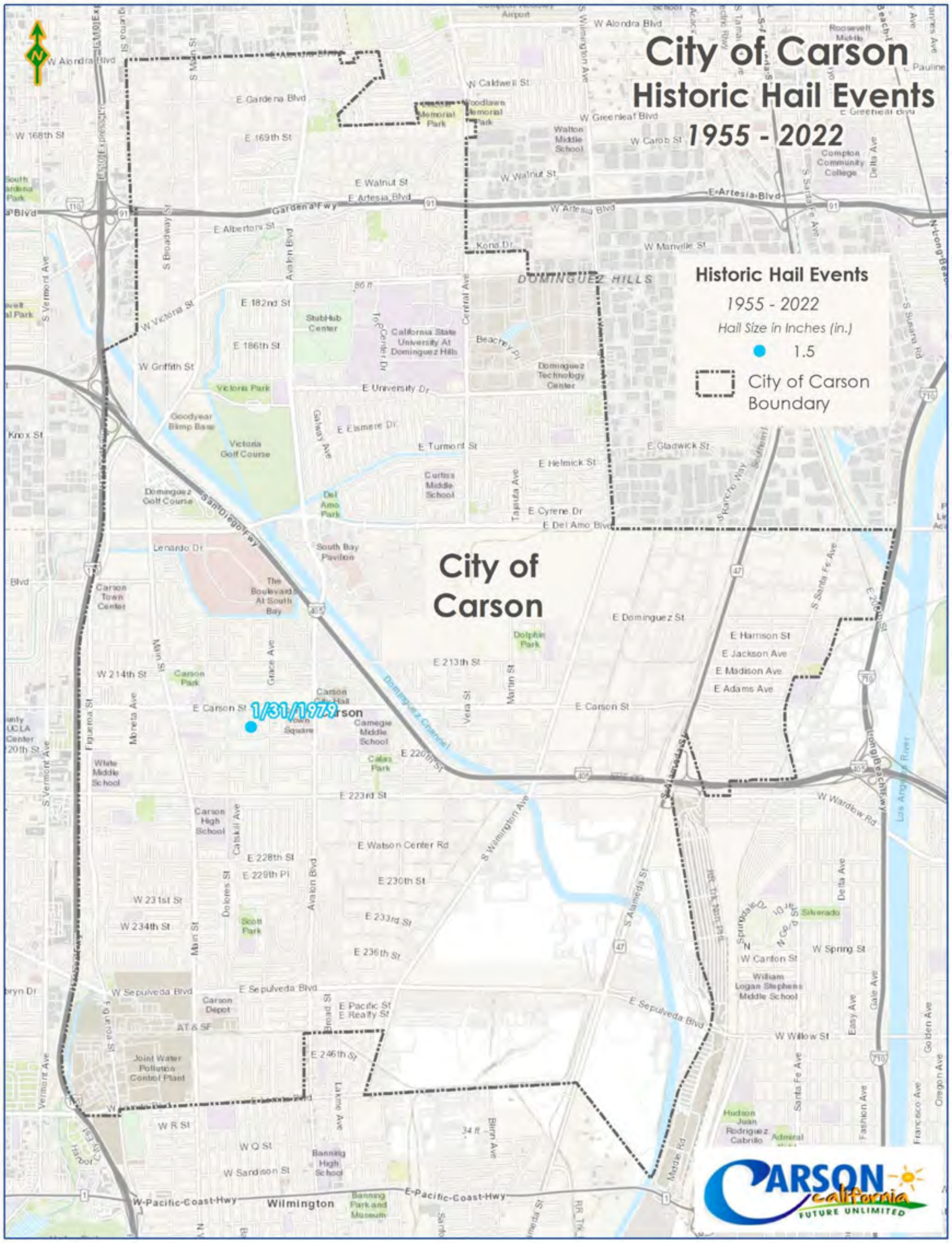
TABLE 51. PREVIOUS HAIL OCCURRENCES

EVENT TYPE	MAGNITUDE	DATE	DEATHS, INJURIES, OR DAMAGE	DESCRIPTION
Hail	1.25	2/11/1959	0	Near the City of Carson
Hail	1.5	1/31/1979	0	City of Carson
Hail	0.5	1/12/2003	3.5 million in damages	Near the City of Carson. A large and powerful thunderstorm produced heavy rain more than 5 inches in less than two hours, flash flooding and hail across South Central Los Angeles County. Hail accumulations in the area were over 5 inches. Numerous intersections were flooded with several feet of water, stranding thousands of motorists during rush hour. Over 130 homes and businesses experienced considerable damage due to flooding and hail. The damage was so significant that South Central Los Angeles County was declared a state disaster area. Overall, damage estimates were around $3.5 million for the area.

Source: NOAA NCEI Storm Events Database

The one hail event that occurred within the City of Carson was reported on January 31, 1979, between E Carson Street and E 223rd Street near Carson Town Square. A map of the location of the one hail event is shown below.

FIGURE 63 - CITY OF CARSON HISTORIC HAIL EVENTS*



*No events recorded in 2023 or first half of 2024

v) Future Probability

Unlikely - The future probability of hail events occurring is not clear and may be dependent on location and certain conditions. Based on previous occurrences, there has been one recorded hail event, which occurred in 1979. According to some scientists, it is predicted that severe convective storms are becoming more likely in our warming climate. Storms with the right mixture of atmospheric ingredients for hail are more likely to form. Because the planet is getting warmer, the odds are generally higher that a hailstone will melt before making its way to the ground. However, the hailstones that do make it down may be larger and cause more damage. [61] Overall, the future probability of hail events occurring in the future is unlikely unless significant changes in the atmosphere increase the chance of hail events impacting the planning area.

vi) Secondary Hazards

Hail is largely a secondary hazard itself to many other natural hazards such as thunderstorms, severe thunderstorms, and tornadoes.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

Although there are no records of significant hail damage specifically within Carson, these events demonstrate that hail can occur and has the potential to impact the city.

Vulnerable Areas in Carson

Hail impacts in Carson would likely be uniform across the city due to its relatively flat topography and urbanized landscape. However, certain factors may increase vulnerability in specific areas:

- Residential Neighborhoods with Older Housing Stock: Homes with aging roofs or those constructed with less resilient materials may be more susceptible to hail damage. Areas with older residences, such as parts of North Carson and communities near Carson Street and Main Street, could experience higher levels of property damage.
- Industrial Zones: Carson's extensive industrial areas, including the Dominguez Technology Center and facilities along Alameda Street, contain equipment and materials

[61] Severe Hailstorms Are Costly and Hard to Predict - Eos https://eos.org/articles/severe-hailstorms-are-costly-and-hard-to-predict

stored outdoors. These assets are vulnerable to hail damage, which could disrupt operations and lead to economic losses.

- Commercial Districts: Shopping centers and businesses with large glass facades or skylights, such as those along Avalon Boulevard and Sepulveda Boulevard, may be at risk of broken windows and water intrusion during hailstorms.

Populations at Risk

While hailstorms in Carson are unlikely to produce large hailstones capable of causing severe injuries, certain populations may be more at risk:

- Outdoor Workers: Individuals employed in construction, landscaping, facility maintenance, and other outdoor occupations may be exposed to hailstorms with little warning. Rapidly developing thunderstorms can catch workers off guard, leading to potential injuries from hail impact or related hazards like lightning.
- Children: Students walking to and from schools such as Carson High School, Andrew Carnegie Middle School, and various elementary schools may be vulnerable if a hailstorm occurs during school hours or dismissal times. Ensuring timely communication and sheltering procedures is essential.
- Homeless Individuals: Those without adequate shelter are at increased risk during any severe weather event. Hailstorms can exacerbate exposure risks for the homeless population in Carson.
- Elderly and Disabled Residents: Mobility challenges may hinder the ability of some residents to seek immediate shelter during sudden hailstorms, increasing their risk of injury.

(1) People

Hail poses a risk to the population as the speed and size of the hailstones falling on individuals can cause injuries or deaths. Motorists, outdoor workers, those experiencing homelessness and unable to seek shelter, are among the some of the populations that would be at increased risk and exposure of harm. Additionally, hail can deteriorate roads and create unsafe driving conditions. Within the city of Carson, there has been no reported data of injuries or harm to residents.

(2) Structures and Systems

Hail is a significant damage cost driver to properties. Insured losses due to property damages from hail have skyrocketed in recent decades, topping $10 billion dollars each year since 2008. Hail can cause extensive damage to vehicles by breaking through glass and damaging the exterior. [62] Based on previous occurrences within and near the City of Carson, previous hail events have caused extensive damage. In one incident, damages amounted to $3.5 million dollars due to hail and flooding. Numerous intersections were flooded with several feet of water, stranding thousands of motorists during rush hour. Over 130 homes and businesses experienced significant damage due to flooding and hail. While this event did not occur within the jurisdictional boundaries of the city, because it occurred nearby it is possible that such an event can occur inside of the city in the future.

Critical Facilities

Hail can cause damage to critical facilities and infrastructure. Depending on the size and the speed of the hailstones, hail has the potential to damage buildings and equipment. However, there is no data on damage to critical facilities from past occurrences within the planning area. Additionally, while hailstorms can pose a risk to critical facilities, typically the damages do not result in major disruptions or debilitating damage to critical assets.

TABLE 52 - POTENTIAL VULNERABILITIES OF LIFELINES TO HAIL EVENTS

LIFELINES	IMPACT TYPE	DESCRIPTION
Food, Hydration, & Shelter		Hail can cause substantial damage to homes and buildings, leading to displacement and the need for temporary shelter. Agricultural areas might also be affected, impacting food production, and leading to potential shortages or increased prices.
Health & Medical		Injuries from hail, such as those caused by falling debris or accidents during the storm, can lead to increased demand for medical services. Healthcare facilities themselves might suffer damage, impacting their ability to provide services.
Communications		Communication networks are essential for issuing warnings and coordinating response efforts. These networks might be affected by hail damage, especially if key infrastructure like cell towers is impacted.

[62] A hail-battered June adds to billions in U.S. storm damage this year » Yale Climate Connections https://yaleclimateconnections.org/2023/06/a-hail-battered-june-adds-to-billions-in-u-s-storm-damage-this-year/

LIFELINES	IMPACT TYPE	DESCRIPTION
Energy		Hailstorms can damage power lines and renewable energy installations like solar panels, leading to power outages. Fuel supply chains might also be disrupted due to transportation issues.
Transportation		Hail can damage vehicles, roads, and transportation infrastructure, leading to disruptions in travel and transport. This can affect everything from emergency response capabilities to daily commutes and commercial shipping.

(3) Natural, Cultural, and Historical Resources

Due to the limited previous hail occurrences, there is limited impact to cultural and historic properties due to hail events.

(4) Risk Analysis

Low - Hail poses a low risk to the planning area. Hail is a rare event in Southern California and unlikely to occur just as thunderstorms are unlikely to occur, with only one event causing significant damage to neighboring communities in the past several decades. Hail poses a higher risk to other areas in California such as central California as hailstones can significantly damage crops due to high agriculture uses which can impact supply and their local economies. However, agriculture is not an industry that the city participates in and is therefore at a reduced risk. Future development is unlikely to significantly impact the community in terms of hail risk as the hazard frequency and severity is minimal. Based on the limited previous occurrences and limited extent of damage to the planning area as well as the mixed scientific literature of the increased frequency or severity of the hazard due to climate change and changing weather patterns and conditions, hail poses a low risk to the planning area.

I) HIGH WINDS

i) Hazard Profile

High winds are generally short-duration events involving straight-line winds or gusts of over 50 mph, strong enough to cause property damage. A high wind event in the region can range from short term microburst activity lasting only minutes to a long duration Santa Ana wind condition that can last for several days. High winds or a windstorm are especially dangerous in areas with significant tree stands and areas with exposed property, poorly constructed buildings, manufactured housing units, major infrastructure, and above-ground utility lines. High winds can cause downed trees and power lines, flying debris and building collapses, which may lead to power outages, transportation disruptions, damage to buildings and vehicles, and injury or death. There are several types of high winds events described in the table below. [63]

TABLE 53. TYPES OF HIGH WINDS EVENTS

TYPE	DESCRIPTION
Straight-line winds	Used to describe any thunderstorm wind that is not associated with rotation and is used to differentiate from tornadic winds.
Downdraft	Is a small-scale column of air that rapidly sinks toward the ground.
Macroburst	An outward burst of intense winds at or near the surface with horizontal dimensions larger than 4 km and occurs when a strong downdraft reaches the surface.
Microburst	A small, concentrated downburst that produces an outward burst of intense winds at or near the surface. There are small and short-lived, lasting only 5-10 minutes, with maximum speeds sometimes exceeding 100 miles per hour.
Downburst	Used to broadly describe macro and microbursts. It is a general term for all localized strong wind events that are caused by a strong downdraft within a thunderstorm while microburst simply refers to a small downburst that is less than 4 km across.
Gust Front	Is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm.
Derecho	A widespread, long-lived storm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho event consists of numerous microbursts, downbursts, and downburst clusters. A derecho event is classified when damage extends more than 240 miles and includes wind gusts of at least 58 miles per hour.

Source: NOAA

[63] Severe Weather 101: Damaging Winds Types (noaa.gov) https://www.nssl.noaa.gov/education/svrwx101/wind/types/

(1) Duration

The duration of high wind events depends on the cause of the event. High wind events due to Santa Ana winds can last from one to seven days with an average of 3 days. High wind events due to a thunderstorm, tropical storm, or winter storm, may last as long as the storm does, which can be up to several hours or days.

(2) Seasonality

The seasonality of high wind events may vary depending on what is prompting the event. High wind events from Santa Ana Winds typically occur from September to May. High wind events from winter storms may occur during the winter months while hurricane and tropical storms may occur during the spring, summer, and fall months. Therefore, the planning area can expect high wind events to occur year-round.

(3) Speed of Onset

Typically, high wind events due to Santa Ana Winds are predictable and forecasters can spot their occurrences up to seven days in advance. [64]High wind events due to other weather-related hazards are similarly predictable and forecasters can anticipate their speeds as they reach the region. The formation of these events may take up to several days or weeks in the case of a hurricane or tropical storm.

(4) Santa Ana Winds

Santa Ana Winds are common and impact the Los Angeles Area, including the City of Carson. Santa Ana Winds occur when air from a region of high pressure over the dry, desert region of the southwestern U.S. flows westward towards low pressure located off the California coast. This creates dry winds that flow east to west through the mountain passages in Southern California. These winds are most common during the cooler months of the year, occurring from September through May and peaking in December. Santa Ana winds typically feel warm (or even hot) because as the cool desert air moves down the side of the mountain, it is compressed, which causes the temperature of the air to rise. These strong winds can cause major property damage and increase wildfire risk because of the dryness of the winds and the speed at which they can spread a flame across the region.

(5) Location

The entirety of the planning area is considered vulnerable to high winds.

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[64] Explaining Santa Ana Winds - WeatherNation (weathernationtv.com)
https://www.weathernationtv.com/news/explaining-santa-ana-winds

ii) Magnitude

The Beaufort Wind Scale was one of the first scales to estimate wind speed and effects. It was originally developed to help sailors estimate the winds via visual observations. The scale starts with 0 and goes to a force of 12. The Beaufort scale is still used today to estimate wind strengths shown in the table below.

TABLE 54. THE BEAUFORT SCALE

BEAUFORT NUMBER	DESCRIPTION	SPEED	VISUAL CUES AND DAMAGE EFFECTS
0	Calm	Calm	Calm wind. Smoke rises vertically with little if any drift.
1	Light Air	1-3 mph	The direction of wind is shown by smoke drift, not by wind vanes. Little if any movement with flags. Wind barely moves tree leaves
2	Light Breeze	4-7 mph	Wind felt on face. Leaves rustle and small twigs move. Ordinary wind vanes move.
3	Gentle Breeze	8-12 mph	Leave and small twigs in constant motion. Wind blows up dry leaves from the ground. Flags are extended out.
4	Moderate Breeze	13-18 mph	Wind moves small branches. Wind raises dust and loose paper from the ground and drives them along.
5	Fresh Breeze	19-24 mph	Large branches and small trees in leaf begin to sway. Crested wavelets form on inland lakes and large rivers.
6	Strong Breeze	25-31 mph	Large branches in continuous motion. Whistling sounds heard overhead or near power and telephone lines. Umbrellas used with difficulty.
7	Near Gale	32-38 mph	Whole trees are in motion. Inconvenience felt when walking against the wind.
8	Gale	39-46 mph	Wind breaks twigs and small branches. Wind generally impedes walking.
9	Strong Gale	47-54 mph	Structural damage occurs, such as chimney covers, roofing tiles blown off, and television antennas damaged. The ground is littered with many small twigs and broken branches.
10	Whole Gale	55-63 mph	Considerable structural damage occurs, especially on roofs. Small trees may be blown over and uprooted.
11	Storm Force	64-75 mph	Widespread damage occurs. Larger trees blown over and uprooted.

BEAUFORT NUMBER	DESCRIPTION	SPEED	VISUAL CUES AND DAMAGE EFFECTS
12	Hurricane	Over 75 mph	Severe and extensive damage. Roofs can be peeled off. Windows broken. Trees uprooted. RVs and small mobile homes overturned. Moving automobiles can be pushed off the roadways.

Source: NOAA

The National Weather Service issued wind related products to communicate high wind risk described in the table below.

TABLE 55. NATIONAL WEATHER SERVICE WIND-RELATED PRODUCT

WIND-RELATED PRODUCT	DESCRIPTION
Wind Advisory (Light Brown)	Sustained winds of 31-39 mph for 1 hour or more and/or gusts 45-57 mph for any duration.
High Wind Watch (Yellow)	Conditions are favorable for a high wind event to meet or exceed high wind warning criteria in the next 12 to 48 hours.
High Wind Warning (Dark Orange)	Sustained winds of 40 mph or higher for 1 hour or more and/or gusts 58 mph or higher any duration.

Source: National Weather Service (NWS*)*

iii) Extent

Large - The whole planning area is susceptible to high wind events, partially due to the Santa Ana Winds.

iv) Past Occurrences

NOAA Storm Events Database contains the records of significant weather events to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Additionally, the database captures events that are rare and unusual, and other significant meteorological events. The database archives data since January 1950. According to the NOAA Storm Events Database, there have been 14 high wind events since 1950, shown in the table below.

TABLE 56. HISTORICAL HIGH WIND EVENTS

HAZARD	DATE	MAGNITUDE	DESCRIPTION
High Wind	11/25/1996	85 mph	Strong surface high pressure over the Great Basin produced strong Santa Ana winds across Southern

HAZARD	DATE	MAGNITUDE	DESCRIPTION
			California. Sustained northeast winds of 35 to 45 mph were common. Wind gusts up to 98 mph were reported. Numerous trees and power lines were blown down.
High Wind	11/28/1996	52 mph	Strong northwest winds developed across Southern California in the wake of a cold front. Sustained northwest winds of 30 to 40 mph with gusts up to 60 mph were reported. Numerous trees and power lines were blown down.
High Wind	12/14/1996	83 mph	Strong Santa Ana winds pummeled Southern California. Sustained winds speed reached 45 to 55 MPH with gusts up to 95 MPH through passes and canyons. Numerous damages occurred, including many downed power lines which left thousands without electricity. A tractor trailer driver was injured with the winds knocked his truck off Highway 118 in the Santa Susana Pass. In the Lakeview Terrace area, one 82-year-old man was killed, and his 28-year-old daughter-in-law injured when a pine tree branch fell on their minivan.
High Wind	12/17/1996	61 mph	Strong Santa Ana winds once again ravaged Southern California. Sustained northeast winds of 40 to 50 MPH with gusts up to 70 MPH were reported. Thousands were left without power as the winds snapped power lines. In addition, blowing debris and downed trees caused widespread damage.
High Wind	1/5/1997	86 mph	Strong Santa Ana winds pummeled Southern California. Northeast winds of 40 to 60 mph with gusts of 99 mph were reported. In Shadow Hills, a 55-year-old man was killed when the winds blew down a 70-foot tree onto him. At Burbank Airport, the winds flipped over several small planes. Eleven cities: Arcadia, Claremont, Duarte, La Canada Flintridge, LaVerne, Monrovia, Pasadena, San Dimas, Temple City, San Fernando, and Walnut declared local states of emergency due to wind damage.
High Wind	2/23/1997	52 mph	Strong Santa Ana winds developed over Southern California. Northeast winds gusting up to 60 mph were reported. Numerous power lines were blown

HAZARD	DATE	MAGNITUDE	DESCRIPTION
			down. In Santa Paula downed power lines caused a house fire.
High Wind	12/9/1997	63 mph	Strong north to northeast flow developed across Southern California. Average wind speeds of 30 to 50 mph with gusts up to 72 mph were reported. On Interstate 10, near Covina, the wind blew down a 60-foot tree onto the freeway. One minor accident occurred when a van ran into the tree. In Santa Clarita, the wind blew down a eucalyptus tree onto a car parked at the International House of Pancakes. Numerous power outages were reported across the Southland. On Santa Catalina Island, the strong northeast winds produced very rough seas in Avalon Harbor. Fifteen boats were destroyed.
High Wind, Winter Storm	2/2/1998	78 mph	The first powerful storm of the month slammed into Central and Southern California. Powerful winds buffeted the entire area. Hearst Castle, in San Luis Obispo County, reported winds gusting to ninety mph. Elsewhere, winds gusting in excess of 70 mph were reported. Hundreds of trees and power lines were blown down, resulting in numerous power outages. In Pacoima, the wind blew the roof off an apartment complex. Along with the intense winds, heavy rain drenched the entire area. On average, rainfall totals ranged from 2 to 8 inches over coastal areas, up to twelve inches in the mountains. Widespread flooding was reported in all areas. Forty homes were flooded in Solvang and fifteen homes were flooded in Ojai. Flooding and mudslides closed parts of most major roadways across the area...including Highways 1, 33, 101, 118, 126, 150, 154, 166 and 246. In Santa Maria, one thousand feet of the Santa Maria River levee washed away, flooding hundreds of acres of farmland. In Granada Hills, two teenage girls were rescued after falling into Bull Creek. In Valencia, a farm worker was rescued from Castaic Creek. In the mountains, reported snowfall totals were as high as three feet at some resort locations.
High Winds,	2/5/1998	61 mph	The second storm of the month struck Central and Southern California. Once again, intense winds, gusting up to 70 mph, knocked down many trees

HAZARD	DATE	MAGNITUDE	DESCRIPTION
Heavy Rain			and power lines. Rainfall totals ranged from 1 to 3 inches over coastal areas, up to six inches in the mountains. Numerous flooding problems were reported across the area. Most highways, including the 1, 101, 126 and 154 were closed due to flooding or mudslides. In Santa Barbara, the airport was closed due to flooded runways. In Goleta, a shopping mall was flooded. The worst flooding occurred in Camarillo where a local state of emergency was declared. Camarillo City Hall, as well as hundreds of homes, was flooded after receiving 2.80 inches of rain in less than two hours. The Calleguas Creek overflowed, flooding the Camarillo Springs Golf Course. In Paramount, a female robbery suspect drowned in the Los Angeles River while trying to elude police. In the mountains, the storm produced up to twelve inches of snow at resort levels.
High Wind, Winter Storm	2/7/1998	61 mph	The third storm of the month brought more weather-related problems to Central and Southern California. Intense winds, gusting up to 70 mph, knocked down many trees and power lines. In Encino, the winds blew down Lang Oak, a one-thousand-year-old oak tree. Rainfall totals ranged from 1 to 4 inches over the coasts, up to seven inches in the mountains. Widespread reports of urban and rural flooding were reported. In Santa Maria, Highway 101 was flooded by over one foot of water. Elsewhere, Interstate 5 as well as Highways 126, 166 and 246 reported closures due to flooding and mudslides. In the mountains of Santa Barbara County, a hiker drowned in Rattlesnake Creek. In the Angeles National Forest, a teenage snowboarder was found dead due to exposure. In the San Fernando Valley, a private road washed out, allowing a car to plummet fifty feet down a ravine. One man was killed, and two others injured. In the mountains, up to twelve inches of snow fell at resort levels.
High Wind, Severe	12/27/2006	52 mph	In late December, a fast-moving storm system moved through Southern California. The storm did not produce any significant rainfall but did generate a severe thunderstorm with large hail in

HAZARD	DATE	MAGNITUDE	DESCRIPTION
Thunderstorm			Sherman Oaks. The main weather associated with this storm system was the gusty offshore winds that developed behind the storm. The gusty winds affected Santa Barbara, Ventura and Los Angeles counties and gusted as high as 100 MPH. Widespread power outages were reported across the area due to downed power lines. The winds also damaged numerous orchards across Santa Barbara and Ventura counties, resulting in over $15 million dollars of crop damage. In Lake Casitas, the winds damaged a large boat dock, scattering numerous boats across the lake. One injury due to a falling tree was reported at a campground in Santa Barbara County. Large ocean waves also occurred during this event and resulted in the death of one man who was trying to save two family members who were swept into the ocean by the large waves. The two family members swept into the ocean were eventually saved.
High Winds	10/21/2007	52 mph	Between October 20th and 24th, strong surface high pressure developed over the Great Basin and produced a strong and long-lasting Santa Ana wind event across Southern California. This Santa Ana wind event was the strongest and most widespread in recent memory with peak wind gusts over 100 mph reported at Laguna Peak and Whitaker Peak. The offshore winds produced very warm and dry conditions across Southern California which led to 9 different wildfires across Santa Barbara, Ventura, and Los Angeles counties. Four of the wildfires exceeded 700 acres with one fire burning 60,000 acres.
High Wind, Winter Storm	1/31/2016	36 mph	Another powerful winter storm took aim upon Southwestern California, bringing heavy rain and snow, thunderstorms, and gusty winds. Rainfall totals ranged from 0.50 to 1.50 inches across coastal and valley areas to up to 4.50 inches in the mountains. With such high rainfall totals, some significant snowfall was reported in the mountains with resort levels reporting up to 18 inches. Some severe thunderstorms developed with strong thunderstorm winds (more than 60 MPH)

HAZARD	DATE	MAGNITUDE	DESCRIPTION
			reported. Additionally, intense winds were reported across many areas.
High Wind	11/25/2021	67 mph	Extraordinarily strong and gusty Santa Ana winds once again impacted sections of Ventura and Los Angeles counties. North to northeast wind gusts peaked up to 89 MPH in some spots.
High Wind, Tropical Storm	9/8/2022	40+ mph	Tropical Storm Kay produced heavy rains, minor flooding, and gusty winds in the Los Angeles area.

Source: NOAA NCEI Storm Events Database

Frequency

Since the earliest report of a high wind event in 1996, there is a 52 percent chance of a high wind event occurring in the planning area, in any given year based on the data from the NOAA Storm Events Database. Based on the historical data, it is likely to expect a high wind event impacting the City of Carson in the future.

v) Future Probability

Likely - It is likely that high wind events will continue to occur during any time of the calendar. However, based on previous events and the nature of Santa Ana Winds, the City of Carson can experience an increase of high wind events during the Fall, Winter, and Spring months. Contradicting research found that Santa Ana winds could increase or decrease in frequency and magnitude based on some factors driven by climate change. Key points found in recent research project decreasing Santa Ana Winds (SAW) activity in the 21st century, reductions of SAW are projected to occur in early fall and late spring (shoulders of the SAW season), and reductions are due primarily to decreasing frequency of SAWs and much less so to their decreasing intensity. [65]

vi) Secondary Hazards

High wind events can cause secondary hazards to occur which include wildfires and power outages. More information on each secondary hazard is described in the table below.

TABLE 57. HIGH WIND SECONDARY HAZARD

HAZARD	DESCRIPTION

[65] Climate Change Suppresses Santa Ana Winds of Southern California and Sharpens Their Seasonality - Guzman-Morales - 2019 - Geophysical Research Letters - Wiley Online Library https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018GL080261

Wildfire	High winds combined with dry vegetation cause post a risk for wildfires to occur. Additionally, Santa Ana winds local to region can cause a great deal of damage. The fast, hot winds cause vegetation to dry out, increasing the danger of wildfire. Once the fires start, the winds fan the flames and hasten their spread.
Power Outage	High winds can knock out power lines and cause power outages. Power outages can pose a risk to the whole community by disrupting communications, water and transportation, grocery stores, ATMs, banks, and other services, as well as spoiling food and water contamination. Power outages are especially dangerous when coinciding with other hazards.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

The City of Carson is subject to high wind events that can have significant impacts on the community. These winds can result from various meteorological conditions, including Santa Ana winds, Pacific storms, and thunderstorms. High winds pose risks to public safety, property, infrastructure, and the environment. This assessment provides a detailed analysis of the potential impacts of high wind events on Carson, identifying vulnerable areas, populations, and critical infrastructure.

Types of High Wind Events Affecting Carson

- Santa Ana Winds: These are strong, dry, and warm winds that originate from high-pressure systems over the Great Basin and flow toward the California coast, typically occurring from October through March. Santa Ana winds can reach sustained speeds of 40 to 60 mph, with gusts exceeding 70 mph.
- Pacific Storms: During the winter months, low-pressure systems from the Pacific Ocean can bring strong winds to the region, often accompanied by heavy rain.
- Thunderstorm Winds: Severe thunderstorms, though less common in Southern California, can produce strong gusty winds and microbursts that impact localized areas.

Vulnerable Areas in Carson

- Areas with older, large trees, such as those near Scott Park and Veterans Park, are susceptible to damage from falling branches or uprooted trees during high winds. This can result in property damage and blocked roads.

- Carson hosts significant industrial facilities along Alameda Street and Sepulveda Boulevard. High winds can damage structures, storage facilities, and equipment. There is also a risk of hazardous material releases if containment systems are compromised.
- Ongoing development projects, especially in the Carson Marketplace area, are vulnerable to wind-related damage, including blown debris and instability of incomplete structures.
- Mobile home parks, such as Colony Cove Mobile Estates, may be at higher risk due to the structures' susceptibility to wind damage compared to conventional homes.

Populations at Risk

Homes not built to current building codes may lack the structural integrity to withstand high winds, putting occupants at risk.

Outdoor Workers

Individuals employed in construction, utilities, landscaping, and transportation face increased safety risks during high wind events due to exposure to hazardous conditions.

Elderly and Disabled Individuals

Approximately 12.9% of Carson's population is aged 65 and over. Mobility issues can hinder the ability to secure property or evacuate if necessary.

Low-Income Households

Around 9.5% of residents live below the poverty line. Limited resources may impede preparedness efforts, such as securing loose items or making necessary home repairs.

Potential Impacts

High winds can rapidly spread wildfires, endangering lives and complicating evacuation efforts.

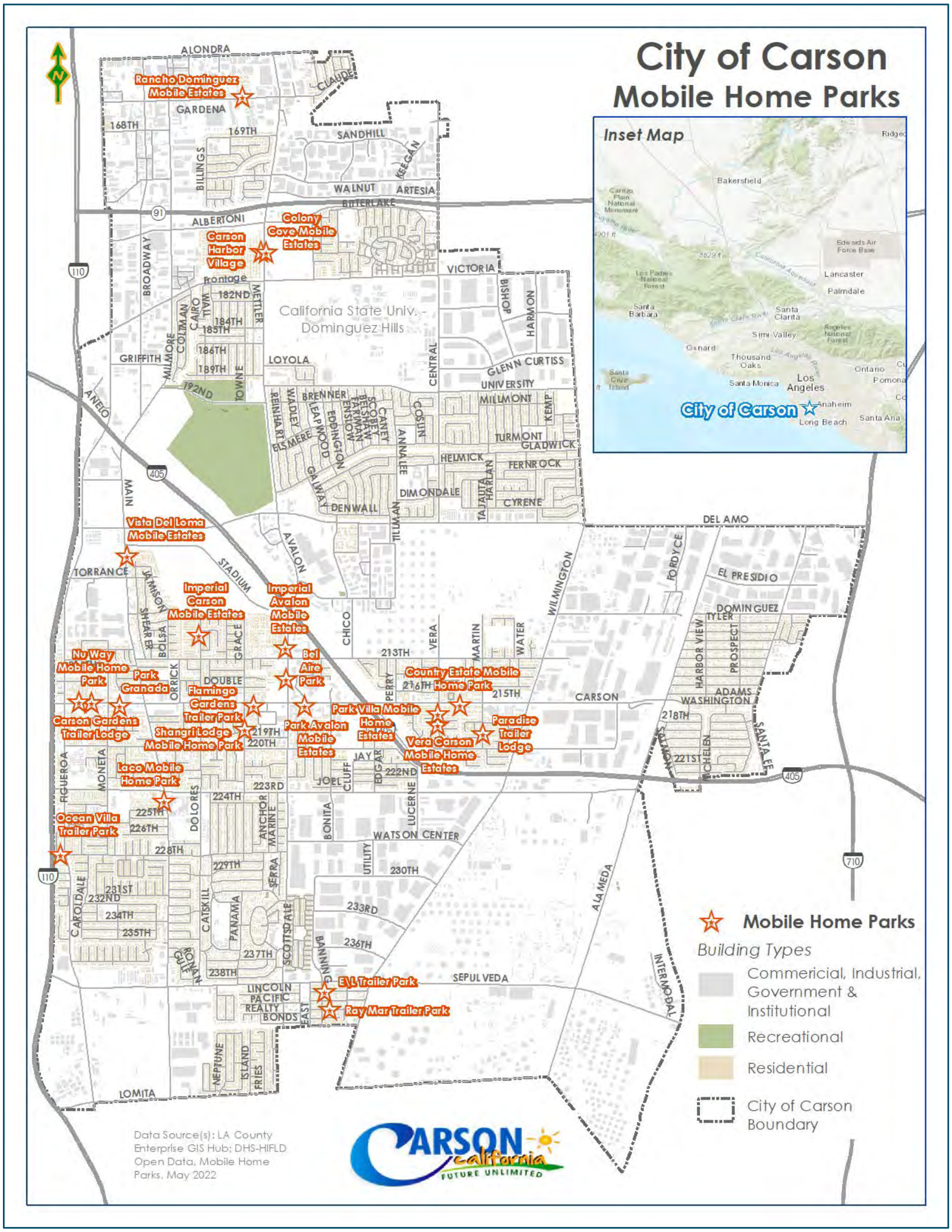
(1) People

Disproportionately impacted communities, particularly those impacted by loss of electrical power such as the elderly, individuals with disabilities, and those that rely on electrical power for their medical needs are exposed and at increased risk of adverse effects from high wind events. High wind events can move everyday objects such as outdoor furniture, debris, and vegetation into projectiles. Additionally, individuals living in mobile homes are at an increased risk to high wind and flying debris as the structural integrity of such structures are more prone to damage. Flying objects can pose a significant threat to the public.

(2) Structures and Systems

The City of Carson has several mobile home parks and would be at high risk of high wind events and the debris that is likely to occur to the structure of the home and for its residents, shown in the map below. Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls. When high winds strike a city, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery. Both residential and commercial structures with weak reinforcement are susceptible to damage. Wind pressure can create a direct and frontal pressure on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift suction forces that pull building components and surfaces outward. With extreme wind forces, the roof or entire building can fail causing considerable damage.

FIGURE 64 - CITY OF CARSON MOBILE HOME PARKS



Critical Facilities

High wind events can pose a risk to all critical facilities within the planning area. Damage to power lines, and other property and infrastructure due to falling trees and branches poses a risk for the community. Long-Term Care Facilities (LTCF) which includes nursing homes, community-based residential facilities and other special needs housing and facilities additionally are burdened by power outages. Downed trees and electrical wires can block streets and highways. During periods of extremely strong Santa Ana winds, major highways can be temporarily closed to truck and recreational vehicle traffic. However, typically these disruptions are not long lasting, nor do they carry a severe long term economic impact on the region.

Historically, falling trees have been the major cause of power outages in the region. During wet winters, saturated soil causes trees to become less stable and more vulnerable to uprooting from high winds. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Falling trees can bring electric power lines down to the pavement, creating the possibility of lethal electric shock.

TABLE 58 - POTENTIAL VULNERABILITIES OF LIFELINES TO SEVERE STORMS

LIFELINES	IMPACT TYPE	DESCRIPTION
Housing & Building Infrastructure		Windstorms can cause damage to homes, businesses, and public buildings, leading to displacement of residents and the need for temporary shelters and renovation efforts.
Utilities		Windstorms can disrupt essential services by damaging power lines, water mains, and communication networks. Restoring these services is crucial for recovery and supporting other lifeline sectors.
Transportation		Debris and damage to roads, bridges, and transportation infrastructure can hinder emergency response efforts and the movement of goods and people. Clearing debris and repairing infrastructure are critical post-storm activities.

(3) Natural, Cultural, and Historical Resources

High winds could cause flying debris which could cause damage to cultural or historic properties within the City of Carson. There are 49 identified historical and cultural properties within the City of Carson. However, there are no known impacts to such properties from previous events.

(4) Risk Analysis

High - High wind events pose a high risk to the planning area. Based on the history of previous occurrences in the region, high wind events can be expected and can cause a wide range of adverse impacts. Wind speeds have historically ranged from 40 to 86 miles per hour. High wind events are likely to occur in any given year and are likely to continue in the future, especially due to local phenomena such as the Santa Ana Winds. Santa Ana Winds occur when air from a region of high pressure over the dry, desert region of the southwestern U.S. flows westward towards low pressure located off the California coast.

High wind events can pose a risk to people, property, and to critical facilities within the planning area. Based on future development trends, it is likely that high winds will increase in risk as the population increases, along with housing and property. Power outages and debris from high wind speeds can cause a significant threat to public health by increasing the risk of injuries and loss of life, especially to communities such as older adults, individuals with disabilities, people experiencing homelessness, individuals experiencing poverty, those living in mobile homes, and those that are medically dependent on power. In summary, high wind events have previously occurred in the region causing damage and impacts and will continue to in the future.

Based on the risk assessment, it is evident that high wind events will continue to have potentially devastating economic, structural, and public health impacts to certain areas of the city. Windstorms in the region can cause extensive damage including heavy tree stands, exposed coastal properties, road and highway infrastructure, and critical utility facilities. Impacts from high wind events include but not limited to the following:

- Injury and loss of life.
- Commercial and residential structural damage.
- Disruption of and damage to public infrastructure.
- Secondary Health hazards e.g. mold and mildew.
- Damage to roads/bridges resulting in loss of mobility.
- Significant economic impact (jobs, sales, tax revenue) upon the community.
- Negative impact on commercial and residential property values; and
- Significant disruption to students and teachers as temporary facilities will be needed.

J) HURRICANE

i) Hazard Profile

A hurricane is a type of storm called a tropical cyclone, which forms over tropical or subtropical waters. They form over the Atlantic Ocean or eastern Pacific Ocean and typically impact North America. Typhoons and cyclones are terms commonly used to describe systems in the Western Pacific and Indian Ocean. Hurricanes pose a great threat and can include powerful winds, heavy rainfall, storm surges, coastal and inland flooding, rip currents, tornadoes, and landslides. When a storm's maximum sustained winds reach 74 mph, it is called a hurricane.

(1) Duration

The formation of hurricanes, as they develop in the ocean by landfall, can last for weeks. However, when they make landfall, it can last from several hours to several days.

(2) Seasonality

The hurricane season runs from June 1 to November 30.[66] Based on previous occurrences within the region, noted in the sections below, tropical storms and hurricanes occur the most in the months of August and September.

(3) Speed of Onset

Hurricanes and tropical storms can take up to several weeks to form before they make landfall. These events provide at least a couple of days of warning time before making landfall which can provide time to initiate response operations to reduce damage, impacts, injuries, and mortality to the impacted area (i.e., evacuations).

(4) Location

The entirety of the planning area is considered vulnerable to hurricanes. While hurricanes are relatively uncommon in this region, such events remain possible and typically impact a wide geographic area.

ii) Magnitude

The Saffir-Simpson Hurricane Wind Scale is used to measure the strength of a hurricane, from 1 to 5, based on the maximum sustained winds. The Saffir-Simpson Hurricane Wind Scale estimates potential property damage. While all hurricanes produce life-threatening winds, hurricanes rated Category 3 and higher are known as major hurricanes, shown in table below.

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[66] What is a hurricane? (noaa.gov) https://oceanservice.noaa.gov/facts/hurricane.html

Major hurricanes can cause devastating to catastrophic wind damage and significant loss of life simply due to the strength of their winds. [67]

TABLE 59. SAFFIR-SIMPSON HURRICANE WIND SCALE

CATEGORY	SUSTAINED WINDS	TYPES OF DAMAGE
1	74-95 mph	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles will result in power outages that could last a few to several days.
2	96-110 mph	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (Major)	111-129 mph	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (Major)	130-156 mph	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with the loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to months. Most of the area will be uninhabitable for weeks or months.
5 (Major)	157 mph or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to months. Most of the area will be uninhabitable for weeks or months.

Source: NOAA

[67] Saffir-Simpson Hurricane Wind Scale (noaa.gov) https://www.nhc.noaa.gov/aboutsshws.php

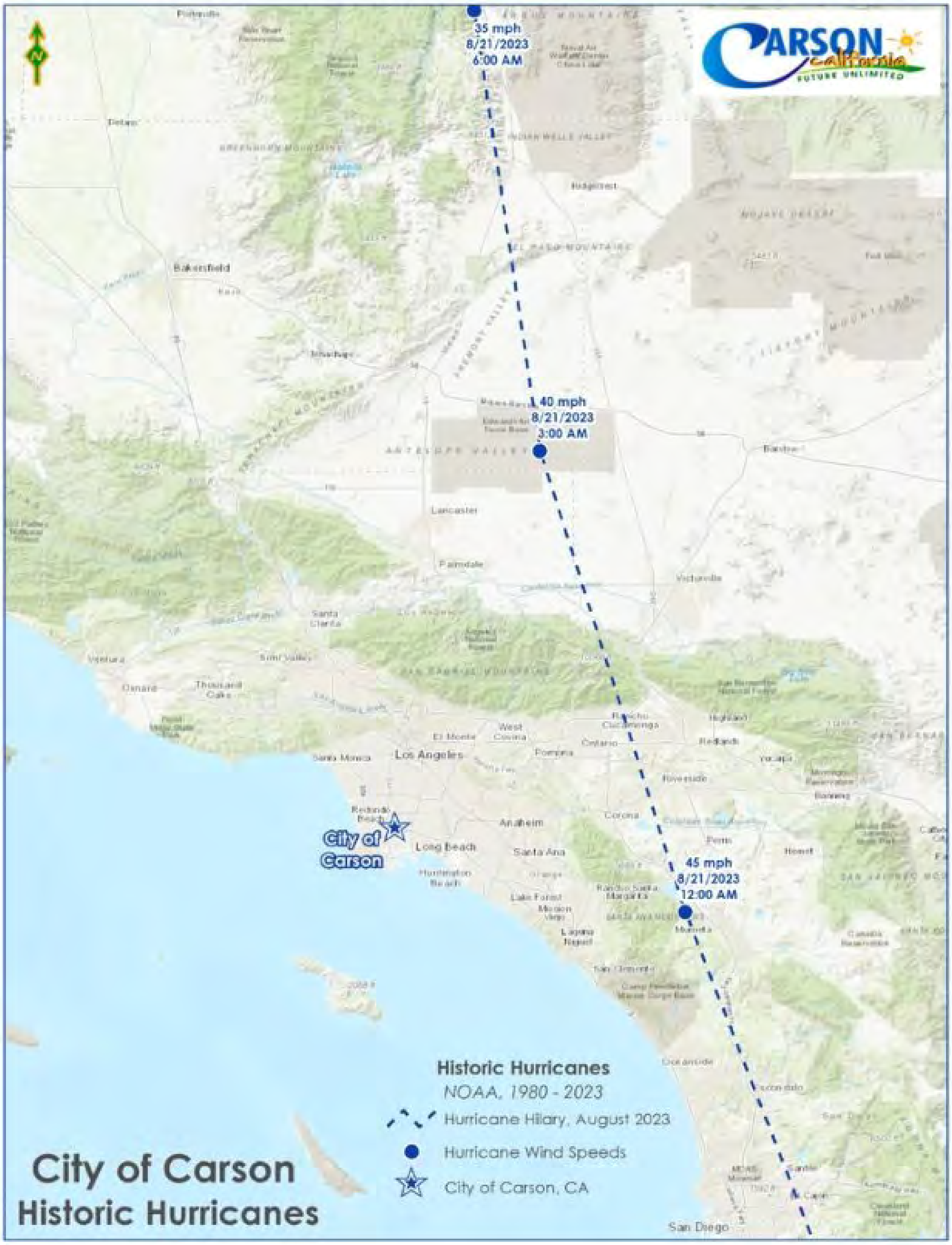
iii) Extent

Large - Due to the City's proximity to the coastline near the Pacific Ocean and the previous occurrences of hurricanes and tropical storms in the past, the whole planning area is at risk of hurricanes occurring and their impacts.

iv) Past Occurrences

On August 20, 2023, southern California was affected by Tropical Storm Hilary producing wind gusts of 40-50 mph range with the highest gusts of 60-70 mph over the San Gabriel Mountains. High intensity rainfall occurred in many areas and broke records for August monthly rainfall. The map below shows the track of Hurricane Hilary as it made landfall in Southern California.

FIGURE 65 - PATH OF HURRICANE HILARY, AUGUST 21, 2023



While Southern California has experienced few hurricanes in the past, there are more instances of tropical storms. All hurricanes and tropical storms that did not strengthen into a hurricane are outlined in the table below. [68]

TABLE 60. PREVIOUS OCCURRENCES IN SOUTHERN CALIFORNIA

DATE	HAZARD TYPE	INJURIES, FATALITIES, DAMAGE, EVACUATIONS	DESCRIPTION
August 20 - August 21, 2023	Hurricane Hilary	5 Evacuations for Los Angeles County	Numerous flooded roads, mudslides, rockslides, road closures, power outages, trees downed etc. Desert and mountains areas experienced a large majority of the impacts. Coastal areas had escaped damage from the Hurricane. In the City of Carson, ready-to-fill sandbags were made available for residents. Schools were cancelled for August 21, 2023.
September 9, 2022	Tropical Storm Kay	N/A	Tropical Storm Kay weakened as it made its way to the Los Angeles area providing heavy rainfall and minor flooding in some areas, strong wind gusts that toppled trees and high tide dangerous close to homes along the coast.
September 25, 1997	Tropical Storm Nora	N/A	Tropical Storm Nora made an impact upon Southern California. Although the center of Nora tracked northward across Baja California and into Arizona tropical moisture associated with Nora brought significant rainfall to the area. The heaviest rain fell in Los Angeles and Ventura counties with rainfall totals ranging from 0.50 to 0.75 inches at the coast to 1.00 to 1.75 inches in the mountains.

[68] PSHLOX_2023EP09_Hilary_Data (weather.gov)
https://www.weather.gov/media/lox/TropicalEventSummary/PSHLOX_2023EP09_Hilary_Summary.pdf

DATE	HAZARD TYPE	INJURIES, FATALITIES, DAMAGE, EVACUATIONS	DESCRIPTION
September 1976	Tropical Storm Kathleen	14 dead in the U.S. and $100 million in damages	The storm mainly caused damage to the El Centro and Ocotillo Wells area of Southern California. [69]
September 1978	Tropical Depression	$300 million in damages.	Rain totaled up to 7 inches in some locations. California's raisin crop was decimated, suffering the largest loss on record. Damages from the storm exceeded $300 million.
September 1939	Tropical Storm	$2 million in damages.	The only tropical storm to make landfall in California in the 20th century. The storm brought torrential rains that totaled more than 5 inches in the Los Angeles area and caused coastal storm surges resulting in widespread flooding that washed away homes and vehicles. 45 lives were lost at sea and property losses estimated to be $2 million. [70]

Source: NOAA, NCEI, Storm Events Database

Frequency

Since the earliest report of a high wind event in 1939, there have been 6 events within an 84 year-period that have affected the Southern California region. While not all events have produced significant damage to the planning area, they all have produced impacts such as heavy rainfall. Based on historical data, there is an 11 percent chance of a hurricane or tropical storm occurring in the planning area, in any given year. Based on the historical data, a hurricane or tropical storm is less likely to occur.

v) Future Probability

Possible - According to the scientists and the National Oceanic and Atmospheric Administration (NOAA) agree that hurricanes and tropical cyclones are not likely to increase in frequency due to climate change. In fact, there is data indicating that the number of cyclones is slightly dropping.

[69] A Rare Storm Leaves 14 Dead and Damage in Millions on Coast - The New York Times (nytimes.com) https://www.nytimes.com/1976/09/14/archives/a-rare-storm-leaves-14-dead-and-damage-in-millions-on-coast.html

[70] The brief history of hurricanes and tropical storms in California (ktla.com) https://ktla.com/news/california/a-look-at-californias-brief-history-with-hurricanes-and-tropical-storms/

However, climate change could increase the intensity of cyclones that develop causing more damage and destruction when they make landfall. [71] Based on the previous hurricanes and tropical cyclones that have impacted Southern California, it is possible that future storms could impact the planning area.

vi) Secondary Hazards

Hurricanes and tropical storms can cause secondary hazards to occur which include dam failure, storm surge, tornado, power outages, flooding, and high winds. More information on each secondary hazard is described in the table below.

TABLE 61. HURRICANE SECONDARY HAZARDS

HAZARD	DESCRIPTION
Dam Failure	Storm surges and flooding can breach or severely damage dams and cause failure. Dam failures can cause devasting damage to property, the environment, and loss of life.
Storm Surge	An abnormal rise of water generated by a storm's winds. Storm surge can reach heights well over 20 feet and can span hundreds of miles of coastline. The destructive power of storm surge and large battering waves can result in loss of life, buildings destroyed, beach and dune erosion and road and bridge damage along the coast. Storm surge can travel several miles inland. In estuaries and bayous, saltwater intrusion endangers public health and the environment.
Tornado	Hurricanes and tropical storms can also produce tornadoes. These tornadoes most often occur in thunderstorms embedded in rain bands well away from the center of the hurricane; however, they can also occur near the eyewall. Usually, tornadoes produced by tropical cyclones are relatively weak and short-lived, but they still pose a significant threat.
Power Outage	Nine out of ten major power outages have been caused by hurricanes. Power outages can pose significant risk to critical facilities and population health.
Flooding	Tropical cyclones often produce widespread, torrential rains in excess of 6 inches, which may result in deadly and destructive floods. In fact, flooding is the major threat from tropical cyclones for people living inland. Flash flooding, defined as a rapid rise in water levels, can occur quickly due to intense rainfall. Longer term flooding on rivers and streams can persist for several days after the storm.
High Winds	Tropical storm-force winds are strong enough to be dangerous to those caught in them. For this reason, emergency managers plan on having their

[71] Will climate change make California tropical storms more common? | cbs8.com https://www.cbs8.com/article/news/local/outreach/earth8/climate-change-tropical-storms-southern-california-more-common/509-14ad79cd-184c-4bcf-b327-a45fa2388535

HAZARD	DESCRIPTION
	evacuations complete and their personnel sheltered before the onset of tropical storm-force winds, not hurricane-force winds. Hurricane-force winds, 74 mph or more, can destroy buildings and mobile homes. Debris, such as signs, roofing material, siding and small items left. outside become flying missiles during hurricanes. Winds can stay above hurricane strength well inland.

Since the city of Carson is close to the coastal area, the lowest elevation level is 5 feet below sea level, and underwater in the Dominguez Channel with an elevation of almost 15 feet below sea level. [72]Due to low elevation, the city may be susceptible to storm surge risks. [73]

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

The cold California Current off the Pacific coast creates an environment unfavorable for hurricanes to maintain strength as they approach land. However, the remnants of tropical storms and hurricanes from the eastern Pacific Ocean can occasionally affect Southern California, bringing heavy rainfall, strong winds, and flooding. This assessment evaluates the potential impacts of such events on Carson.

While the direct landfall of a hurricane in Carson is highly unlikely, the city can experience indirect effects from the remnants of tropical storms, primarily in the form of heavy rainfall and strong winds.

Vulnerable Areas in Carson

- Neighborhoods Near the Dominguez Channel: Communities adjacent to the channel are at higher risk of flooding due to potential overflows.
- Low-Lying and Poorly Drained Areas: Regions with inadequate stormwater infrastructure are more susceptible to water accumulation.
- Industrial Zones: Flooding can disrupt operations in industrial areas along Alameda Street and Sepulveda Boulevard, potentially leading to economic losses and environmental hazards if hazardous materials are involved.

[72] Carson 2040 General Plan

Populations at Risk

- Economically Disadvantaged Residents: Approximately 9.5% of Carson's population lives below the poverty line. These individuals may have limited resources for preparation and recovery, lack access to insurance, and reside in more vulnerable housing.
- Elderly and Disabled Individuals: About 12.9% of residents are aged 65 or older. Mobility challenges can hinder evacuation efforts, and medical conditions may be exacerbated by power outages or lack of access to services.
- Non-English Speaking Communities: Carson's diverse population includes significant Latino and Asian communities. Language barriers may impede access to critical information and emergency communications.
- Homeless Population: Individuals experiencing homelessness are particularly vulnerable due to exposure and lack of shelter options.

Infrastructure Impacts

- Stormwater Systems: Heavy rainfall can overwhelm drainage infrastructure, leading to backups and increased flood risk.
- Transportation Networks: Flooding can damage roads and bridges, disrupt public transit services, and hinder access for emergency responders.
- Utilities: Power outages may occur due to wind damage, affecting homes, businesses, and critical facilities. Water and sewage systems may also be impacted by flooding.
- Communication Systems: Damage to infrastructure can disrupt cellular and internet services, complicating emergency coordination and public information dissemination.

(1) People

Hurricanes and tropical storms can cause health impacts arising from widespread power outages, water contamination, damaged sanitation systems, and acute food insecurity in its aftermath. Homes with severe structural damage can leave homes inhabitable and lead to displacement of people. Disruptions to health services can pose a great risk to individuals with medical needs and chronic health conditions. Damage to business may lead to unemployment and impact on the local economy. Additionally, individuals at sea or near the shoreline are at increased risk if they are not able to seek safety as one previous tropical storm event caused 45 fatalities due to individuals being at sea.

Previous tropical storms and hurricanes in the area caused minimal impacts (school closures, heavy rainfall, etc.) to the planning area but it’s important to understand and plan for potential impacts that these events may bring to reduce risk to Carson residents.

(2) Structures and Systems

Hurricanes and tropical storms can damage homes, buildings and roads and cause environmental problems. A hurricane can cause extensive damage to a community's structures, ranging from homes and businesses to public infrastructure. The specific types and extent of damage can vary based on the hurricane's strength, duration, and proximity to the affected area. Common forms of structural damage caused by hurricanes include roof and building damage, structural collapse, debris, and tree damage. Based on previous occurrences in the southern California region, tropical storms and hurricanes occur infrequently but have created extensive damage ranging from $2 million to $300 million dollars.

Critical Facilities

All critical facilities within the planning area could be at risk for hurricane and tropical storm impacts when they do occur, however their frequency of occurrence is low. The city can expect disruptions to critical infrastructure including power, communication, emergency services, and transportation. No extensive damage to critical facilities was reported within the planning area from the previous events.

TABLE 62 - POTENTIAL VULNERABILITIES OF LIFELINES TO HURRICANE

LIFELINES	IMPACT TYPE	DESCRIPTION
Safety & Security	Safety and Security	Immediate threats to life and property necessitate rapid emergency response, including search and rescue operations, medical assistance, and maintaining public order to prevent looting or other crimes in affected areas.
Health & Medical	Health and Medical	Hurricanes can cause injuries ranging from minor to severe, placing a sudden demand for healthcare facilities. Hospitals and clinics must be prepared for an influx of patients and possible damages to their own infrastructure.
Housing & Building Infrastructure	Food, Hydration, Shelter	Hurricane can cause significant damage to homes, businesses, and public buildings, leading to displacement of residents and the need for temporary shelters and long-term rebuilding efforts.
Utilities	Energy (Power & Fuel)	Hurricanes can disrupt essential services by damaging power lines, water mains, and communication networks. Restoring these services is crucial for recovery and supporting other lifeline sectors.

Transportation		Damage to roads, bridges, and transportation infrastructure can hinder emergency response efforts and the movement of goods and people. Clearing debris and repairing infrastructure are critical post-hurricane activities.

(3) Natural, Cultural, and Historical Resources

Hurricanes and tropical storms could have damage to important cultural resources within a community and irreparable damage to cherished landmarks and historical sites. There are 49 identified historical and cultural properties within the City of Carson. Storms can erode the outside of these properties due to high winds and flooding can damage priceless artifacts, artworks, or historical documents due to flood waters. Flood and wind mitigation actions should be considered to fortify these properties from future impacts.

(4) Risk Analysis

Moderate - Hurricanes and tropical storms can cause major disruptions and damage to the property, environment, and people within the City of Carson and pose a moderate risk to the planning area. Hurricane and tropical storms have a low occurrence frequency and are relative to other hurricanes that occur on the east coast, cause minor damage, especially near the planning area. However, due to the location of the planning area near the Pacific Ocean, it is possible for destructive tropical storms or hurricanes to hit the City of Carson in the future. There is some evidence that shows that these events might decrease in frequency, however when they do form could cause greater risk due to increased severity of the storms. As noted with some previous events like Hurricane Hilary, these events can be beneficial in bringing excessive rainfall which has alleviated drought and water shortage impacts. Additionally, based on future development trends, it is likely that hurricanes and tropical storms will increase in risk as the population increases, along with housing and property. The City of Carson is close to the coastal area, the lowest elevation level is 5 feet below sea level. Due to the low elevation, and potential sea level rise driven by climate change, hurricane and tropical impacts may increase in future decades from storm surges.

K) INDUSTRIAL POLLUTION / CHEMICAL RELEASE

i) Hazard Profile

The California State Hazardous Materials Incident Contingency Plan of 1991 defines a hazardous material as a substance or combination of substances that, due to its amount, concentration, or physical, chemical, or infectious properties, can either cause or significantly increase the risk of death or serious illness, or pose a major immediate or future threat to human health or the environment. Hazardous materials can be characterized by one or more of the following traits: flammable, corrosive, irritating, oxidizing, explosive, toxic (which includes poisonous or infectious), thermally unstable or reactive, and radioactive. These materials are commonly found in all stages of production, usage, and disposal in modern society.

While federal and state regulations do allow the deliberate release of certain hazardous materials into the environment under controlled conditions deemed safe for human health and the environment, there are instances where such releases are accidental. These unintentional releases can occur due to leaks, accidents, or natural disasters. This section specifically addresses these accidental releases and categorizes them into key types for better understanding and management.

- **Fixed Hazardous Materials Incident:** A fixed hazardous materials incident is the accidental release of chemical substances or mixtures during production or handling at a fixed facility.
- **Transportation Hazardous Materials Incident:** A transportation hazardous materials incident is the accidental release of chemical substances or mixtures during highway, waterway or air transport.
- **Pipeline Incident:** A pipeline transportation incident occurs when a break in a pipeline creates the potential for an explosion or leak of a dangerous substance (oil, gas, etc.) possibly requiring evacuation. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small, slow leak to a large rupture where an explosion is possible. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk to those near the pipelines.

FIGURE 66: PLACARDS USED FOR THE NINE CLASSES OF HAZARDOUS MATERIALS USED BY THE DEPARTMENT OF TRANSPORTATION AS OF 2024

Hazardous materials can also be classified according to worker safety and health.[74] Information provided by California Division of Safety and Health includes guidelines related to:

- **Safety hazards** (fire and fire byproducts, electricity, flammable gases, unstable structures, demolition, sharp or flying objects, excavations)
- **Health hazards** (carbon monoxide ash, soot, and dust; asbestos; hazardous liquids; other hazardous substances; heat illness)
- **Natural-Technological Incidents (Natechs):** During the past two decades, increasing attention has been given to hazardous materials releases resulting from *Natechs* or a natural disaster event that triggers a technological hazard event. Natechs are of particular concern for the following reasons:
    - They can produce a simultaneous effect on many industrial facilities[75]
    - Can overwhelm response capacity
    - Containment systems may fail
    - May produce cascading disasters[76]

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[74] California Department of Industrial Relations. *Worker Safety and Health During Fire Cleanup.* Retrieved 12.11.2023 from: https://www.dir.ca.gov/dosh/wildfire/Worker-Health-and-Safety-During-Fire-Cleanup.html

[75] Lindell, M.K. & Perry, R.W. (1996). Identifying and managing conjoint threats: Earthquake-induced hazardous materials releases in the U.S. *Journal of Hazardous Materials, 50*(1), 31-46.

[76] Young, S., Balluz, L., & Malilay, J. (2004). Natural and technologic hazardous material releases during and after natural disasters: a review. *Science of the Total Environment, 322*(1-3), 3-20. https://doi.org/10.1016/S0048-9697(03)00446-7

- Response may be hindered by a disaster's impact on the physical environment[77]

(1) Duration

Industrial pollution is an ongoing event in the planning area. Chemical releases, for example, the recent event that took place in 2021 and commonly referred to as the "Dominguez Channel Incident", lasted for several weeks. Overall, the duration of incidents may vary depending on the type of incident and the response and time it takes to clean up or resolve the situation. In severe cases, incidents can devasting impacts that can span over months and even years.

(2) Seasonality

Hazardous materials incidents can occur during any time of the year.

(3) Speed of Onset

Hazardous materials incidents can occur very quickly with little to no warning.

(4) Location

The entirety of the planning area is considered vulnerable to hazardous materials incidents. While the source of such incidents may be limited to fixed sites and certain transportation routes, the impact of these events can quickly spread. Wind and water can carry hazardous materials across – or into – the City of Carson.

ii) Magnitude

The negative impacts resulting from an uncontrolled release of hazardous materials are generally limited to the immediate vicinity, but the magnitude of an incident increases significantly when hazardous materials are present in volumes commonly used for bulk transportation or commercial and industrial operations. Additionally, hazardous materials can have properties which make them unpredictable in an uncontrolled environment, and this can complicate remediation efforts. If a spill is not quickly and properly addressed, hazardous materials can impart wide-reaching and long-lasting consequences on the surrounding populations and environment.

Uncontrolled releases of hazardous materials can be particularly dangerous if the substance is gaseous, as it can easily be lofted into the atmosphere and swept across large areas. Furthermore, hazardous gases can be colorless and odorless, and this can make it difficult to detect an uncontrolled release of these substances. Clouds of hazardous materials can quickly drift over urban areas and envelop large populations. Common symptoms of exposure to

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[77] Steinberg, L.J., Sengul, H., & Cruz, A.M. (2008). Natech risk and management: An assessment of the state of the art. *Natural Hazards 46*, *143-152.* https://doi.org/10.1007/s11069-007-9205-3

hazardous materials include irritation of the eyes and skin as well as respiratory issues which may require hospitalization. Severe events can result in fatalities among the affected population.

Hazardous materials in a liquid or solid state may percolate down into the ground and reach the water table, and they can be carried miles away from the release site by rivers or streams. Land contaminated by hazardous materials may be rendered unusable until the area is properly treated, which can be a resource-intensive process. Many previous remediation projects across the U.S. have cost millions of dollars and taken years to complete, and the sites are typically monitored for a while afterwards to check that the work was successful. Hazardous materials, regardless of the state they are in when released, can cause both short-term and long-term health effects, and individuals will likely need to be evacuated from the impacted area(s).

It is not uncommon for hazardous materials to be transported along routes which are highly trafficked and near populated areas. According to the 2022 Transportation Statistics Annual Report, there are about 1 million daily shipments of hazardous materials by land, water, and air transportation modes. Across the U.S. in 2021, approximately 25,000 hazardous materials incidents (excluding pipeline incidents) associated with these shipments were reported to the U.S. Department of Transportation (DOT).[78] Additionally, the Pipeline and Hazardous Materials Safety Administration (PHMSA) acknowledges that accidents involving hazardous materials are more likely to be significant events, and four out of five hazardous materials road accidents led to severe consequences. [79]

For accidents involving an aircraft, the hazardous material most likely to be present is the fuel for the aircraft. However, additional hazardous materials may be present, particularly if the aircraft was carrying freight. The size of an aircraft should not be used to infer the likelihood of hazardous materials present at the site of an accident -- smaller crafts such as spray planes used for agricultural purposes may contain significant quantities of herbicides and pesticides which may be detrimental to human health.

iii) Extent

Moderate - Carson is ranked in the top quartile of statewide pollution burden and population vulnerability according to the California Communities Environmental Health Screening Tool, with an especially high pollution burden of toxic releases, fine particulate matter, and hazardous waste.

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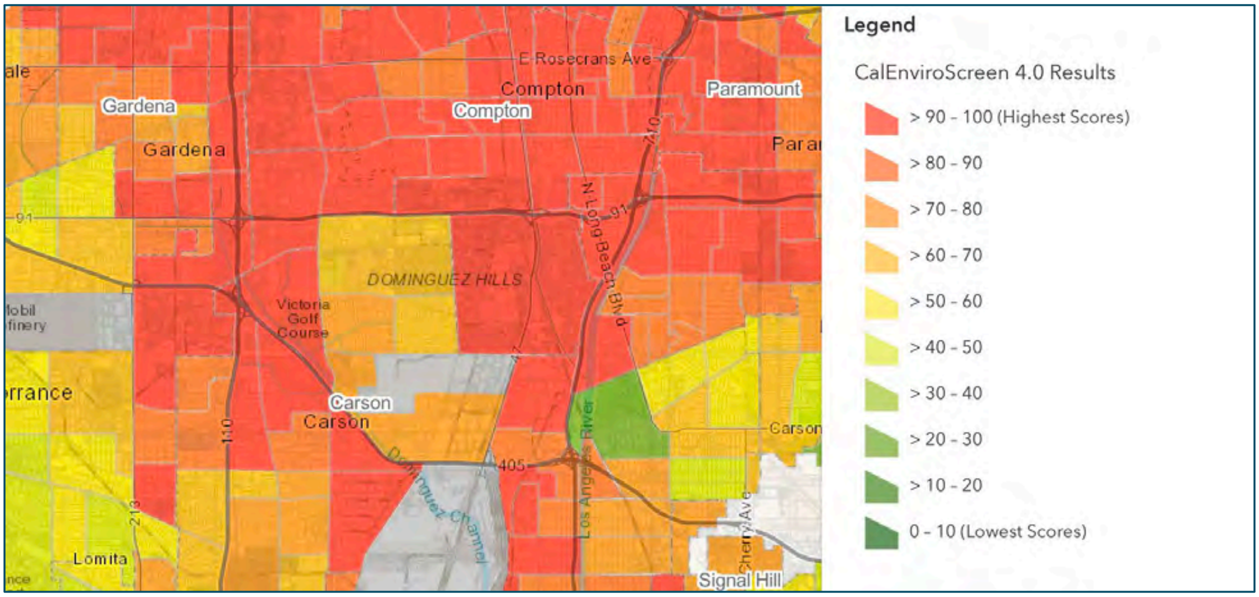
[78] Department of Transportation, Pipeline and Hazardous Materials Safety Administration, and Office of Hazardous Material Study. “10 Year Incident Summary Reports.” portal.phmsa.dot.gov, August 22, 2023. https://portal.phmsa.dot.gov/analytics/saw.dll

[79] Zhigerbayeva, Guldana, and Ming Yang. “A Safety Function Deployment Approach to Risk Management of HazMat Highway Transportation.” *ACS Chemical Health & Safety* 28, no. 5 (September 27, 2021): 348–57. https://doi.org/10.1021/acs.chas.1c00020.

FIGURE 67: CALIFORNIA COMMUNITIES ENVIRONMENTAL HEALTH SCREENING TOOL[80]



Source: CalEnviroScreen 4.0, 2024

Hazardous materials and infrastructure such as fuel tanks, rail lines, chemicals, hazardous waste sites and gas pipelines to varying degrees are located within the City of Carson and/or within its surrounding communities. At larger scales (beyond the city planning area) hazardous materials are located throughout the region, and reflect different types, configurations and scales dispersed across these geographic areas. An uncontrolled release of hazardous materials can occur at virtually any site where hazardous materials are present. Because hazardous materials are utilized for a wide variety of purposes, it is not uncommon for them to found near residential areas, and concerns about this contributed to the passing of the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986. EPCRA requires any facility which uses or stores hazardous materials to provide a list of the specific substances to their State or Tribal Emergency Response Commission, Local or Tribal Emergency Planning Committee, and local fire department. Additionally, facilities using or storing hazardous materials must share an annual inventory of these substances with the entities, and the information must be made available to the public. A map of the hazardous waste percentile and their proximity to hazardous waste facilities are described below.

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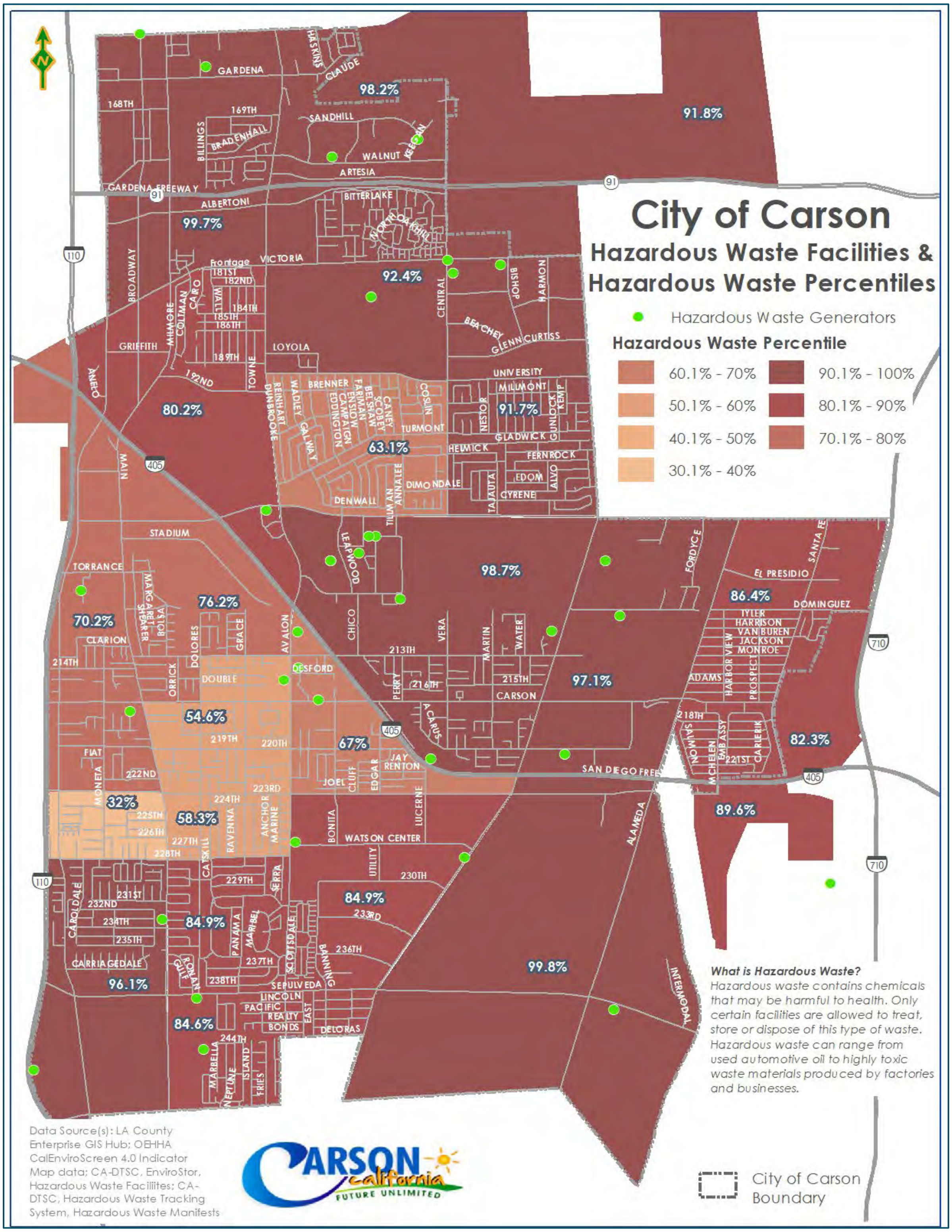
[80] California Office of Environmental Health Hazard Assessment - https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

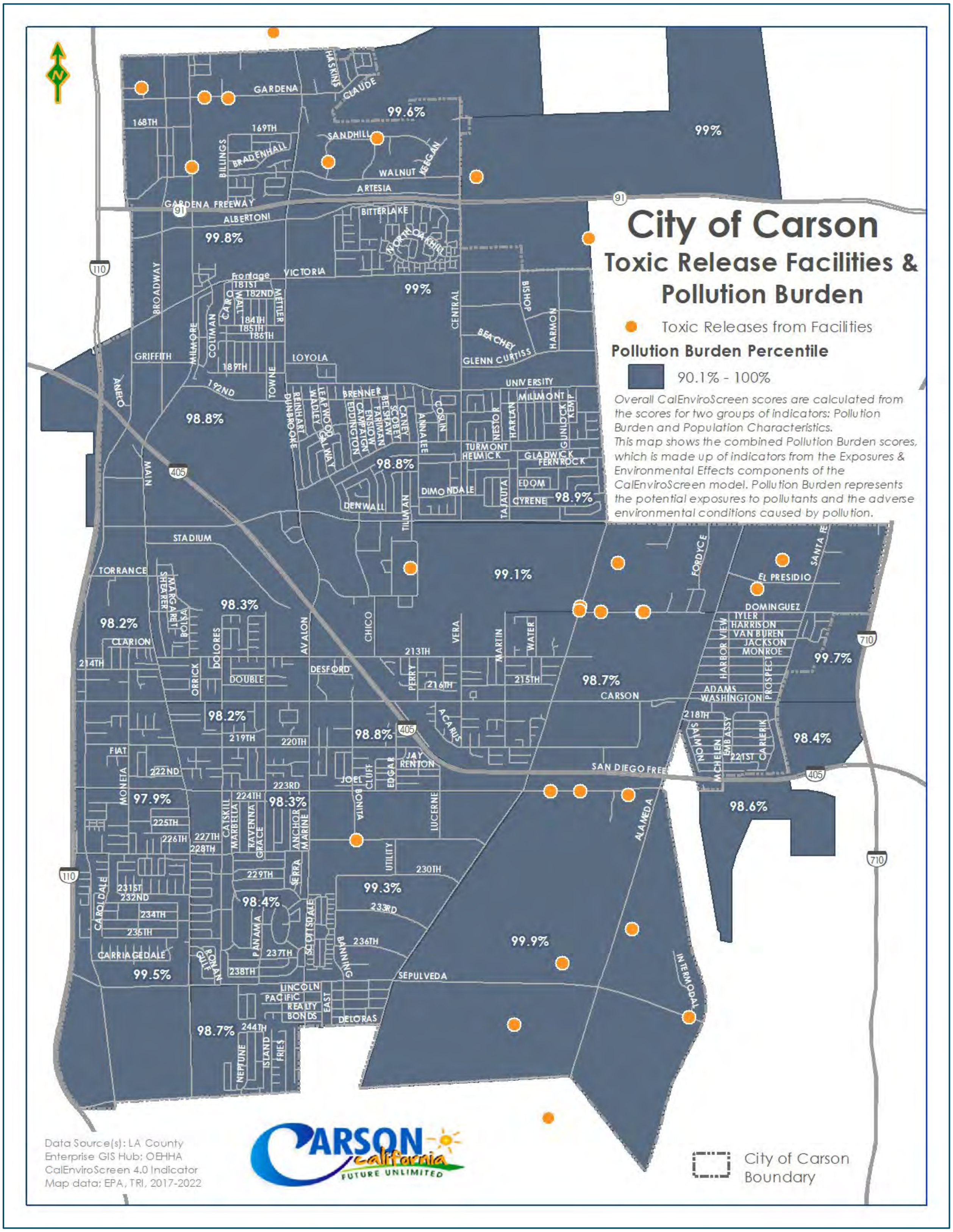
FIGURE 68 - CITY OF CARSON HAZARDOUS WASTE FACILITIES AND PERCENTILES AS OF 2024



Uncontrolled releases of hazardous materials are also possible during transportation. These events are often quite visible, and several high-profile incidents have occurred recently. In 2023, events such as the train derailment in East Palestine, OH and a truck rollover on I-10 in Tucson, AZ prompted shelter-in-place orders and drew national attention. These events highlight the fact that uncontrolled releases of hazardous materials can occur near communities which may be nowhere near facilities using or storing hazardous materials.

Toxic Release Inventory Sites (TRI) are facilities that make or use toxic chemicals that can release these chemicals into the air. Information is available on the amount of chemicals released for over 500 chemicals for large facilities in the United States. These chemicals are sometimes detected in the air of communities nearby. People living near facilities may breathe contaminated air regularly or if contaminants are released during an accident. The map below depicts TRI Sites in and around the City of Carson.

FIGURE 69 - CITY OF CARSON TOXIC RELEASE FACILITIES AND POLLUTION BURDEN 2017-2024



iv) Past Occurrences

According to the CA Governor's Office of Emergency Services' Hazardous Materials Spill Report, the state experiences from 10 to 30 spill events daily. The State of California tracks spill releases by year. From 2017-2022, The City of Carson experienced a total of 100 incidents that totaled up to $250,000. None of the incidents caused injuries, hospitalizations, or fatalities, however 4 incidents required evacuations. Detailed information on the incidents is described in the table below.

TABLE 63. CITY OF CARSON SPILL INCIDENTS BY TYPE (2017-2022)

INCIDENT TYPE	2017	2018	2019	2020	2021	2022
Fixed	3	5	9	15	19	10
Pipeline	2	0	3	2	2	1
Railroad	1	1	0	0	0	0
Storage Tank	2	1	0	3	1	2
Unknown Sheen	0	1	1	0	5	1
Mobile	0	0	2	4	0	3
Railroad non-release	0	0	0	0	0	1

Source: Cal OES, Spill Release Reporting

Based on recent historical events, the City of Carson has experienced roughly three incidents that have caused major impacts which are described in further detail below.

- **September 17th, 2021**: A magnitude 4.3 earthquake struck near Carson that results in hazardous material incidents at both the Marathon as well as the Phillips 66 refinery. According to the refinery's last notice given to the California Governor's Office of Emergency Services on Saturday morning, more than 1,000 pounds of nitrogen dioxide and 500 pounds of sulfur dioxide had been released. The amounts far exceeded the levels approved by the air quality board during flaring events. Additional toxins may have also been released into the Dominguez Channel, a 15-mile watershed that feeds into the Pacific Ocean, as well as a residential lake in Wilmington, California, according to the report.
  - The Marathon Refinery wasn't alone in its excess emissions following the quake. Less than five miles away, the Phillips 66 refinery in Wilmington was also experiencing a continuous flare. As of 8 hours after the earthquake, the refinery had reported releasing more than 500 pounds of sulfur dioxide.

    - The earthquake, while relatively small, underscored the risk residents face in a region defined by both natural disasters and the fossil fuel industry.

- **September 30, 2021**: In early October 2021, thousands of residents in Carson, California began complaining of noxious odors, headaches, breathing problems, and nausea. The local regulatory agency, the South Coast Air Quality Management District (SCAQMD), received over 4000 odor complaints within 1 week from residents regarding a noxious rotten-egg-like smell.[81] Initial investigations measured hydrogen sulfide (H_2S) levels of 400–900 parts per billion (ppb) near the Dominguez Channel—a 25 km flood-control concrete waterway in the densely populated area of the South Bay in Los Angeles (LA) County. The levels continued to increase and peaked in mid-October at around 7000 ppb—230 times the California's acute ambient air quality standard of 30 ppb[82]. Strong malodors and adverse health effects associated with them plagued the predominantly low-income communities of color in Carson and the South Bay for over 2 months[83].
    - The cause of the H2S spike in Carson was unknown for 2 months, during which time government officials attributed the H2S to the natural decay of organic materials in the Channel. In December 2021, SCAQMD issued notices of violation to four companies and the County of Los Angeles. According to their investigation, the H2S release was connected to a large warehouse fire on September 30, 2021, in the City of Carson that resulted in chemicals, including ethanol, benzene, and isopropyl alcohol, being flushed into the Dominguez Channel. They concluded that this facilitated the anaerobic decay of organic materials in the Channel which subsequently resulted in the release massive quantities of H2S.

- **December 30th, 2021**: A sewer line burst under a freeway exit, releasing more than 8 million gallons of sewage into the Dominguez Channel. This incident added a new odor to the area, already suffering from air pollution due to other events.

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[81] Chung C. Warehouse Fire Was Source of 'Putrid' Odor in California. The New York Times [Internet]. 2021 December 5. Available from: https://www.nytimes.com/2021/12/05/us/carson-california-warehouse-fire-stench.html.

82 Hydrogen Sulfide & Health: California Air Resources Board https://ww2.arb.ca.gov/resources/hydrogen-sulfide-and-health.

[83] H2S 1-hour Data: South Coast Air Quality Management District 2021 [January 15, 2022]. https://www.aqmd.gov/docs/default-source/compliance/dominguez-channel/h2s-1-hour-data.pdf?sfvrsn=16.

Frequency

Based on the spill incident report from the California Office of Emergency Services, the City of Carson has experienced 100 spill release incidents in the past 6 years. On average, the city experiences about 17 incidents every year. [84]

v) Future Probability

Possible - The probability of occurrence for a hazmat event in the City of Carson can be viewed in two different ways: the history of occurrence serves as a sound predictor of future probability assuming current risk and vulnerability factors remain somewhat constant. For the purposes of the current estimate, no current data clearly indicates otherwise. The probability of occurrence is highly likely. While there has been few hazmat recorded events, the most recent incidents occurred in quick succession of each other. Additionally, the city is in close proximity to industrial sites and therefore has an increased exposure to such events occurring nearby. The large amount of industry in the region increases the amount of air pollution and exposure to residents, which is a continuous occurrence. In regard to hazmat occurrences, they are largely based on human error, and any changes in risk and vulnerability factors such as a decreased vigilance in materials oversight and handling practices or changes in the amount of chemicals or exposure will likely increase the probability in the city.

vi) Secondary Hazards

Industrial pollution and chemical releases can cause secondary hazards to occur which include toxic exposures, environmental contamination, evacuation and displacement, economic impact, psychological stress. More information on each secondary hazard is described in the table below.

TABLE 64: POTENTIAL SECONDARY HAZARDS RESULTING FROM A HAZMAT INCIDENT

HAZARD	DESCRIPTION
Toxic Exposure	Exposure to toxic substances can occur during a HazMat incident, leading to acute or chronic health issues.
Environmental Contamination	HazMat incidents can lead to the contamination of soil, water, and air, causing long-term environmental damage.
Evacuation & Displacement	In response to HazMat incidents, large-scale evacuations may be necessary, displacing people from their homes and workplaces.
Economic Impact	These incidents can disrupt local businesses and economies, leading to significant financial losses.

[84] Spill Release Reporting | California Governor's Office of Emergency Services https://www.caloes.ca.gov/office-of-the-director/operations/response-operations/fire-rescue/hazardous-materials/spill-release-reporting/

HAZARD	DESCRIPTION
Psychological Stress	The fear and uncertainty associated with HazMat incidents can cause psychological stress and anxiety in affected communities.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

The city hosts a variety of industries, including oil refineries, chemical plants, manufacturing facilities, and logistics centers. Major transportation corridors, such as the I-405 and I-110 freeways, the Alameda Corridor rail line, and the proximity to the Ports of Los Angeles and Long Beach, contribute to the high volume of hazardous materials transported through and stored within the city. This industrial concentration and transportation nexus increase the risk of hazardous materials incidents, which can have profound impacts on public health, safety, property, infrastructure, and the environment.

Vulnerable Areas in Carson

The City of Carson faces significant vulnerability to hazardous materials incidents due to its concentration of industrial zones and critical transportation corridors. One of the primary areas of concern is the industrial sector, particularly the regions housing refineries and chemical plants. Facilities such as the Marathon Petroleum Refinery—previously owned by Tesoro and BP—store and process large quantities of flammable and toxic substances. These operations inherently carry the risk of accidental releases, which can have immediate and severe impacts on both workers within the facilities and the surrounding communities. The potential for fires, explosions, and airborne toxic releases poses a substantial threat to public health and safety.

Manufacturing and storage facilities located along major thoroughfares like Sepulveda Boulevard and Alameda Street further contribute to the city's vulnerability. These warehouses and plants handle various chemicals and hazardous goods, increasing the risk of incidents that could affect employees and nearby residents. The mishandling of materials or equipment failure can lead to spills, leaks, or emissions of hazardous substances into the environment.

Transportation corridors amplify the risk of hazardous materials incidents in Carson. The city is traversed by significant highways, including the I-405 and I-110 freeways, which serve as major routes for the transportation of hazardous materials. The high volume of HazMat trucks on these freeways elevates the likelihood of traffic accidents that could result in spills, fires, or explosions. Similarly, the Alameda Corridor rail line, a critical freight route, carries trains transporting hazardous materials to and from the ports of Los Angeles and Long Beach. A derailment or collision along this rail line could have catastrophic consequences, releasing toxic substances into densely populated areas.

Another critical aspect of Carson's vulnerability is the proximity of industrial facilities to residential neighborhoods, schools, and parks. Many industrial sites are adjacent to places where people live, work, and play, increasing the potential for community exposure during an incident. For example, a hazardous release from a refinery could quickly affect nearby homes or schools, endangering residents and students. The close distance means there is less time for warnings and evacuations, and the effects of any incident could be more immediate and severe.

Populations at Risk

Several groups within Carson are particularly at risk due to the potential for hazardous materials incidents. Nearby residents, especially those living in communities adjacent to industrial sites, face heightened dangers. These residents are at increased risk of exposure to airborne toxic substances, fires, or explosions resulting from industrial accidents. The threat is not just hypothetical; the daily operations of these facilities involve materials that, if accidentally released, can have serious health implications.

Low-income and minority populations are disproportionately affected, raising concerns about environmental justice. These communities may have limited resources to prepare for, respond to, or recover from hazardous materials incidents. Economic constraints might limit their access to information, emergency services, or the ability to relocate temporarily or permanently if necessary. Language barriers can also hinder effective communication during emergencies, making it more challenging for these populations to receive timely warnings and instructions.

Workers within the industrial sector are another group at significant risk. Industrial employees who handle hazardous materials as part of their jobs face direct exposure to dangers associated with accidents or operational failures. Without proper safety protocols, training, and equipment, these workers are vulnerable to immediate health risks, including chemical burns, inhalation of toxic fumes, or long-term health issues due to exposure.

First responders—such as firefighters, police officers, and medical personnel—are also at risk when hazardous materials incidents occur. Their roles require them to enter potentially dangerous environments to manage emergencies, contain spills, or rescue affected individuals. Responding to HazMat incidents necessitates specialized training and equipment to protect themselves from exposure while effectively addressing the situation. The complexity and unpredictability of such incidents can put even well-prepared first responders in harm's way.

Sensitive populations, including children and the elderly, are particularly vulnerable to the effects of hazardous materials. Schools like Carson High School and nearby senior centers could be impacted during an incident, with occupants more susceptible to adverse health effects from exposure. Children's developing bodies and the potentially compromised health of the elderly make them more prone to serious complications. Evacuations or shelter-in-place orders can be especially challenging for these groups due to mobility issues or the need for specialized care.

Individuals with pre-existing health conditions, such as respiratory illnesses or compromised immune systems, are at increased risk during hazardous materials incidents. Exposure to toxic substances can exacerbate their conditions, leading to severe health crises or long-term health deterioration. For example, someone with asthma might suffer a life-threatening attack if exposed to airborne chemicals released during an industrial accident.

(1) People

A hazardous material (HazMat) incident in Carson could have profound impacts on the local population. Such an incident might lead to immediate health risks due to exposure to toxic substances, necessitating urgent medical attention and possible hospitalizations. The fear and uncertainty surrounding the nature and extent of the hazard could cause widespread anxiety and stress among residents. Evacuations might be required, disrupting daily life, and causing significant inconvenience. Long-term effects could include ongoing health monitoring for those exposed to hazardous substances and potential decreases in property values due to perceived environmental risks. The incident could also strain local emergency services and healthcare facilities, highlighting the need for robust disaster preparedness and response plans in communities with industrial facilities.

(2) Structures and Systems

A HazMat incident in the city could significantly impact property vulnerabilities. Such an event might lead to contamination of land and structures, requiring extensive and costly decontamination efforts. Properties close to the incident site could see a decrease in market value due to perceived environmental risks and stigma. Infrastructure such as roads, utilities, and public facilities may also be damaged, leading to long-term disruptions and expensive repairs. The incident underscores the need for stringent safety measures in areas with hazardous materials to reduce risk to properties and work towards community resilience.

Critical Facilities

A hazardous material incident in Carson could severely impact critical facilities such as schools, police stations, hospitals, and city-owned buildings. These facilities, essential for community functioning, might face operational disruptions or damage. For instance, schools may need to temporarily close or relocate, disrupting education. Hospitals and emergency services could be overwhelmed by the sudden influx of patients or be in the hazard zone themselves, complicating response efforts. Government buildings could be rendered unusable, affecting municipal services. Such scenarios highlight the necessity for robust emergency preparedness and contingency plans for critical facilities in order to continue operations and swift recovery post-incident.

TABLE 65 - POTENTIAL VULNNERABILITIES TO LIFELINES FROM HAZARDOUS MATERIAL INCIDENTS

LIFELINES	IMPACT TYPE	DESCRIPTION
Safety & Security	Safety and Security	HazMat incidents pose immediate threats to public safety, requiring prompt evacuation and emergency response. Law enforcement and HazMat response teams play a crucial role in securing the area, managing the situation, and preventing further harm.
Health & Medical	Health and Medical	Exposure to hazardous materials can lead to acute and chronic health issues. Medical facilities need to be prepared to treat victims of such exposure, which may require specialized treatment and decontamination procedures.
Housing & Building Infrastructure	Food, Hydration, Shelter	Chemical spills or gas leaks can lead to the contamination of buildings, requiring evacuation and extensive clean-up before they are safe for reoccupation. In severe cases, infrastructure may be permanently damaged.

(3) Natural, Cultural, and Historical Resources

There are 49 identified historical and cultural properties within the City of Carson. Hazardous materials incidents can cause wide reaching impacts depending on the type and severity of the incident which could cause impacts to nearby historic and cultural properties from flying debris due to explosions or fires.

(4) Risk Analysis

High - Hazardous materials pose a risk to the City of Carson. As identified by the city planning committee and, on the hazmat, maps presented in previous sections. Although it is quite difficult to produce a quantitative measure of vulnerability because (unlike natural hazards) the probability of occurrence is dependent on human error, which itself is variable based upon a fluctuating set of interrelated factors, some of which lack prediction or control, given the complexity of how all natural and built environments and hazmat risks factors interrelate at the local level, it is prudent to assume for planning purposes that the city's vulnerability is a sub-set of the larger community's vulnerability. Additionally, based on future development trends, it is likely that hazardous materials incidents will increase in risk as the population increases, along with housing and property.

It is well understood that with regards to hazmat vulnerability, that the City of Carson and the surrounding community operates through a complex and dynamic interaction between industrial and commercial inputs and outputs and the natural and bult environment. Such activity produces hazardous materials that move through the environment along both convergent and divergent routes and across all levels. It is also clear from a review of the Los Angeles County hazard mitigation plan and Cal OES' records of hazardous material spills, that such events occur with great frequency and varying degrees of severity across jurisdictions statewide. As such, in assessing the vulnerability of the City of Carson, city-level risks and vulnerabilities are not discreet or isolated but can become exacerbated or augmented through connections to broader community-level hazmat risks and vulnerabilities.

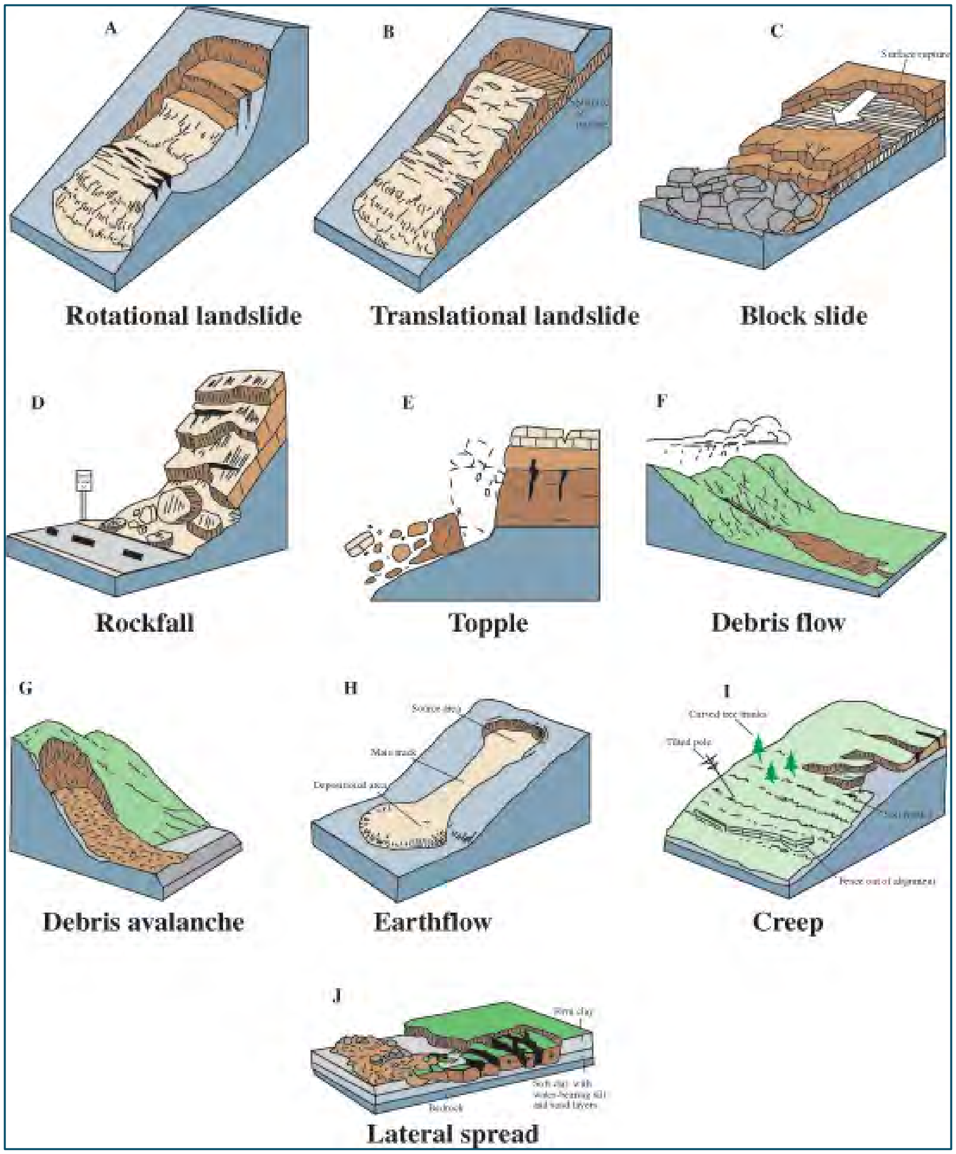
Finally, to draw conclusions on vulnerability, it should be noted that any identified vulnerabilities at the city level and/or community level are circumscribed and potentially reduced by targeted policy and program interventions. Numerous policies and programs have been established in recent years in response to California's widespread and complex and integrated hazardous materials risks - California established the Unified Program which consolidates and integrates the administrative requirements, permits, inspections, and enforcement activities of the following environmental and emergency response programs: the Aboveground Petroleum Storage Act (APSA) Program, Area Plans for Hazardous Materials Emergencies, the California Accidental Release Prevention (Cal ARP) Program, the Hazardous Materials Release Response Plans and Inventories (Business Plans), Hazardous Material Management Plan (HMMP) and Hazardous Material Inventory Statement (HMIS) requirements (California Fire Code), the Hazardous Waste Generator and Onsite Hazardous Waste Treatment (tiered permitting) Programs, and the Underground Storage Tank Program.

L) LANDSLIDE / MUDFLOW

i) Hazard Profile

Landslides and mudflows can destroy properties and cause injuries and deaths. A landslide refers to a wide range of ground movement, such as rock falls, deep failure of slopes and shallow debris flow. The figure below illustrates the different types of landslide movement. The primary driving force of landslides is gravity but other contributing factors such as rainfall, earthquakes, volcanic eruptions, groundwater pressure, erosion, destabilization of slopes (because of deforestation, cultivation and construction, snow, and glacial melt) can drive a landslide to occur as well.

FIGURE 70. TYPES OF LANDSLIDE MOVEMENTS[85]



Landslides encompass five modes of slope movement: falls, topples, slides, spreads, and flows and subdivided by the type of geologic materials (bedrock, bedrock, or earth). Landslides can be triggered by an earthquake, called an earthquake produced landslide. Earthquakes pose a high risk in the City of Carson due to the proximity of fault lines.

(1) Debris Flow or Mudflow

Debris flow or mudflow is a landslide type and is a fast-moving mass of loose mud, sand, soil, rock, water, and air that moves downhill due to gravity. Preconditions for a debris flow are very

[85] U.S. Geological Survey, and U.S. Department of the Interior. "Landslide Types and Processes." pubs.usgs.gov, July 2004. https://pubs.usgs.gov/fs/2004/3072/fs-2004-3072.html.

steep slopes, loose debris and water, and little vegetation. Debris flow can reach speeds of over 160 kilometers per hour (100 miles per hour) in very steep areas. [86]

(2) Duration

The duration of landslides varies greatly depending on the conditions. Landslides and mudflow can occur very quickly or over several months or years.

(3) Seasonality

Landslides are often triggered by precipitation and as a result are sensitive to local climate conditions. Due to climate change, precipitation patterns worldwide and therefore will likely have a strong influence on landslide activity in the next couple of decades. A study found that during 2015 to 2020 that landslides in both the wet regions in northwestern California and dry regions in southern California moved faster than average during wet years and slower than average during dry years. [87]

(4) Speed of Onset

The warning time for hazards such as landslides and debris flow are often very short and may occur very quickly. Identifying the area in which these events are likely to occur can assist with hazard preparedness when triggering types of events like heavy rainfall occurs. However, in some cases, landslides can occur very slowly, even extremely slowly and building on these landscapes may remain in use for hundreds of years with only minimal damage and repair costs. [88]

(5) Location

The entirety of the planning area is considered to be equally vulnerable to landslides and mudslides. According to landslide hazard maps and the lack of previous occurrences of landslides occurring in the City of Carson, the risk of landslides is low, even considering future developments trends on increases in people and housing units as the hazard zone is outside of the jurisdictions.

ii) Magnitude

The severity of a landslide or mudflow depends on many factors including local bedrock, soil conditions, moisture content, slope, and vegetation. Landslide velocities vary over ten orders of

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[86] 14-LANDSLIDE-HR.pdf (ifrc.org) https://www.ifrc.org/sites/default/files/2021-06/14-LANDSLIDE-HR.pdf

[87] Handwerger, Alexander L., et al. "Landslide sensitivity and response to precipitation changes in wet and dry climates." Geophysical Research Letters, vol. 49, no. 13, 2022, https://doi.org/10.1029/2022gl099499.

[88] Turner, A.K. Social and environmental impacts of landslides. Innov. Infrastruct. Solut. 3, 70 (2018). https://doi.org/10.1007/s41062-018-0175-y

magnitude from extremely slow (a few millimeters a year) to extremely rapid (more than 5 millimeters a second), shown in the table below. Many human activities can make the earth's materials less stable, therefore increasing the chance of ground failure. Human activities contribute to soil instability through grading of steep sloped or overloading them with artificial fill, by extensive irrigation, construction of impermeable surface, excessive groundwater, withdrawal, and removal of stabilizing vegetation. Some of the natural non-seismic causes of ground instability include heavy rainfall and poor-quality natural materials.

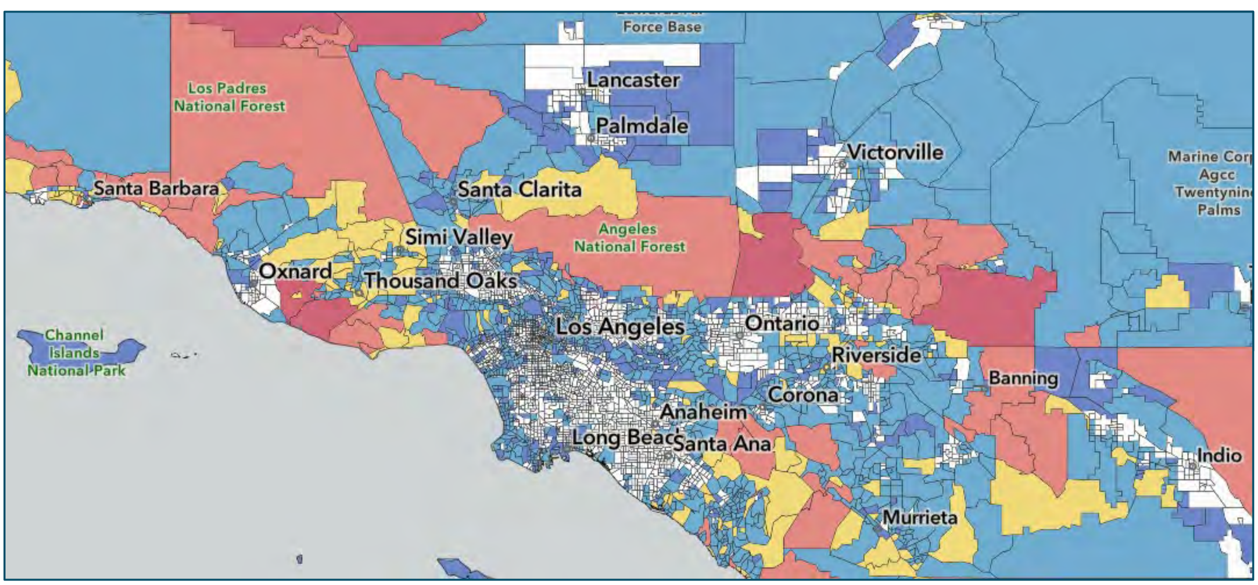
TABLE 66- LANDSLIDE VELOCITY COMPARISON

VELOCITY CLASS	DESCRIPTION	VELOCITY (MM/S)	TYPICAL VELOCITY	RESPONSE
7	Extremely Rapid	5X10^3	5 m/s	N/A
6	Very Rapid	5X10^1	3 m/min	N/A
5	Rapid	5X10^-1	1.8 m/h	Evacuation
4	Moderate	5X10^-3	13 m/month	Evacuation
3	Slow	5X10^-5	1.6 m/year	Maintenance
2	Very	5X10^-7	16 mm/year	Maintenance
1	Extremely Slow			N/A

Source: Social and Environmental Impacts of Landslides, Springer Link, Turner, A.K. (2018)

According to the FEMA National Risk Index, most areas at risk of wildfires in California reside in central and northern California. Within Los Angeles County, at risk areas reside in the northern parts and coastal areas near Malibu, shown in the map below.

FIGURE 71 - LANDSLIDE RISK INDEX SCORE, FEMA



Source: FEMA NRI, 2024

iii) Extent

Negligible - Landslides occur in every state and can occur in any area composed of very weak or fractured materials resting on a steep slope can and will likely experience landslides. [89] Areas vulnerable to landslides include the following:

Areas more prone to landslides

- On existing old landslides
- On or at the base of slopes
- In or at the base of minor drainage hollows
- At the bae or top of an old fill slope
- At the base or top of a steep cut slope
- Burn area and canyon, hillside, mountain, and other steep areas are vulnerable
- Develop hillsides where leach field septic systems are used

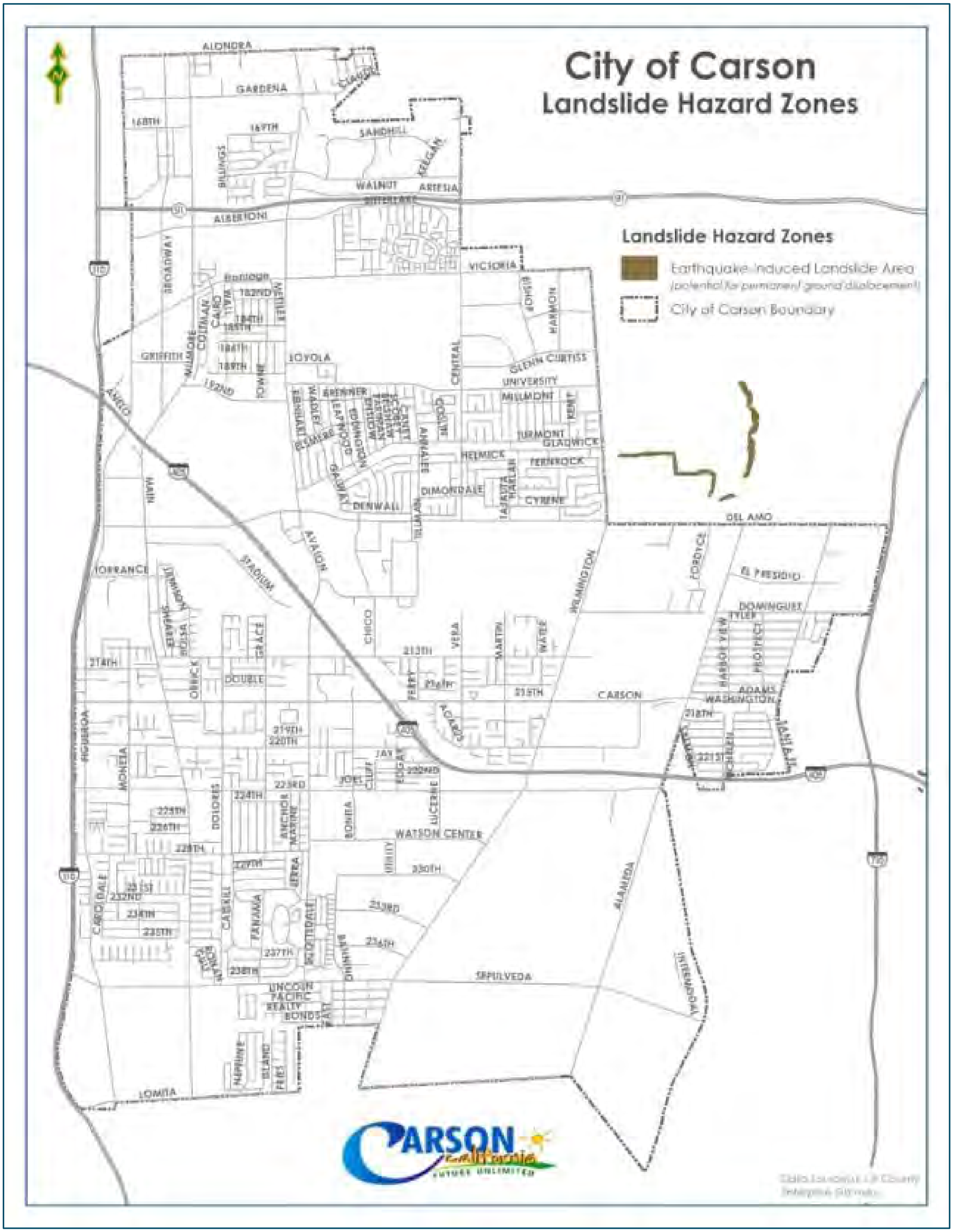
Areas less prone to landslides

- On hard, non-jointed bedrock that has not moved in the past
- On relatively flat-lying areas away from sudden changes in slope angle
- At the top or along the nose of ridges, set back from the tops of slopes

According to the landslide zones layer from the County of Los Angeles, the City of Carson is not at risk of experiencing an earthquake induced landslide (potential for permanent ground displacement). However, there is a small landslide area right outside of the planning area, near the Rancho Dominguez area, shown in the map below.

[89] Landslide Basics | U.S. Geological Survey (usgs.gov) https://www.usgs.gov/programs/landslide-hazards/landslide-basics

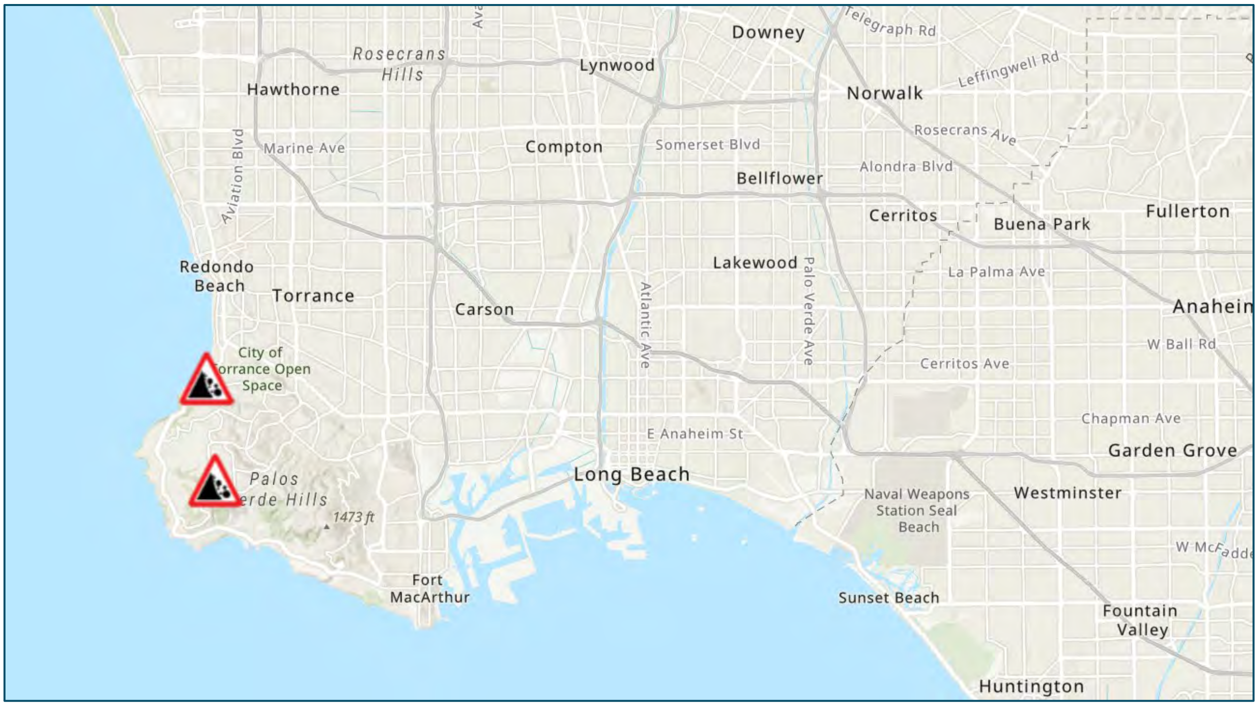
FIGURE 72 - LANDSLIDE ZONE IN RANCHO DOMINGUEZ AS OF 2024



iv) Past Occurrences

There have been no previous landslide or mudslide events within the City of Carson. However, there have been two occurrences since 2018 near the Palos Verdes Hills and Torrance areas, shown in the figure and table below.

FIGURE 73 - PREVIOUS LANDSLIDE EVENTS (2018-2023), CALIFORNIA DEPARTMENT OF CONSERVATION



Source: NOAA, NCEI, Storm Events Database

TABLE 67. PREVIOUS LANDSLIDE OCCURRENCES

HAZARD	DATE	LOCATION	DESCRIPTION
Landslide	12/9/2022	Rat Beach, Palos Verdes Estates, Los Angeles County	Bluff Collapse at Rat Beach impacted a vehicle and result in beach closure.
Landslide	7/8/2023	Peartree Lane, Palos Verdes Peninsula, Los Angeles County	Multiple homes damaged or destroyed by landslide on slop of canyon adjacent to Peartree Lane.

Source: NOAA, NCEI, Storm Events Database

v) Future Probability

Unlikely - There have been no previous landslides occurrences in the City of Carson and based on the landslide hazard zone map presented above, the chance of an earthquake induced landslide is minimal to none. Therefore, the future probability of a landslide occurring in the City of Carson is low.

vi) Secondary Hazards

Landslides and mudflows can be secondary hazards to earthquakes, floods, volcanic eruptions, and wildfires.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

The City of Carson's current vulnerability to landslides and mudflows appears to be relatively low, largely due to the lack of sloped terrain. According to data from the U.S. Geological Survey, nearly the entirety of the City of Carson sits at an elevation between 50 and 100 feet above sea level. The second supervisory district of Los Angeles, which includes the City of Carson as well as Compton, Inglewood, and multiple other communities covers more than 176 square miles; analysis available in the 2020 County of Los Angeles All-Hazard Mitigation Plan shows that only 2.73 square miles (1.68%) of the second supervisory district is area with high landslide susceptibility.

Shallow landslides are more likely to occur when the ground becomes saturated with moisture. According to the U.S. Geological Survey, at least 10 inches of rainfall during the winter months is needed to saturate the ground in Southern California. After the ground becomes saturated, a rain burst of 0.2 to 0.25 inches in a one-hour period has been observed to trigger shallow landslides. The 2020 County of Los Angeles All-Hazard Mitigation Plan found that significant rainfall, which can saturate the ground in Los Angeles County, is most likely to occur during strong El Niño events. Broadly, El Niño events occur every two to seven years, and they can last between 9 and 24 months.

Although unlikely, the possibility of landslides in the City of Carson should not be overlooked. The steepest slopes are along the Dominquez Channel and near Interstate 405 bridges. The slopes along the Interstate 405 bridge over the Alameda Corridor railway are among the steepest in the community, rising roughly 30 feet in elevation over a distance of 200 feet. The impact of a landslide at this location could be highly problematic due to the possibility of closing two major transportation routes. Interstate 405 supports hundreds of thousands of vehicles each day, and the Alameda Corridor moves millions of cargo containers inland from the Port of Los Angeles, annually. Disruption of normal service along these two transportation routes can have major consequences on day-to-day activity in the City of Carson, as well as the larger Los Angeles metropolitan area. There are also multiple minor embankments spread around the Los

Angeles Refinery and Kinder Morgan Carson Terminal – these embankments are intended to function like levees and contain the spread of petroleum and other stored liquids in the event of an on-site leak. Failures involving these embankments may result in uncontrolled releases of hazardous materials.

(1) People

On average, 25 to 50 people are killed by landslides each year in the United States and even more worldwide. In the state of California, more than 100 residents have been killed by debris flows during the past 25 years. Most of the fatalities occurred due to debris flow burying individuals sleeping in lower-floor bedrooms adjacent to hazardous slopes. [90] Health and safety concerns due to landslides and mudflow include rapidly moving water and debris, broken electrical, water, gas, and sewage lines that can result in injury and illness, and disrupted roadways and railways endangering motorists and impeding on transport and access to healthcare. Additionally, nearby landslides, such as the ones that occurred in the Rolling Hills Estates, damaged homes and have displaced people. There have been no previous events within the City of Carson therefore no known impacts of landslides on the population.

(2) Structures and Systems

Landslides and mudslides are one of the most destructive hazard processes that can cause tremendous damage to the built environment. This hazard can drastically alter the physical landscape and destroy buildings and homes. Based on nearby previous occurrences, landslides have damaged vehicles and homes which resulted in beach and road closure. There have been no previous occurrences within the City of Carson and therefore there are no known impacts of landslides on properties.

Critical Facilities

Landslides and mudslides have the power to disrupt vital utilities and communication lines as well are damage critical infrastructure. Based on nearby previous occurrences there is no reported damage to critical facilities.

TABLE 68. POTENTIAL VULNERABILITIES OF LIFELINES TO LANDSLIDES

LIFELINES	IMPACT TYPE	DESCRIPTION
Safety & Security		Landslides can hinder emergency response efforts and law enforcement capabilities by blocking roads and creating hazardous conditions.

[90] Landslide | Impact (fema.gov) https://community.fema.gov/ProtectiveActions/s/article/Landslide-Impact

Transportation		Landslides can block roads, railways, and even air travel if debris obstructs airport runways, disrupting the flow of goods and people. In some cases, blocked roads can divert traffic to other areas causing congestion and other road hazards.

(3) Natural, Cultural, and Historical Resources

Since the landslides hazard area is outside of the city boundaries, there is little risk to the cultural or historic properties within the City of Carson.

(4) Risk Analysis

Low - Landslides pose a low risk to the planning area. Landslides have the potential to cause devastating impacts to affected areas disrupting vital utilities and communications, damaging homes, and buildings, and can displace residents from their homes. According to landslide hazard maps and the lack of previous occurrences of landslides occurring in the City of Carson, the risk of landslides is low, even considering future developments trends on increases in people and housing units as the hazard zone is outside of the jurisdictions. Earthquake induced landslides are possible to occur just outside of jurisdictional boundaries, north of Del Amo Road, and may have secondary impacts to Carson residents and the community through possible response and recovery efforts depending on the severity of the incident and support needed.

M) LAND SUBSIDENCE / KARST

i) Hazard Profile

Land subsidence is a gradual settling or sudden sinking of the Earth's surface due to removal or displacement of subsurface earth materials. An example of the sinking of the earth's surface in the San Joaquin Valley is shown below. More than 80 percent of known land subsidence is a consequence of groundwater use and is often overlooked environmental consequence of our land and water-use practices. Increasing land development threatens to exacerbate existing problems with land subsidence and can ignite new ones to occur. The main causes of land subsidence include the following:

- Aquifer-system compaction associated with groundwater withdrawal
- Drainage of organic soils
- Underground mining
- Natural compaction or collapse, such as with sinkholes or thawing permafrost

FIGURE 74 - LAND SUBSIDENCE IN THE SAN JOAQUIN VALLEY, CALIFORNIA

Source: USGS

Subsidence can also be caused by natural events such as earthquakes, soil compaction, glacial isostatic adjustment, erosion, sinkhole formation, and adding water to fine soils deposited by wind. [91] An example of land subsidence in illustrated in the figure below from the San Joaquin Valley in central California.

In California, land subsidence was first documented by USGS scientists in the first half of the 20th century. Most of the land subsidence was a result of excessive groundwater pumping. There have been efforts to decrease subsidence, but it continues today, sometimes at nearly historically high rates (1 foot per year). Types of land subsidence are outlined in the table below.

TABLE 69. TYPES OF LAND SUBSIDENCE

LAND SUBSIDENCE TYPE	DESCRIPTION
Groundwater Pumping	Compaction of soils in some aquifer systems can accompany excessive groundwater pumping and it is by far the single largest cause of subsidence. Excessive pumping of such aquifer systems has resulted in permanent subsidence and has resulted in ground failures. In some cases, when substantial amounts of water are pumped, the subsoil compacts, thus reducing the size and number the open pore spaces in the soil the previously held water. This can result in a permanent reduction in the total storage capacity of the aquifer system. [92]
Peat	Peat is a form of land subsidence, which is the downward movement of the Earth's surface due to the removal of subsurface earth materials. Land subsidence is more familiar when we talk about it happening with mineral soil. Peatlands are among the most valuable and carbon rich ecosystems. [93]
Oil Extraction	Most oil and gas reservoirs experience only lesser amounts of compaction and surface subsidence. Significant subsidence due to production of hydrocarbons has been observed over some oil and gas fields. [94]

Source: USGS

Karst is a type of landscape where the dissolving of the bedrock has created sinkholes, sinking streams, caves, springs, and other characteristics features. Karst landscapes typically form when much of the water falling on the surface interacts with and enters the subsurface through cracks, fractures, and holes that have been dissolved into the bedrock.

[91] What is subsidence? (noaa.gov) https://oceanservice.noaa.gov/facts/subsidence.html
[92] Land Subsidence | U.S. Geological Survey (usgs.gov) https://www.usgs.gov/special-topics/water-science-school/science/land-subsidence
[93] What is Peat Subsidence? | World Resources Institute (wri.org) https://www.wri.org/insights/what-peat-subsidence-and-how-can-countries-prevent-environmental-disaster
[94] J. C. Martin, S. Serdengecti, 1984. "Subsidence over oil and gas fields", Man-Induced Land Subsidence, Thomas L. Holzer

(1) Duration

Land subsidence occurs slowly and continuously over time. Land subsidence can also occur on abrupt occasions as in the case of sudden formation of sinkholes.

(2) Seasonality

Land subsidence or karst do not have a seasonality or time of year in which they occur, especially as some hazard events occur over a long period of time.

(3) Speed of Onset

Land subsidence can also occur on abrupt occasions as in the case of sudden formation of sinkholes.

(4) Location

Due to the lack of widely accepted procedures for determining probability and frequency of land subsidence, it is difficult to establish with a high degree of certainty the locations vulnerable to land subsidence. However, mineral extraction and groundwater pumping have previously been associated with the onset of appreciable land subsidence. Groundwater pumping and oil extraction has occurred under most of the City of Carson, save for a small area in the northwest portion of the City.

ii) Magnitude

The severity of land subsidence has no generally established measure. Land subsidence occurs slowly and continuously over time or on abrupt occasions, as in the case of sudden formation of sinkholes. Procedures for determining the probability or frequency of land subsidence have not been established. However, land subsidence can be described in terms of the rate of change in ground elevation relative to sea level.

Elevation or elevation change measurements are fundamental to understanding and monitoring land subsidence. Tools used to measure land subsidence include:

- Interferometric Synthetic Aperture Radar (InSAR)
- Continuous GPS (CGPS) measurements
- Campaign Global Positioning System (GPS) surveying
- Spirit-level surveying[95]

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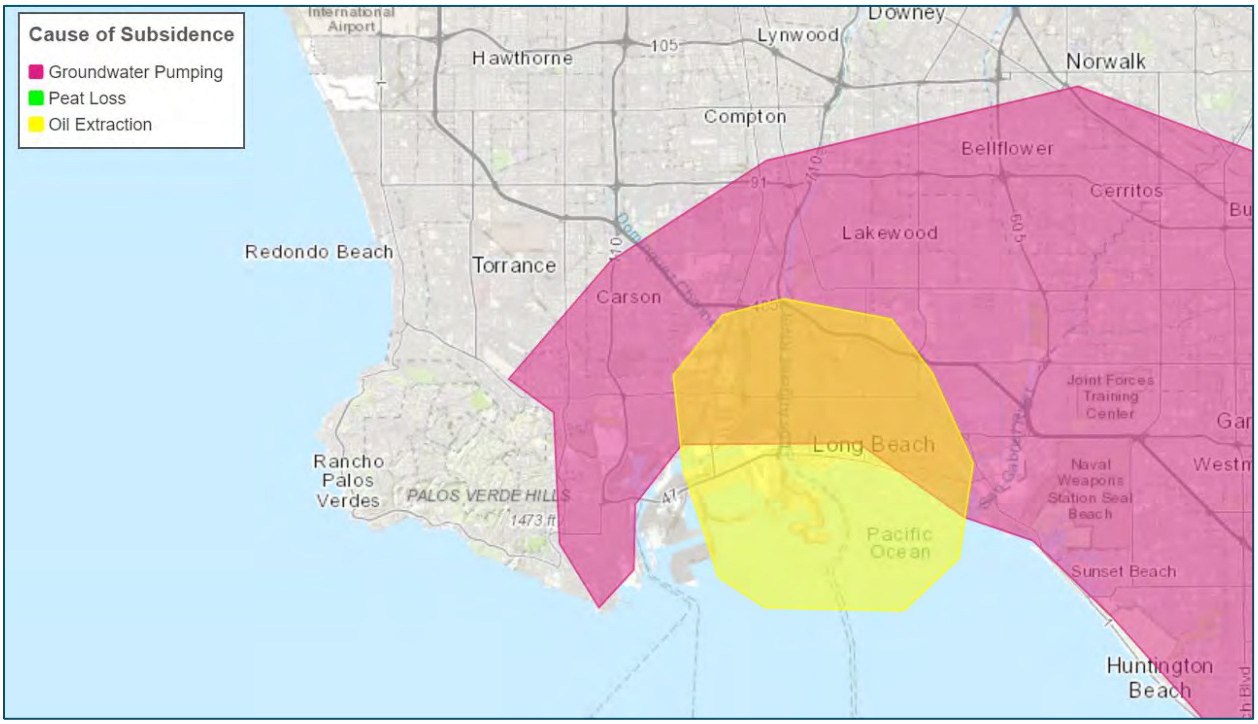
[95] Measuring and Monitoring | U.S. Geological Survey (usgs.gov) https://www.usgs.gov/centers/land-subsidence-in-california/science/measuring-and-monitoring

iii) Extent

In Southern California, land subsidence is due to groundwater pumping, like the rest of the state, and oil extraction which impacts the planning area as well. The City of Carson has an extensive history in oil extraction and manufacturing. Dominguez Hills was also the site of the first oil drilling in Carson in 1921. Later, drilling expanded to multiple locations and still operates to this day. Carson's history in oil extraction has led to land subsidence in the south-eastern portion of the city, illustrated in the map below. The map below illustrates areas of recorded subsidence, historical and current, across California.[96]

FIGURE 75 - LAND SUBSIDENCE MAP, USGS



Source: USGS

iv) Past Occurrences

Land subsidence is an ongoing occurrence and therefore it is difficult to identify specific occurrences of the land subsidence hazard.

Frequency

Based on the continuous nature of the hazard there is assumed to be a 100 percent annual statistical probability of occurrence.

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[96] Subsiding Areas in California | USGS California Water Science Center https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html

v) Future Probability

Highly likely - Procedures for determining the probability or frequency of land subsidence have yet been established. However, due to the state's historical problem with drought, people and companies have turned to groundwater to meet their water needs. The increased groundwater pumping has led to the lowering of groundwater levels throughout the state and has greatly contributed to land subsidence seen throughout the state. Depending on the water year and level of drought the state is experiencing, land subsidence may be occurring at a lower or higher rate. As climate change continues to drive warmer temperatures, it is likely for the state to continue to experience periods of drought which strains groundwater pumping in order to maintain water needs and therefore the region will continue to see land subsidence occurring depending on the severity of drought and water shortages. [97]

vi) Secondary Hazards

Land subsidence is largely a secondary hazard to many other natural hazards such as earthquakes, wildfire, and droughts.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

Land subsidence is largely dependent upon subsurface conditions, particularly the local geology and hydrology. These conditions can be affected by human activity such as mining, fossil fuel extraction, and agriculture. In the first half of the 20th century, parts of California experienced significant land subsidence mainly due to excessive groundwater pumping. Efforts in the latter half of the 20th century to draw water from more sustainable sources caused a corresponding decrease in land subsidence, although some land subsidence does continue. The California Water Science Center and U.S. Geological Survey endeavored to map land subsidence within California, and their work found that between 1993 and 1998 roughly two-thirds of the City of Carson experienced land subsidence at a rate of approximately 20 millimeters per year. It is unclear if the subsidence measured during the 1990's continues today.

Practically all structures situated on land that is subsiding are subject to strain. Materials which are relatively inelastic such as brick and masonry may be the first to show signs of stress such as cracking and spalling. Within the City of Carson, concrete is used extensively for a multitude of

[97] Past, Present and Future: California Provides Insight on the Severity of the Drought and 2022 Guidance (californiawaterviews.com) https://www.californiawaterviews.com/past-present-and-future-california-provides-insight-on-the-severity-of-the-drought-and-2022-guidance

purposes – roads, bridges, municipal buildings, and residential foundations, are just a few components built with concrete. Damage to major transportation routes like Interstate 110 and Interstate 405 would be particularly problematic due to the volume of traffic these routes support. Furthermore, many businesses in the City of Carson rely on freight shipments which require large roadways like Interstate 110 and Interstate 405 to operate efficiently and safely.

(1) People

Land subsidence is an ongoing event, therefore there is no data on previous events and their impact on the population within the City of Carson. However, based on the land subsidence map above, the majority of the planning area is affected by land subsidence due to groundwater pumping and oil extraction. Land subsidence caused by groundwater pumping will increasingly stress the water system and pose a risk to drinking water for residents. This becomes even more problematic during droughts since drought conditions can exacerbate land subsidence compared to wet years.

(2) Structures and Systems

Land subsidence is an ongoing event, therefore there is no data on previous events and their impact on property within the City of Carson. Based on the land subsidence map above, most of the planning area is affected by land subsidence due to groundwater pumping and oil extraction. Additionally, land subsidence can increase the risk of flooding communities and properties by the sinking of the ground's surface. Extreme issues of sinking can compromise the stability of properties, building, and homes, increasing vulnerability of collapsing. Land subsidence can cause cracks to form which can introduce leaks and increase the risk of mold and other structural issues.

Critical Facilities

Land subsidence is an ongoing event, therefore there is no data on previous events and their impact on critical facilities within the City of Carson. Based on the land subsidence map above, the majority of the planning area is affected by land subsidence due to groundwater pumping and oil extraction. Long-term impacts of land subsidence include threatening critical facilities such as roadways, airports, and rail lines due to the continuous sinking of land. Additionally, land subsidence can cause a variety of impacts to occur such as damage to infrastructure and property. Major impacts of land subsidence to critical facilities include:

- Increased flood risk and more frequent inundation induced by rainfall because of the reduced effectiveness of the drainage systems.
- Damage to buildings, foundations, infrastructure (i.e., roads, bridges, dikes) and underground structures (i.e., drainage, sewerage, pipes).

- Disruption of water management and related effects (i.e., change of gradient of streams, canals, drains, increased seawater intrusion, increased pump power).[98]

TABLE 70 - POTENTIAL VULNERABILITIES OF LIFELINES TO SINKHOLE / KARST

LIFELINES	IMPACT TYPE	DESCRIPTION
Food, Hydration, & Shelter		Sinkholes can destroy or damage homes and buildings, leading to displacement of residents and the need for temporary housing solutions. The rebuilding process can be extensive and resource intensive.
Health & Medical		The immediate threat of injury during a karst event and potential for public health concerns afterward (due to disrupted water and sanitation systems) can increase the demand for medical services and strain healthcare facilities.
Utilities		Sinkholes can damage utility lines and infrastructure, leading to power outages, water supply disruptions, and communication breakdowns. Restoring these services is crucial for recovery and normalcy.
Transportation		Sinkholes can block roads and railways, disrupting transportation and access, including emergency response routes. Repairing these routes can be time-consuming and costly.

(3) Natural, Cultural, and Historical Resources

There is limited information and knowledge on land subsidence to properties within the city and more specifically with cultural or historic sites. Based on the lack of information of impacts from land subsidence, is it likely that impacts to such properties is limited.

(4) Risk Analysis

Low - While land subsidence poses a risk to the planning area and can cause negative impacts to people, property, and critical facilities. Land subsidence poses a low risk to the planning area. There have been no significant impacts documented in the City of Carson, however, land subsidence from ground water extraction and oil extraction impacts most of the planning area

[98] 1.4 Major Environmental Impacts – Land Subsidence and its Mitigation (gw-project.org) https://books.gw-project.org/land-subsidence-and-its-mitigation/chapter/major-environmental-impacts

and occurs continuously. Land subsidence occurs over a long period of time, impacts can be seen over years to decades. Therefore, impacts from land subsidence can still arise in the future. Policies that implement consistent monitoring of high-risk areas and damage evaluation could help reduce the impacts of subsidence to reduce risk to people, property, and critical facilities.

N) PANDEMIC / EPIDEMIC

i) Hazard Profile

Outbreaks, epidemics, and pandemics are terms used to classify the spread of diseases among human populations. According to the CDC, an outbreak occurs when an infectious disease results in a higher number of cases than expected in an area within a certain time period. An epidemic is similar to an outbreak, but with a larger number of cases or occurring over a greater area. Pandemics are similar to epidemics, but spread over several countries or continents, usually affecting a large number of people.[99] The lethality of a disease has no impact on whether the spread is considered an outbreak, epidemic, or pandemic. Furthermore, actions which are recommended for addressing a pandemic largely apply to both epidemics and outbreaks. For the purposes of this plan, outbreaks, epidemics, and pandemics are considered interchangeable, unless otherwise noted. Pandemics are large-scale outbreaks of infectious disease that can greatly increase morbidity and mortality over a wide geographic area and cause significant economic, social, and political disruption. The most recent pandemic, Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2), as known as COVID-19, resulted in an unprecedented global health crisis which significantly impacted all sectors and communities.

(1) Duration

Pandemics can last for a long period of time, encompassing several years, compared to other natural hazards. The recent COVID-19 pandemic lasted for 3 years, from January 2020-May 2023, with the ending of the emergency proclamation. However, even though the federal government ended the emergency proclamation for the pandemic, the virus still circulates, causing nearly 1,000 deaths per week at the height of the 2023-2024 winter season. Other examples of pandemics ending but still circulating, also termed as becoming “endemic”, is the Spanish Flu. The Spanish Flu caused a pandemic in early 1900s which is now the seasonal flu. COVID-19 and its variants are still persistent globally and new variants of the virus continues to evolve.

The Pandemic Intervals Framework (PIF) describes the progression of an influenza pandemic using six intervals described in the table below. [100]

[99] U.S. Centers for Disease Control and Prevention. “What Is a Pandemic -- Lesson Plan,” May 23, 2022. https://www.cdc.gov/scienceambassador/documents/module-1-defining-a-pandemic-lesson-plan.pdf.
[100] Pandemic Intervals Framework (PIF) | Pandemic Influenza (Flu) | CDC https://www.cdc.gov/flu/pandemic-resources/national-strategy/intervals-framework.html

TABLE 71. PANDEMIC INTERVALS FRAMEWORK (PIF)

INTERVAL NUMBER	INTERVAL NAME	DESCRIPTION
1	**Investigation**	Investigation of cases of a novel influenza A virus infection in humans. Public health actions focus on targeted monitoring and investigation.
2	**Recognition**	Recognition of increased potential for ongoing transmission of a novel influenza A virus. public health actions focus on control of the outbreak, including treatment of sick persons.
3	**Initiation**	Initiation of a pandemic wave. A pandemic occurs when people are easily infected with a novel influenza A virus that has the ability to spread in a sustained manner from person-to-person
4	**Acceleration**	The acceleration (or "speeding up") is the upward epidemiological curve as the new virus infects susceptible people. Public health actions at this time may focus on the use of appropriate non-pharmaceutical interventions in the community (e.g. school and child-care facility closures, social distancing), as well the use of medications (e.g. antivirals) and vaccines, if available. These actions combined can reduce the spread of the disease and prevent illness or death.
5	**Deceleration**	The deceleration (or "slowing down") happens when pandemic influenza cases consistently decrease in the United States. Public health actions include continued vaccination, monitoring of pandemic influenza A virus circulation and illness, and reducing the use of non-pharmaceutical interventions in the community (e.g. school closures).
6	**Preparation**	When pandemic influenza has subsided, public health actions include continued monitoring of pandemic influenza A virus activity and preparing for potential additional waves of infection. It is possible that a 2nd pandemic wave could have higher severity than the initial wave.

Source: CDC

(2) Seasonality

It has long been recognized that human influenza viruses and the like occur in temperate climate during the winter season and have low activity during the summer months. The onset of pandemics is likely to occur during the winter months as the weather becomes colder and more and more people congregate inside with poor indoor air quality. Additionally, ongoing pandemics are likely to increase in activity around the winter months for similar reasons as experienced with the COVID-19 pandemic. [101]

(3) Speed of Onset

Pandemics can occur relatively quickly, usually over several months, but comparatively to natural hazards, it can be a long time. However, initial fatalities from a pandemic will not be known until perhaps weeks after infection, delaying response from public health and government leaders. The spread of disease can occur rather quickly due to international transportation such as air travel. The World Health Organization is responsible for closely monitoring infectious disease on a global scale, its activity, and spread. [102]

There are different thresholds that define the spread of disease by scale described in the table below.

TABLE 72. SCALE OF INFECTIOUS DISEASE

TERM	DEFINITION
Outbreak	An outbreak is an occurrence of cases of disease that is more than expected, or cases clustered by time, space, or common behaviors.
Epidemic	Epidemic is described as an unexpected increase in the number of disease cases in a specific geographical area.
Endemic	A disease outbreak is endemic when it is consistently present but limited to a particular region. This makes the disease spread and rates predictable.
Pandemic	An epidemic that has spread over several countries or continents and affects many people.

Source: CDC

(4) Location

The entirety of the planning area is considered equally vulnerable to pandemics/epidemics.

ii) Magnitude

Pandemics in nature are destructive, causing major disruptions to the economy, the public health and health care system, and population health. Pandemic impacts are not felt equally across populations, certain populations including people of color, children, the elderly, individuals with disabilities, and individuals with chronic health conditions. Previously, the

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[101] Seasonality of influenza and other respiratory viruses - PMC (nih.gov) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8988196/

[102] Pandemic | Description, History, Preparedness, & Facts | Britannica https://www.britannica.com/science/pandemic

magnitude of a pandemic was measured by the Pandemic Severity Index (PSI) which has been phased out by the Pandemic Severity Assessment Framework (PFAS). There are two main factors that can be used to determine the impact of a pandemic and guide decisions. [103]

1. **Clinical Severity**: how serious is the illness associated with the infection.
2. **Transmissibility**: how easily the pandemic virus spreads from person-to-person.

Guidance from the CDC states that health officials should perform at least two assessments when using the PSAF. The first assessment is appropriately called an "initial assessment," and health officials should complete this assessment early on during a pandemic. At this point, activity may be detected in pockets or certain communities across the country so information and understanding about the pandemic virus may be limited. The initial assessment is intended to help health officials develop a preliminary understanding of the potential impact of the pandemic. Once quality data becomes available, health officials can perform a "refined assessment" which provides a more detailed and accurate picture of pandemic impact, including assessments of the impact by age group. The following table describes scaled measures of transmissibility and clinical severity for refined assessments of pandemic influenza effects.

TABLE 73. SCALES MEASURES OF TRANSMISSIBILITY AND CLINICAL SEVERITY

PARAMETER NO. AND DESCRIPTION[104]	SCALE						
	1	2	3	4	5	6	7
Transmissibility							
1. Symptomatic attack rate, community, %	<10	11-15	16-20	21-24	>25	-	-
2. Symptomatic attack rate, school, %	<20	21-25	26-30	31-35	>36	-	-
3. Symptomatic attack rate, workplace, %	<10	11-15	16-20	21-24	>25	-	-
4. Household secondary attack rate,	<5	6-10	11-15	16-20	>21	-	-

[103] Pandemic Severity Assessment Framework (PSAF) | Pandemic Influenza (Flu) | CDC https://www.cdc.gov/flu/pandemic-resources/national-strategy/severity-assessment-framework.html

[104] [104] Reed, Carrie, Matthew Biggerstaff, Lyn Finelli, Lisa M. Koonin, Denise Beauvais, Amra Uzicanin, Andrew Plummer, Joe Bresee, Stephen C. Redd, and Daniel B. Jernigan. "Novel Framework for Assessing Epidemiologic Effects of Influenza Epidemics and Pandemics - Volume 19, Number 1—January 2013 - Emerging Infectious Diseases Journal - CDC." Accessed August 28, 2023. https://doi.org/10.3201/eid1901.120124.

PARAMETER NO. AND DESCRIPTION[104]	SCALE						
	1	2	3	4	5	6	7
symptomatic, %							
5. R_0: basic reproductive number	<1.1	1.2-1.3	1.4-1.5	1.6-1.7	>1.8	-	-
6. Peak % outpatient visits for influenza-like illness	1-3	1-3	1-3	1-3	1-3	-	-
Clinical Severity							
1. Case-fatality ratio, %	<0.02	0.02-0.05	0.05-0.1	0.1-0.25	0.25-0.5	0.5-1	>1
2. Case-hospitalization ratio, %	<0.5	0.5-0.8	0.8-1.5	1.5-3	3-5	5-7	>7
3. Ratio, deaths: hospitalization, %	<3	4-6	7-9	10-12	13-15	16-18	>18

Source: CDC

Federal, state, and local public health agencies provide instructions to all organizations and individuals based on the severity of a pandemic and the infectious diseases' transmission methods. The worst-case scenario for the City of Carson would be a disease with high clinical severity (7) and high transmissibility (5) in the CDC's PSAF.

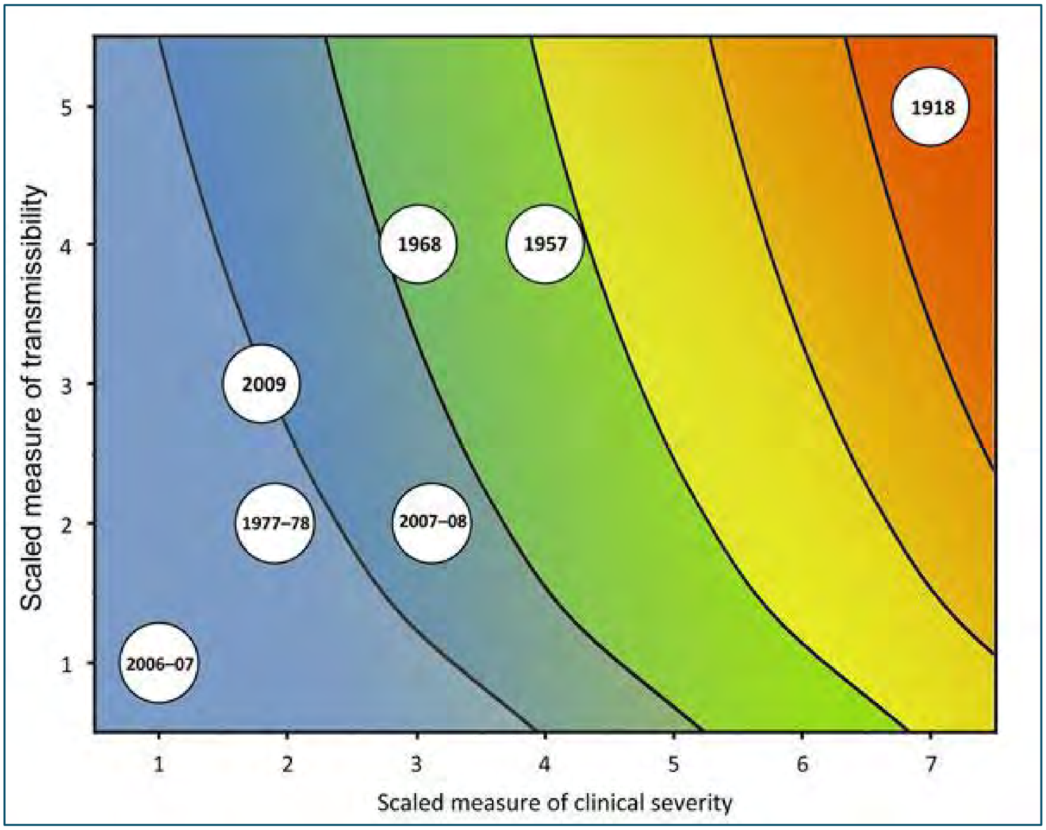
iii) Extent

Large - The entire planning area is considered at risk of pandemics and infectious diseases. Determining the specific location in which epidemics or pandemics begin is difficult and usually occurs sometime after the spread of the disease through contract tracing and other response efforts.

iv) Past Occurrences

Since 1918, there have been six epidemics or pandemics over the span of 105 years. Using the PSAF developed by the CDC, each prior epidemic or pandemic has been measured by their transmissibility and clinical severity score shown in the figure and table below.

FIGURE 76 - SCALES MEASURE OF CLINICAL SEVERITY



Source: CDC

TABLE 74. MAGNITUDE OF PAST PANDEMIC OR EPIDEMIC EVENTS

DISEASE/FLU SEASON	TRANSMISSIBILITY SCORE	CLINICAL SEVERITY SCORE
1918 Spanish Flu Pandemic	5	7
1957-1958 Flu Pandemic	4	4
1968 Flu Pandemic	4	3
1977-1978 Flu Epidemic	2	2
2006-2007 Flu Season	1	1
2007-2007 Flu Season	2	3
2009 Swine Flu Pandemic	3	2
2020 COVID-19 Pandemic[105]	5*	4-7*

Source: CDC *Preliminary results from a preliminary assessment of COVID-19 using PSAF in April 2020.

[105] PSAF scores determined by a team of researchers in Brazil. As of 2023, the CDC has not published an official PSAF rating for the COVID-19 Pandemic.

The COVID-19 Pandemic

The most recent and notable pandemic that has occurred is the COVID-19 pandemic which has been the deadliest pandemic in history. On March 11, 2020, The World Health Organization (WHO) officially declaration the Coronavirus disease 2019 (COVID-19) outbreak a pandemic due to the global spread and the severity of the disease. COVID-19 is a respiratory illness that can spread from person to person and is highly contagious. Soon after, stay-at-home orders were issued across the country to keep people safe against contracting the virus, then COVID-19 testing sites opened and were a critical tool in informing individuals if they had COVID-19 or not in order to minimize and reduce the spread of the virus.

December 2020 marked a historical moment in the pandemic as COVID-19 vaccines were developed to be distributed under emergency use to improve the population's immune response against adverse health effects from COVID-19, especially for older adults, who were passing away at a higher rate than other age groups. The pandemic response efforts expanded into vaccine distribution and administration. In the beginning of the vaccine response, due to high demand and low supply, vaccine was prioritized for older adults, healthcare workers and other groups that were identified as high risk by state, local health departments, and Tribes.

Since 2020, the virus has mutated, and different variants have emerged. Some symptoms of COVID-19 include cough, difficulty breathing, fever, fatigue, muscle pain, and loss of taste or smell. Severe cases resulted in hospitalizations, death, or chronic conditions from long-COVID. Individuals at high risk of adverse health outcomes included the elderly, people with underlying medical conditions and those who are immunocompromised.

The pandemic highlighted existing health disparities among communities resulting in disproportionate impacts in COVID-19 case rates, hospitalizations, and deaths. Those without health insurance and access to healthcare, people of color, people with disabilities, and low socioeconomic status bared the burden of COVID-19 from physical impacts in contracting the virus to financial burdens such as unemployment. [106]

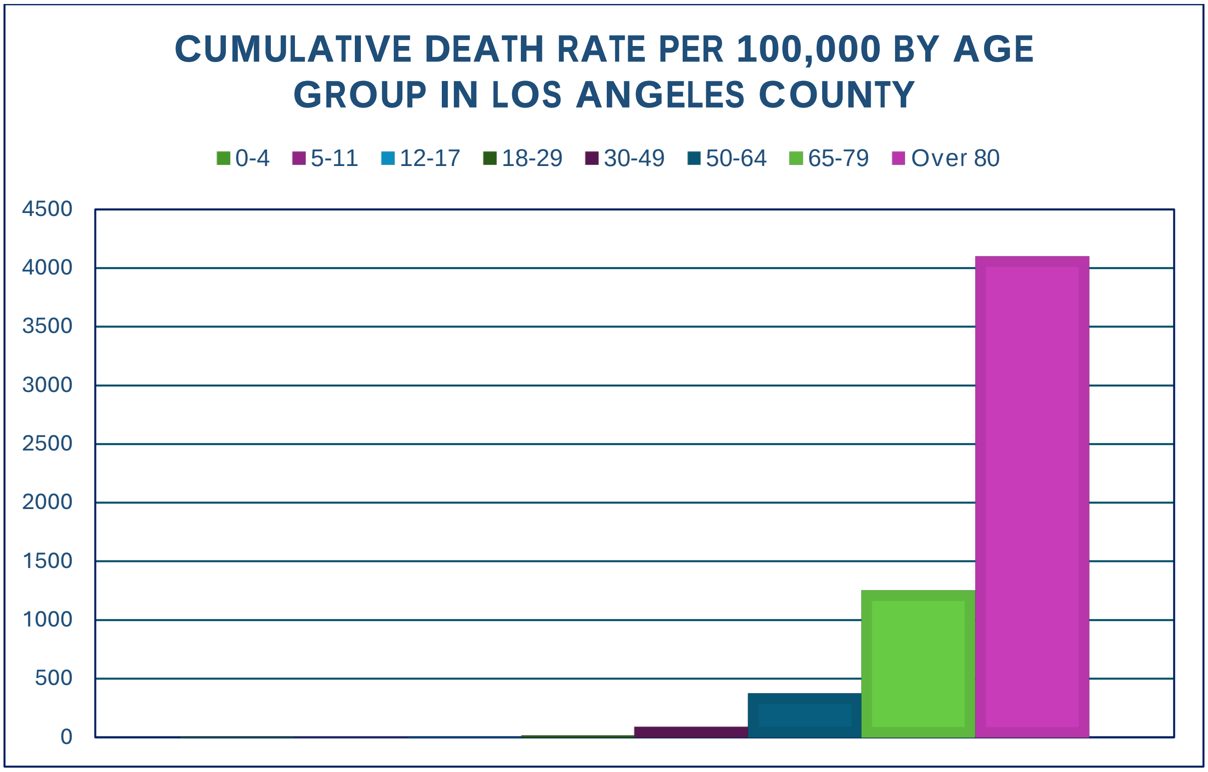
In Los Angeles County, the pandemic produced an unprecedented demand on the healthcare system exacerbated by limited resources and a rapidly changing environment.[107] The figures below describe how the virus disproportionately impacted communities based on their race and ethnicity, age, and income. Individuals over the age of 80, Native Hawaiian and Pacific Islander, Latinx, and individuals living in higher areas of poverty experienced higher rates of infections, hospitalizations and deaths compared to other demographics (i.e., white). Higher rates may be contributed by historical racism which has percolated through the United States' institutions

[106] Inequity and the Disproportionate Impact of COVID-19 on Communities of Color in the United States: The Need for a Trauma-Informed Social Justice Response - PMC (nih.gov)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8243721/

[107] CPARS - LACoEMSA COVID-19 AAR (lacounty.gov)
https://file.lacounty.gov/SDSInter/dhs/1123780_LACountyEMSAgencyCOVID-19AARJan2020-April2021.pdf

and systems, increasing the disparity between demographics. For example, Black and African American see generally worse health outcomes due to less access to quality medical care and racism itself within the medical system. [108]In the City of Carson, cumulatively, as of December 7, 2023, there have been 35,953 COVID-19 infections and 362 deaths. [109]

FIGURE 77 - CUMULATIVE DEATH RATE PER 100,000 BY AGE GROUP IN LOS ANGELES COUNTY (2020-PRESENT)

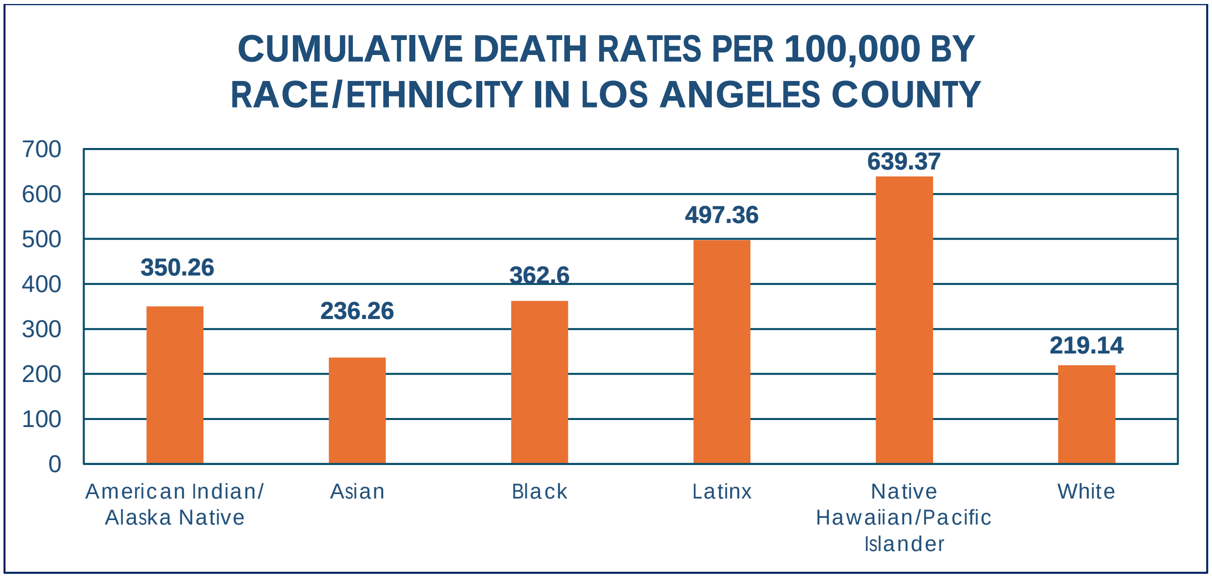


Source: LA County Department of Public Health

[108] Black Americans' views about health disparities, experiences with health care| Pew Research Center https://www.pewresearch.org/science/2022/04/07/black-americans-views-about-health-disparities-experiences-with-health-care

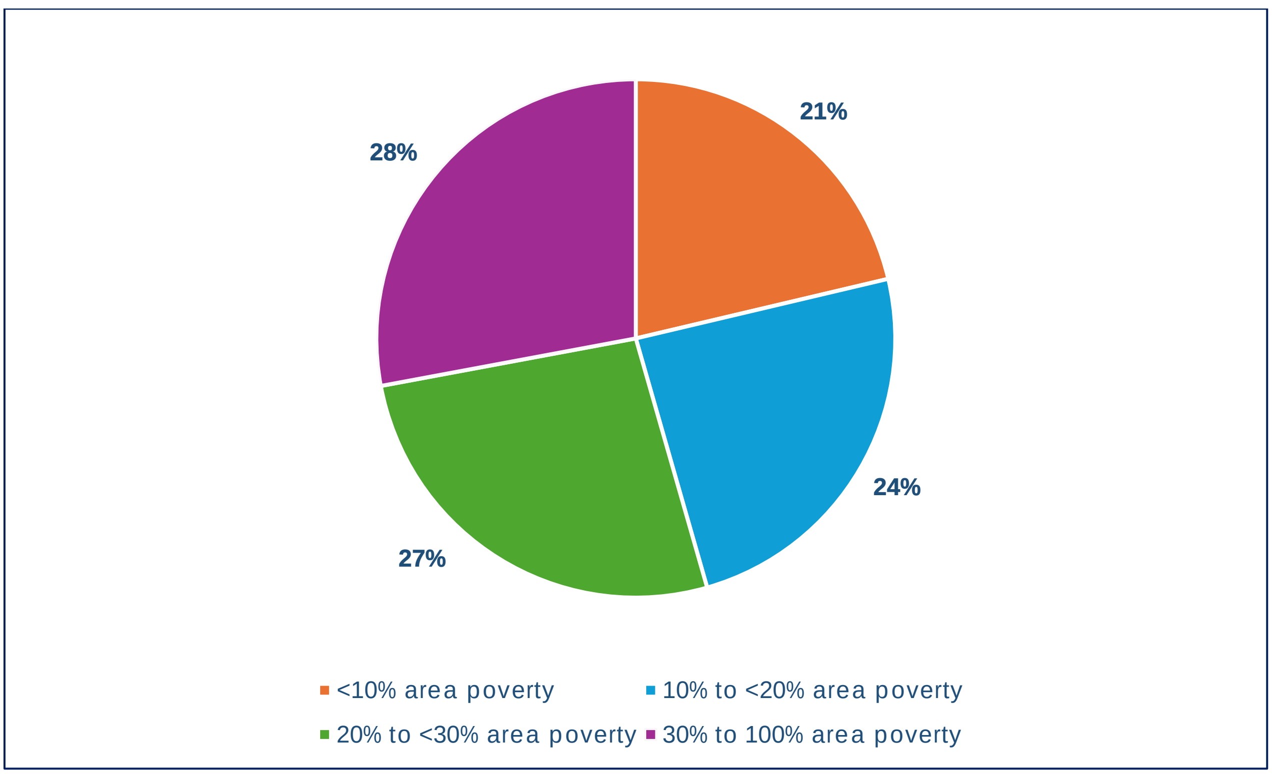
[109] LA County Daily COVID-19 Data - LA County Department of Public Health http://publichealth.lacounty.gov/media/Coronavirus/data/index.htm

FIGURE 78 - CUMULATIVE DEATH RATE PER 100,000 BY RACE/ETHNICITY IN LOS ANGELES COUNTY (2020-PRESENT)



Source: LA County Department of Public Health

FIGURE 79. CUMULATIVE DEATH RATE PER 100,000 BY AREA OF POVERTY IN LOS ANGELES COUNTY (2020-PRESENT)



Source: LA County Department of Public Health

v) Future Probability

Possible - Due to the recent COVID-19 pandemic, there have been studies trying to understand and predict how likely a similar pandemic is to occur in the future and how we can better prepare for the next one. According to one study, the probability of a pandemic similar to COVID-19 is about a two-percent chance of occurring in any year. Based on the increasing rate at which novel pathogens such as SARS-CoV-2 have broken loose in human populations in the past 50 years, the study estimates that the probability of novel disease outbreaks will likely grow three-fold in the next few decades.[110]

Historical modeling suggests that the frequency and severity of epidemics caused by zoonotic disease are increasing, driven by human activities and their impact on the environment. They estimate that the probability of a future zoonotic events resulting in a pandemic of COVID-19 magnitude or larger is between 2.5-3.3 percent annually. In other words, there is a 22-28 percent chance that another outbreak on the magnitude of COVID-19 will occur within the next 10 years, and a 47-57 percent chance that it will occur within the next 25 years.[111] It is likely for a future epidemic or pandemic occurring and impacting the planning area in a similar manner as the COVID-19 pandemic.

Additionally, Climate conditions can influence the spread of infectious diseases, and changes to these conditions can lead to new patterns. Temperature differences can affect where insect populations live and the diseases they may carry. Insects such as fleas, ticks, and mosquitoes can carry diseases like Lyme, West Nile, Malaria, and Zika. Additionally, changes in climate can increase the likelihood of new viruses occurring or mutating in different animal species and infecting humans.

vi) Secondary Hazards

Pandemics are human-caused and do not trigger the same secondary nature-based hazards as an earthquake or flood. Pandemics are not isolated incidents and have historically caused devasting losses and disruptions globally. Using the COVID-19 pandemic as an example, secondary impacts from a pandemic include employment, housing, public health, the environment, public safety, mental health, business, education, healthcare, government, and transportation. Similar to the disproportionate impact of contracting the COVID-19 virus and certain populations experiencing severe outcomes, the secondary impacts were exacerbated by

[110] Statistics Say Large Pandemics Are More Likely Than We Thought (duke.edu) https://globalhealth.duke.edu/news/statistics-say-large-pandemics-are-more-likely-we-thought
[111] What's Next? Predicting The Frequency and Scale of Future Pandemics | Center For Global Development | Ideas to Action (cgdev.org) https://www.cgdev.org/event/whats-next-predicting-frequency-and-scale-future-pandemics

existing inequities in healthcare coverage, existing structural inequities, systemic racism, bias and discrimination, and the politization and misinformation about COVID-19. [112]

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

There are multiple variables that a community should consider when determining its vulnerability to infectious diseases, as well as the impacts that a pandemic may have on the community. Some of the key variables include the following:

Population Density

The overall density of people living within an area can affect how quickly an infectious disease can spread, although it is not the only factor. Preliminary findings from research conducted following the outbreak of COVID-19 found a positive correlation between incidence of the disease and the compactness of people. According to the Census data, the population density of the City of Carson in 2020 was 5,102 people per square mile. For comparison, the nearby communities of Los Angeles, Long Beach, and Torrence had 2020 population densities of 8,205 people per square mile, 9,204 people per square mile, and 7,200 people per square mile, respectively.

Connectivity to Other Communities

Travel of disease carriers is the primary way by which a new disease is introduced to a community. This is why travel restrictions are sometimes utilized by nations, states, and other entities seeking to prevent the outbreak of a novel disease in their respective jurisdiction. The feasibility of travel restrictions largely depends on a community's connectivity and its ability to enforce such restrictions. The City of Carson is surrounded by other jurisdictions, and it would require a significant volume of resources to prevent any and all individuals from entering the City of Carson. The City could take actions such as closing roads and suspending public transportation with service to outside jurisdictions, but just one unauthorized entry could render these actions pointless. Limiting the spread of disease originating from outside the City of Carson is further complicated by the reality that the neighboring community of Los Angeles contains two of the busiest international entry points in California (Los Angeles International

[112] resource-us-programs-secondary-impacts-covid-19.pdf (fhi360.org) https://www.fhi360.org/sites/default/files/media/documents/resource-us-programs-secondary-impacts-covid-19.pdf

Airport and the Port of Los Angeles). International travelers may be coming from nations with varying health standards and regulations.

Socioeconomic Conditions

The Socioeconomic conditions of a population can significantly affect the impact of a pandemic. Health concerns including obesity, diabetes, and preexisting medical conditions can increase a person's risk of experiencing severe health effects or death from an infection. Other socioeconomic factors including a poverty, education, language, housing characteristics, and many others can also increase a community's vulnerability to pandemics. The CDC/ASTDR Social Vulnerability Index uses multiple variables to essentially rank U.S. counties' capacity to prepare for and respond to disasters, including disease/pandemics. The Social Vulnerability Index gives the socioeconomic status of Los Angeles County a score of 0.895, which indicates a high level of vulnerability. This score indicates that the socioeconomic characteristics of Los Angeles County puts the county at a greater vulnerability to pandemics than nearly 90% of all U.S. counties. The Social Vulnerability Index does not provide scores or individual municipalities, including the City of Carson.

Healthcare Infrastructure

In the event of a pandemic, the quality and availability of healthcare services will affect the overall impact felt by the community. There are a number of medical institutions within the City of Carson, including those with urgent care capabilities, but there are no major 9-1-1 receiving hospitals identified within the community. Therefore, the City of Carson may require support from neighboring communities to respond to a pandemic. Examples of the support that may be needed include hospital beds, ventilators, and pathogen testing equipment. The community is encouraged to maintain an appropriate stockpile of personal protective equipment (PPE) and other equipment which is likely to be needed in the event of a pandemic. The City of Carson should consult entities with relevant expertise to determine the full range of items that should be stockpiled, as well as the amounts.

Digital and Communications Infrastructure

As a result of the COVID-19 pandemic, many businesses began utilizing remote work as a way to continue operating when public health restrictions make it difficult for employees to meet in person. Some industries found that remote work was a viable alternative, and some have continued utilizing remote work despite the lifting of many public health restrictions. One of the most common remote working software is Microsoft Teams, and the minimum possible bitrates to facilitate video meetings through this software is 150/200 kilobits. The recommended bitrate for Microsoft Teams video calls is 2,500/4,000 kilobits. Maps from the California Public Utilities Commission indicate that virtually all of the City of Carson has 5G-NR coverage, which should support the minimum requirements for Microsoft Teams. However, if this service is disrupted or unaffordable then businesses may struggle to operate, and employees may struggle to keep or gain employment.

Economic Characteristics

Some businesses are unable to adjust their operations (such as switching to remote work) due to the nature of their work. Some businesses may be directed to temporarily cease operations in the interest of public health, and other businesses may be considered essential and exempted from restrictions and ordinances which are mandatory for non-essential operations. In the event of pandemic such as COVID-19, the City of Carson should anticipate that businesses centered around tourism and services will experience significant decreases in economic activity. Additionally, the City is encouraged to have a plan in place for businesses that may be considered essential, such as those supporting the energy and transportation industries. Collaborating with these businesses may help city officials determine steps that can be taken which adequately balance public health and safety concerns with the need to keep essential businesses operating.

(1) People

All residents and visitors of the City could be susceptible to exposure from an infectious disease and subsequent impacts from a pandemic or epidemic. However, based on existing inequities, some populations and communities will continue to bear the burden of those impacts, similar to previous occurrences. Disproportionately impacted communities include but are not limited to:

- Rural communities
- Black, Indigenous, People of Color (BIPOC) Communities
- LGBTQ+ communities
- Incarcerated/detained populations
- Individuals with disabilities
- Individuals with chronic health conditions
- Individuals with no health insurance or lack of access to healthcare services
- Low socioeconomic status
- People experiencing homelessness
- Individuals with limited English proficiency

During the COVID-19 pandemic response, the Los Angeles County Department of Public Health focused on supporting populations with the greatest vulnerability to the disease due to clinical and/or social drivers of health described in the table below.

- Educational institutions
- Incarcerated populations
- People experiencing homelessness
- Skilled nursing facilities and congregate living settings
- Essential workers

- Health care/public health
- Emergency services
- Food and agriculture
- Energy
- Waste and wastewater
- Transportation and logistics
- Communications and information technology
- Government operations and other community-based essential functions
- Critical manufacturing
- Financial services
- Chemical and hazardous materials
- Defense industrial base
- Industrial, commercial, residential, and sheltering facilities and services

It is critical that future planning and preparedness activities for pandemic and epidemics account for the existing disparities in the City of Carson and potential barriers communities may face to mitigate adverse health outcomes and other impacts such as unemployment and the subsequent impacts (i.e., food and housing insecurity). The County of Los Angeles Department of Public Health – COVID-19 Response Interim Review Report outlined several recommendations to reduce risk among at-risk communities such as improving communications with trusted community organizations, developing more accessible communications, and ensuring response operations consider health literacy, language, and cultural differences.[113] Such efforts will assist in reducing the health disparities often seen in pandemic and epidemics as well as improving health outcomes and the livelihoods of disproportionately impacted communities.

(2) Structures and Systems

Pandemics and epidemics do not typically physically damage buildings and property, however they can cause damage to properties through disrupting supply chains and the distribution of goods which can slow or force businesses to close. Industry and commerce are also likely to suffer losses which occurred during the COVID-19 pandemic.

Good ventilation and indoor air quality are critical in reducing airborne exposure to viruses and other disease vectors. Buildings and their ventilation and air conditioning (HVAC) systems can pose a higher risk for disease spread through lack of adequate ventilation and air filtration. Adjustments can be made to improve indoor air filtration. During the COVID-19 pandemic, public health recommendations included adding portable high efficiency particulate air (HEPA)

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[113] Manatt_Report_COVIDResponseInterimReview_Dec2022.pdf (lacounty.gov) http://publichealth.lacounty.gov/media/coronavirus/docs/Manatt_Report_COVIDResponseInterimReview_Dec2022.pdf

cleaners to reduce the number of airborne infectious particles, especially in congregate settings.[114]

Critical Facilities

The COVID-19 pandemic rapidly escalated demands on the health care system, medical infrastructure, and health care workforce. Unlike a one-time disaster event, the COVID-19 pandemic disease spread had many surges repeatedly stressing hospitals, EMS, and healthcare settings causing ripple effects throughout the community. In order for the healthcare system to cope with surge of patients seeking medical care and attention, many hospitals cancelled non-emergency (but still needed) procedures and were not prioritizing people with non-COVID needs which increased all-cause and COVID-19 specific mortality in the subsequent weeks after the start of the pandemic. Additionally, hospitals were already operating close to capacity and the pandemic pushed the entire healthcare system to the brink. Educational settings faced many challenges in barriers in continuing to provide education to students which caused disruptions to learning and critical learning milestones for K-12 students. Many schools, for the first time, explore virtual schooling options, which posed challenges. Rural communities with limited access to the internet struggled to connect and participate in virtual classrooms. These hardships create a difficult environment for the school, teachers, students, and parents to navigate.

TABLE 75 - POTENTIAL VULNERABILITIES TO LIFELINES FROM A PANDEMIC

LIFELINES	IMPACT TYPE	DESCRIPTION
Health & Medical	Health and Medical	The most direct impact of a pandemic is on health services. Hospitals and healthcare facilities can become overwhelmed with patients, leading to a strain on resources, personnel, and infrastructure. The need for medical supplies, ventilators, and personal protective equipment can surge beyond normal levels.
Food, Water, & Shelter	Food, Hydration, Shelter	Supply chains for essential goods, including food and water, can be disrupted due to illness-related workforce shortages or quarantine measures. Ensuring access to these necessities become a critical challenge, particularly for vulnerable populations.

[114] Efficacy of Portable Air Cleaners and Masking for Reducing Indoor Exposure to Simulated Exhaled SARS-CoV-2 Aerosols — United States, 2021 | MMWR (cdc.gov) https://www.cdc.gov/mmwr/volumes/70/wr/mm7027e1.htm

LIFELINES	IMPACT TYPE	DESCRIPTION
Transportation		Pandemics can lead to reduced transportation services due to decreased demand, illness among transportation workers, or quarantine measures. This can affect the movement of goods and people, including the delivery of essential supplies and access to healthcare.
Communications		Reliable communication is crucial for disseminating public health information, guidelines, and updates during a pandemic. The increased demand for internet and telecommunication services can strain existing communication networks, especially with more people working from home.
Energy		While energy infrastructure may be less directly impacted, workforce shortages due to illness can affect the maintenance and operation of power plants and the energy grid.
Safety & Security		The need for public safety and security services can increase, as pandemics can lead to heightened public anxiety, the enforcement of quarantine measures, and the potential for civil unrest.

(3) Natural, Cultural, and Historical Resources

There are 49 identified historical and cultural properties within the City of Carson. A pandemic can have a wide-ranging impact on both natural and cultural resources in a community. Reduced human activity, such as tourism and outdoor recreation can cause economic hardships. Economic downturns during a pandemic can lead to budget cuts and reduced funding to such activities to preserve cultural and historic properties.

Cultural institutions such as museums, historic sites, and art galleries may be closed or operate at reduced capacity during a pandemic. This can lead to decreased access to cultural resources for the public. Cultural organizations often rely on visitor revenue and donations to sustain operations. Reduced visitation and economic uncertainty during a pandemic can strain the financial stability of these institutions, impacting their ability to preserve cultural resources. Cultural resource preservation and restoration projects may be delayed or postponed due to budget constraints and public health restrictions, potentially leading to deterioration of historic buildings and artifacts. Archives, libraries, and repositories of cultural heritage materials may face disruptions in operations, making it difficult to access and preserve historical records and documents.

(4) Risk Analysis

High - Pandemics and infectious diseases pose a high risk to the planning area. The severity of these events can be catastrophic and have caused millions of deaths worldwide, even more hospitalizations, disrupting, almost to the brink of collapsing, healthcare systems, tanking the economy, and causing all kind of ripple effects in our society. In some cases, these events may go undetected for several weeks and full understanding of the disease may not occur until some time has passed as more data is collected. It is important to note that with the increases in cost of living and healthcare expenses in recent years, more and more people may be vulnerable to a future pandemic or infectious disease event. Communities may not have the resources to cope as pandemics tend to strain the economy and increase the cost of goods, services, and housing.

The recent COVID-19 pandemic highlighted the health inequities and structural and systemic barriers that certain communities face rooted in racism and discrimination. Communities of color, disabled individuals, and older adults were among some of the communities that were disproportionately impacted in COVID-19 case rates, hospitalizations, and deaths. In some cases, those that recovered from COVID-19 now face chronic conditions from Long-COVID which are symptoms that persist even after an acute attack of COVID-19. This typically includes fatigue, dyspnea, chest pain, and cough. Less common persistent symptoms include anosmia, joint pain, headache, rhinitis, poor appetite, dizziness, myalgias, and insomnia. [115]

The COVID-19 pandemic caused catastrophic impacts, but through this disaster came innovation and has drastically improved the development of vaccines for emerging viruses and disease. The sudden emergence of a previously unknown, highly contagious respiratory pathogen as the cause of a global pandemic necessitated the rapid development and testing of vaccines. This effort benefited from more than a decade of advances in vaccine antigen design and new vaccine platform technologies. [116] However, the recent pandemic exacerbated many communities' mistrusts in government and as a result, childhood vaccination rates have decreased, increasing the risk of certain illnesses resurfacing and or increasing the frequency and severity of illnesses. Additionally, based on future development trends, it is likely that epidemics and pandemics will increase in risk as the population increases. In summary, not only do pandemic and infectious disease incidents cause significant harm and destruction and loss of lives to communities, but they cause several ripple effects (i.e., lower vaccination rates) that planners and government officials will have to contend with. The recent COVID-19 pandemic

[115] Long COVID or Post-COVID Conditions | CDC https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html

[116] Bok K, Sitar S, Graham BS, Mascola JR. Accelerated COVID-19 vaccine development: milestones, lessons, and prospects. Immunity. 2021 Aug 10;54(8):1636-1651. doi: 10.1016/j.immuni.2021.07.017. Epub 2021 Aug 3. PMID: 34348117; PMCID: PMC8328682

highlighted gaps in planning and preparedness efforts from the federal to local governments and these events are expected to occur again in the future.

O) SEVERE STORM / THUNDERSTORM / LIGHTNING

i) Hazard Profile

A **thunderstorm** is a rain shower that produces lightning and thunder. A **severe storm** is a thunderstorm that can produce destructive and deadly weather including tornadoes, hail, strong winds, lightning, and flooding. **Lightning** is caused by the attraction between positive and negative charges in the atmosphere, resulting in the buildup and discharge of electrical energy. Rapid heating and cooling in the air produces a shock wave that results in thunder that can be heard following lightning. This hazard profile will specifically focus on severe thunderstorms that produce lightning as hail, tornado, and high winds are profiled in other sections within this plan. Lightning is caused by the attraction between positive and negative charges in the atmosphere, resulting in the buildup and discharge of electrical energy.

Thunderstorms are not uniform and have unique characteristics to each type. The different thunderstorm types include the following below.

- **Single-cell thunderstorms**: often called “popcorn” convection, single-cell thunderstorms are small, brief, weak storms that grow and die within an hour or so. Typically, these storms are driven by heating on a summer afternoon. Single-cell storms may produce heavy rain and lightning.
- **Multi-cell storm**: is a common, garden-variety thunderstorm in which new updrafts form along the leading edge of rain-cooled air (the gust front). Individual cells usually last 30 to 60 minutes, while the system may last for many hours. Multicell storms may produce hail, strong winds, brief tornadoes, and/or flooding.
- **A squall line:** is a group of storms arranged in a line, often accompanied by “squalls” of high wind and heavy rain. Squall lines tend to pass quickly and are less prone to produce tornadoes than supercells. They can be hundreds of miles long but are typically only 10 or 20 miles wide.
- **Supercell:** is a long-lived (greater than 1 hour) and highly organized storm feeding off an updraft (a rising current of air) that is tilted and rotating. This rotating updraft can present as much as 20 to 60 minutes before a tornado forms. Most large and violent tornadoes come from supercells.
- **A “bow echo”:** is a radar signature of a squall line that “bows out” as winds behind the line and circulations develop on either end. A strongly bowed echo may indicate high

winds in the middle of the line, where the storms are moving forward most quickly. Brief tornadoes may occur on the leading edge of a bow echo. [117]

The ingredients to produce a thunderstorm include moisture, lifting, instability, and wind shear. The main difference between a thunderstorm and a severe thunderstorm is the wind field.

(1) Atmospheric Rivers

Atmospheric Rivers are ribbons of moisture carried by strong winds in the lower atmosphere. They carry massive amounts of moisture from the tropics to the poles and accounts for 90 percent of the total water vapor that moves across Earth's mid-latitude, where the United States is located. The average atmospheric river is about 1,200 miles long, 300 miles wide, and two miles deep. Atmospheric rivers can bring benefits, for example, they account for up to 50 percent of California's total annual precipitation and streamflow as well as relieve drought impacts. However, some drawbacks of atmospheric rivers include flooding, landslides, and levee breaks. Climate change can drive conditions to be conducive to an increase and greater intensity of atmospheric rivers due to warmer temperatures. [118]Additional moisture from atmospheric rivers could increase the frequency of thunderstorms and severe storms to occur. [119]

(2) Duration

Severe thunderstorms can last for a couple of minutes up to several hours and depends on the type and size of the storm. The average duration of a thunderstorm is 30 minutes.

(3) Seasonality

Thunderstorms can occur throughout the year and at any time of the day. However, thunderstorms are most likely to occur in the spring and summer months and during the afternoon and evening hours.

(4) Speed of Onset

Most thunderstorms form in three stages:

- **The developing stage:** when storm clouds form
- **The mature stage:** when the storm is fully formed
- **The dissipating stage:** when the storm weakens and breaks apart

[117] Severe Weather 101: Thunderstorm Types (noaa.gov) https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/types/
[118] Atmospheric Rivers | Climate Central https://www.climatecentral.org/climate-matters/atmospheric-rivers-2023
[119] Lightning in California: Why Isn't the State Struck More Often? - The New York Times (nytimes.com) https://www.nytimes.com/2023/01/11/us/lightning-california-storm.html

Thunderstorms can occur relatively quickly, as the whole process of a thunderstorm moving through the developing and dissipating stage can last about an hour or longer depending on the size and how powerful the storm is. [120]

(5) Location

The entirety of the planning area is considered to be equally vulnerable to severe storms.

ii) Magnitude

Thunderstorms can range from general thunderstorms to severe thunderstorms. NOAA categorizes thunderstorms into six categories to describe the different severity of severe thunderstorms occurring. The six categories are described in the table below.

TABLE 76. NOAA STORM PREDICTION CENTER THUNDERSTORM RISK CATEGORIES

SEVERE THUNDERSTORM RISK CATEGORIES					
Thunderstorms (No Label)	**1 - Marginal (MRGL)**	**2 – Slight (SLGT)**	**3 – Enhanced (ENH)**	**4 – Moderate (MDT)**	**5 – HIGH (HIGH)**
No severe thunderstorms expected	Isolated severe thunderstorms possible	Scattered severe storms possible	Numerous severe storms possible	Widespread severe storms likely	Widespread severe storms expected
Lightening/ flooding threats exist with all thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense

Source: NOAA

To communicate the risk of severe thunderstorms to the public, the National Weather Service (NWS) issues a severe thunderstorm watch and severe thunderstorm warning. The table below describes each of the NWS products below.

[120] How Thunderstorms Form | Center for Science Education (ucar.edu) https://scied.ucar.edu/learning-zone/storms/how-thunderstorms-form.

TABLE 77. SEVERE THUNDERSTORM NWS PRODUCTS

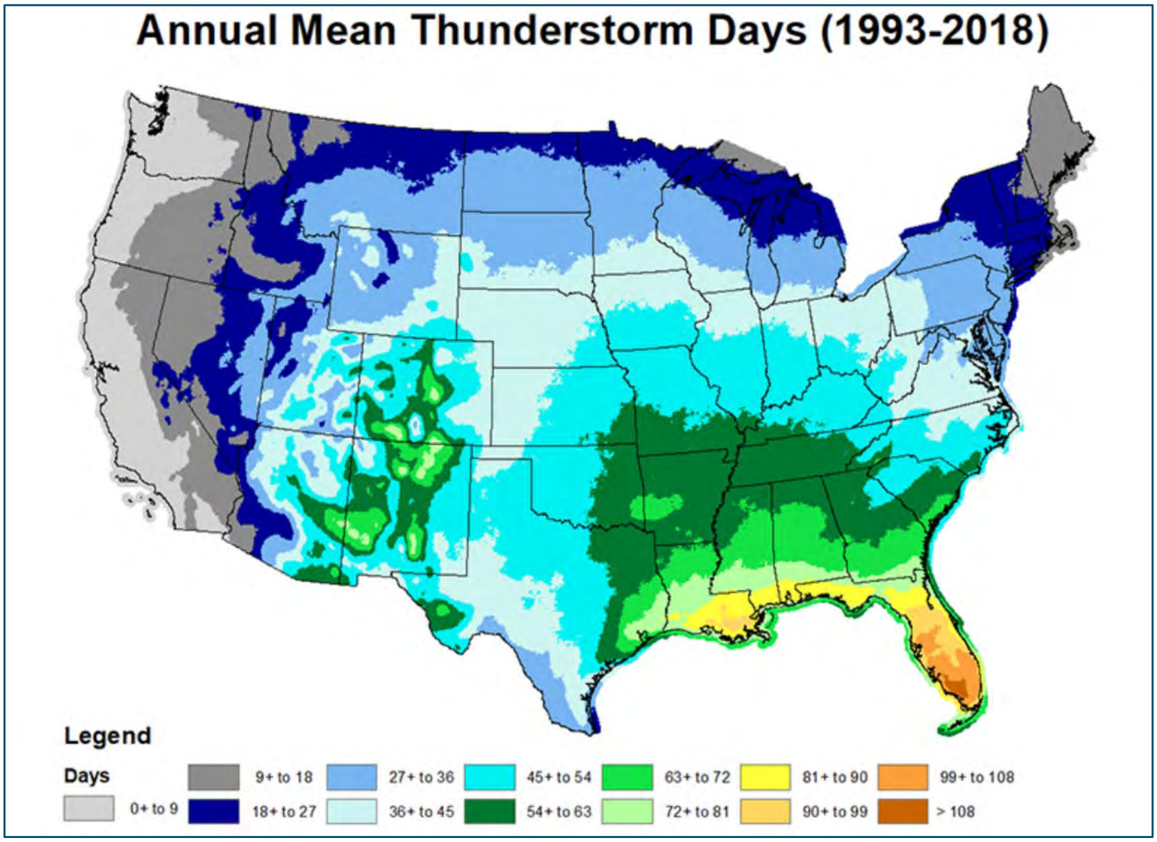
SEVERE THUNDERSTORM PRODUCT	DESCRIPTIONS
Severe Thunderstorm Watch	Severe thunderstorms are possible in and near the watch area. Stay informed and be ready to act if a severe thunderstorm warning is issued. The watch area is typically large, covering numerous counties or even states.
Severe Thunderstorm Warning	Severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property. Take shelter in a substantial building. Get out of mobile homes that can blow over in high winds. Warnings typically encompass a much smaller area (around the size of a city or small county) that may be impacted by a large hail or damaging wind identified by an NWS forecaster on radar or by a trained spotter/law enforcement who is watching the storm.

Source: National Weather Service (NWS)

iii) Extent

Large - Thunderstorms can develop and form in any geographic location. However, they are more likely to occur within the mid-latitudes, where warm, moist air from tropical latitude collides with cooler air from polar latitudes, shown in the map below with the annual map thunderstorm days from 1993 to 2018.

FIGURE 80 - CONTIGUOUS U.S. ANNUAL MEAN THUNDERSTORM DAYS (1993-2018), NWS



Source: National Weather Service (NWS)

California does not experience many thunderstorms compared to the other southern eastern states. Within the state, it is well understood that thunderstorms are more likely to occur inland, in the southeastern corner of the state. This region is often affected by the annual monsoonal moisture that impacts southwestern states every summer. [121]

Lightning Extent

The extent for lightning can be expressed in terms of the number of strikes in an interval. NOAA utilizes lightning activity levels (LALs) on a scale from 1-6. LAL rankings reflect the frequency of cloud-to-ground lightning either forecast or observed as described in the table below.

[121] Lightning is extremely rare in the Bay Area. But here's why it can be so dangerous when it strikes (sfchronicle.com) https://www.sfchronicle.com/projects/2022/weather-lightning

TABLE 78: NOAA LIGHTNING ACTIVITY LEVELS (LAL)[122]

LAL	CLOUD & STORM DEVELOPMENT	LIGHTNING STRIKES/ 15 MIN
1	No thunderstorm.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common, and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy, and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	9-15

iv) Past Occurrences

There have been several thunderstorm events within Los Angeles County throughout the years, however, there have only been singular thunderstorm events, based on the NOAA Storm Events Database, shown in the map below. Details of these events are listed in the table below. In order to identify previous thunderstorm events in the Storm Events Database, the terms "Lightning" and "Thunderstorm Wind" were used in lieu of a category listed in the database specifically for thunderstorms. All events illustrated in the map below are "Thunderstorm Wind" events.

[122] NOAA - https://forecast.weather.gov/glossary.php?word=LALs

FIGURE 81 - THUNDERSTORM WIND EVENTS (1950-2023), NOAA

Source: NOAA, NCEI, Storm Events Database

TABLE 79. PREVIOUS THUNDERSTORM WIND OCCURRENCES, NOAA

HAZARD	DATE	LOCATION	DESCRIPTION
Thunderstorm Wind	12/4/1957	Liberty Village	N/A
Thunderstorm Wind	3/12/1958	Long Beach	N/A
Thunderstorm Wind	8/17/1962	Rolling Hills Estates	N/A
Thunderstorm Wind	5/8/1977	Lakewood	N/A
Thunderstorm Wind	3/1/1981	Carson	N/A
Thunderstorm Wind	5/13/1998	Long Beach	Wind speed is 60 miles per hour. Strong thunderstorm winds produced damage across parts of the Long Beach area. At a car dealership, the roof of a couple of service bays

HAZARD	DATE	LOCATION	DESCRIPTION
			was blown off. Next door, a 600 square-foot section of roof was torn off an aircraft instrument company.
Thunderstorm Wind	3/5/2000	Long Beach	Wind speed is 60 miles per hour. A severe thunderstorm struck the city of Long Beach. Downburst winds, gusting up to 70 mph, blew down numerous power poles near the intersection of Stearn Street and Redondo Lane.

Source: NOAA, NCEI, Storm Events Database

(1) Lightning

The NCEI does not include the LAL for historical lightning events. Over the past several years, the U.S. averaged about 17.8 lightning strikes per square kilometer per years. On average states like Florida saw more than 87 strikes per square kilometer per year while other states like California saw just 1.1. The reason California does not experience more lightning is due to the lack of humidity compared to other parts of the country. Recently, the state has experienced more atmospheric river events which bring in huge amounts of moisture from the Pacific Ocean causing an increase of lightning bolts.

(2) Frequency

Based on the previous occurrences, a thunderstorm has occurred once since 1950, according to the NOAA Storm Events Database. Therefore, the frequency of thunderstorms occurring in the City of Carson is minimal. Based on the previous occurrences within and just outside of the city, there have been seven occurrences in the past nearly 75 years. Therefore, within the coastal region, there is a nine percent chance of occurrence.

v) Future Probability

Possible - Given the low number of previous thunderstorms, severe thunderstorms, and lightning events within the city, it is possible that these events will continue to be sparse and cause minimal damage. On a large scale, lightning strikes nationwide are projected to increase by 12 percent per every degree Celsius of global warning and about 50 percent over the 21st century if greenhouse gases increase at their current pace. However, so far scientists have not yet seen an increase in lightning events. When looking at the past 25 years, there hasn’t been a noticeable increase in global lightening or U.S. lightning. [123] In future decades, it is uncertain if lightning events will increase or decrease in frequency within the planning area.

vi) Secondary Hazards

Severe thunderstorms can produce a variety of secondary hazards including damaging hail and high winds, tornadoes, and lightning produced by these storms can start wildfires under the right conditions. Descriptions for each of these secondary hazards are provided in the table below.

TABLE 80. SEVERE THUNDERSTORMS SECONDARY HAZARDS

HAZARD	DESCRIPTION
Hail	Hail is a form of precipitation consisting of solid ice that forms inside thunderstorm updrafts. Hail can damage aircraft, homes, and cars, and can be deadly to livestock and people.
High Winds	Damaging winds are often called “straight-line” winds to differentiate the damage they cause from tornado damage. Strong thunderstorm winds can come from several different processes. Most thunderstorm winds that cause damage to the ground are a result of outflow generated by a thunderstorm downdraft. Damaging winds are classified as those exceeding 50-60 mph.
Tornadoes	A tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust and debris. Tornadoes can be among the most violent phenomena of all atmospheric storms we experience.
Wildfires	Lightning strikes from thunderstorms, in the right conditions, can create wildfire to occur. In fact, there have been several major fires in California which were started by lightning strikes.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

[123] Lightning could spark more California fires as world warms - CalMatters https://calmatters.org/environment/2021/09/california-fires-lightning/

The main threats associated with severe thunderstorms are flash flooding, hail, high winds, and lightning. This section will primarily consider the lightning component, as flash flooding, hail, and high winds are reviewed in detail in the Flood, Hail, and High Winds sections, respectively.

Impacts of Lightning Voltage

Lightning is essentially a large electric discharge between two charged regions. These discharges are highly energetic events, and the two primary risks associated with lighting are the voltage and heat produced. An average lightning strike contains roughly 300 million volts, which is approximately 2.5 million times more than the 120 volts found in standard home outlets. Additionally, lightning can momentarily heat the air to temperatures above 50,000 degrees Fahrenheit. The surge of electricity resulting from a lightning strike can completely ruin practically all electrical components connected to the grid. Because of this, many safety features have been incorporated to protect public and private property. However, these safety features can temporarily interrupt electrical service, and this can disrupt business operations and pose a risk to certain vulnerable populations such as those who rely on powered medical devices such as ventilators and dialysis machines.

Impacts of Lightning Heat

Regarding heat, the temperatures produced by a lightning strike are sufficient to ignite fires; the City of Carson is particularly vulnerable to this due to the large volume of flammable material within the city. There are multiple petroleum and natural gas facilities located in the City of Carson including the Los Angeles Refinery, Kinder Morgan Carson Terminal, and Shell Carson Distribution Complex. The community is also home to multiple warehouses, which may contain flammable materials. In 2021 a fire at a warehouse in the City of Carson required more than 200 firefighters to extinguish, three of whom sustained minor injuries. The intensity of the fire was attributed to boxes of rubbing alcohol which were stored at the site. While this event was not caused by a lightning strike, it serves as an example of the type of fire that can result if a lightning strikes a warehouse.

(1) People

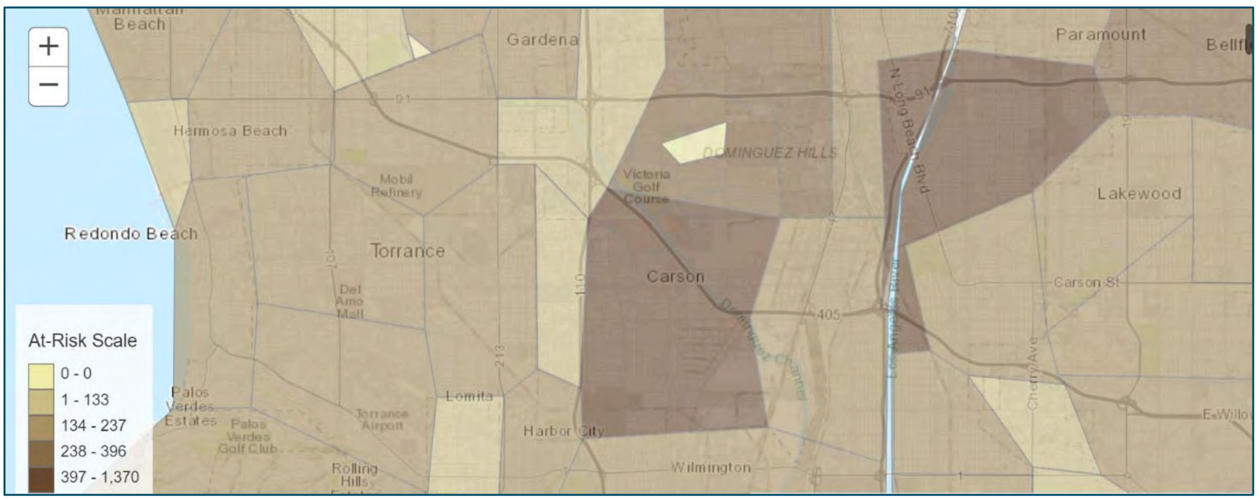
Lightning from thunderstorms and severe thunderstorms can pose a risk to the population, especially increased population density and urbanization continues. Impacts from these events can include individuals being struck by lightning and power outages. There are risks of being struck by lightning and the consequences of lightning strike injuries are serious. In the United States, an average of 182 people is injured and 33 people pass away each year by lightning. Although most survive, many can experience long-term debilitating symptoms. [124] However, based on the previous occurrences in the city, there have been no reported injuries, fatalities, or

[124] Thunderstorm | Impact (fema.gov) https://community.fema.gov/ProtectiveActions/s/article/Thunderstorm-Lightning-and-Hail-Impact

other related impacts to the populations from thunderstorms, severe thunderstorms, and lightning.

Populations that may be disproportionately impacted by severe thunderstorms and lightning include those that medically rely on electricity when the power fails, those with limited English proficiency (i.e., emergency communications may only be in English), individuals experiencing homelessness, and individuals experiencing poverty. The zip code, 98745, within the City of Carson that has the highest number of individuals that are medically dependent on electricity is 11,696, shown in the map below. When power outages occur, these populations may need additional support to prevent injury, illness, or death.

FIGURE 82 - EMPOWER DATA BY ZIP CODE, HHS



Source: HHS, emPOWER

(2) Structures and Systems

Fallen trees, power lines, flooded areas, and debris are common after severe thunderstorms due to high winds, heavy rainfall, and lightning. These events can block access to roads and cause damage to buildings and properties. Damage to properties can cause a financial strain to businesses to rebuild. Based on previous occurrences in the city, there has been no reported damage from these events in the City of Carson.

Critical Facilities

Thunderstorms and lightning, especially severe thunderstorms, can pose a risk to the City of Carson due to disruption of critical facilities such as public utilities, telecommunications, and transportation routes. These disruptions can cause significant delays and issues for emergency services to respond and recover from the incident.

TABLE 81 – POTENTIAL LIFELINE IMPACTS – WIND AND THUNDERSTORMS

LIFELINES	IMPACT TYPE	DESCRIPTION
Housing & Building Infrastructure	Food, Hydration, Shelter	Wind and Thunderstorms can cause damage to homes, businesses, and public buildings, leading to displacement of residents and the need for temporary shelters and renovation efforts. Direct lightning strikes can cause structural damage to buildings, necessitating repairs and, in severe cases, temporary relocation of residents.
Utilities	Energy (Power & Fuel)	Windstorms can disrupt essential services by damaging power lines, water mains, and communication networks. Restoring these services is crucial for recovery and supporting other lifeline sectors.
Transportation	Transportation	Debris and damage to roads, bridges, and transportation infrastructure can hinder emergency response efforts and the movement of goods and people. Clearing debris and repairing infrastructure are critical post-storm activities.
Energy	Energy (Power & Fuel)	Lightning strikes can cause power outages by damaging electrical infrastructure, including power lines and transformers. This disruption affects not just residential areas but also critical services and businesses.
Communications	Communications	Lightning can damage communication infrastructure, such as cell towers and broadcasting equipment, leading to disruptions in both personal and emergency communications.

(3) Natural, Cultural, and Historical Resources

There are 49 identified historical and cultural properties within the City of Carson. Thunderstorms, severe thunderstorms, and lightning cause damage cultural and historic properties which can cause structural damage, debris damage, power outages, tree damage, and accessibility issues which can pose a risk for public safety and cause financial impacts.

(4) Risk Analysis

Low - Based on the previous occurrences in the planning area, which included only one documented event, thunderstorms, severe thunderstorms, and lightning pose a low risk to the planning area. Despite the lack of impact and damage from previous events, it is possible that these events can cause significant impacts to people, property, critical facilities, and infrastructure. Impacts from these events can range from lightning striking individuals to power outages, debris damage, to road closures. Additionally, based on future development trends, it is likely that thunderstorms will increase in risk as the population increases, along with housing and properties.

However, thunderstorms are a rare occurrence in the state of California, especially in the planning area, as most of the occurrences appear in the eastern and southern portion of the United States. When thunderstorms do occur, they cause minimal damage to the city and surrounding areas. Additionally, there is a lack of scientific evidence pointing to a drastic increase and severity of these events within Southern California, at least for the next couple of years. Therefore, the planning area can expect minimal impacts from these events in the future but should plan for the rare occasion that a severe thunderstorm can cause significant damage to the community.

P) TORNADO

i) Hazard Profile

Tornadoes are spawned when there is warm, moist air near the ground, cool air aloft, and winds that speed up and change direction. An obstruction, such as a house, in the path of the wind causes it to change direction. This change increases pressure on parts of the house, and the combination of increased pressures and fluctuating wind speeds creates stresses that frequently cause structural failures. Tornadoes typically occur during the “tornado season” from April through June.

(1) Duration

Tornadoes can last from several seconds to more than an hour as they are rolling through communities. However, most tornadoes usually last less than 10 minutes. Typically, tornadoes will gradually lose intensity as the condensation funnel decreases in size, the tornado becomes tilted with height before it completely dissipates.

(2) Seasonality

Tornadoes usually occur in the spring and summer months, however the tornadoes that have occurred in the planning area and in neighboring communities have occurred in the spring but also in the winter months (December and January).

(3) Speed of Onset

Tornadoes can form anywhere from an instant to several hours, although the typical time is around 5 to 10 minutes.

(4) Location

The entirety of the planning area is considered vulnerable to tornadoes. While these events are rare in the region, such events have been previously documented. An individual event is unlikely to impact the entirety of the planning area, but it is impossible to predict which areas of the community will be impacted by a given event.

ii) Magnitude

The size of the tornado does not necessarily equate to the severity of the tornado. Occasionally, small tornadoes can do major damage and some very large tornadoes, over a quarter-mile wide, have produced only light damage. The measure of the magnitude and intensity of a Tornado, the Enhanced Fujita Scale or EF Scale, which became operational in 2007, is used to categorize tornadoes based on estimated wind speeds and related damage, shown in table below. The EF scale is based off wind estimates (not measurements) from the relevant damage. The scale uses three-second gusts estimated at the point of damage. Additionally, the National Weather Service is the only federal agency with authority to provide an “official” tornado EF Scale rating.[125]

TABLE 82. THE ENHANCED FUJITA SCALE

EF SCALE	
EF RATING	**3 SECOND GUST (MPH)**
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

Source: NOAA

The EF scale is based off wind estimates (not measurements) from the relevant damage. The scale uses three-second gusts estimated at the point of damage based on the damage indicators described in the table below. Additionally, the National Weather Service is the only federal agency with authority to provide an “official” tornado EF Scale rating.

TABLE 83. DAMAGES INDICATORS FOR THE ENHANCED FUJITA SCALE

NUMBER	DAMAGE INDICATOR
1	Small barns, farm outbuildings
2	One- or two-family residences
3	Single-wide mobile home (MHSW)
4	Double-wide mobile home
5	Apt, condo, townhouse (3 stories or less)
6	Motel
7	Masonry apt. or motel
8	Small retail bldg. (fast food)
9	Small professional (doctor office, branch bank)
10	Strip mall
11	Large shopping mall
12	Large, isolated ("big box") retail bldg.
13	Automobile showroom
14	Automotive service building
15	School - 1-story elementary (interior or exterior halls)

[125] Thunderstorm Hazards - Tornadoes | National Oceanic and Atmospheric Administration (noaa.gov) https://www.noaa.gov/jetstream/thunderstorms/thunderstorm-hazards-tornadoes

NUMBER	DAMAGE INDICATOR
16	School - jr. or sr. high school
17	Low-rise (1-4 story) bldg.
18	Mid-rise (5-20 story) bldg.
19	High-rise (over 20 stories)
20	Institutional bldg. (hospital, govt. or university)
21	Metal building system
22	Service station canopy
23	Warehouse (tilt-up walls or heavy timber)
24	Transmission line tower
25	Free-standing tower
26	Free standing pole (light, flag, luminary)
27	Tree - hardwood
28	Tree - softwood

Source: National Weather Service (NWS)

In order to communicate tornado risk to the public, the National Weather Service issues a tornado watch or a tornado warning, described in the table below.

TABLE 84. TORNADO WATCHES AND WARNING DESCRIPTIONS

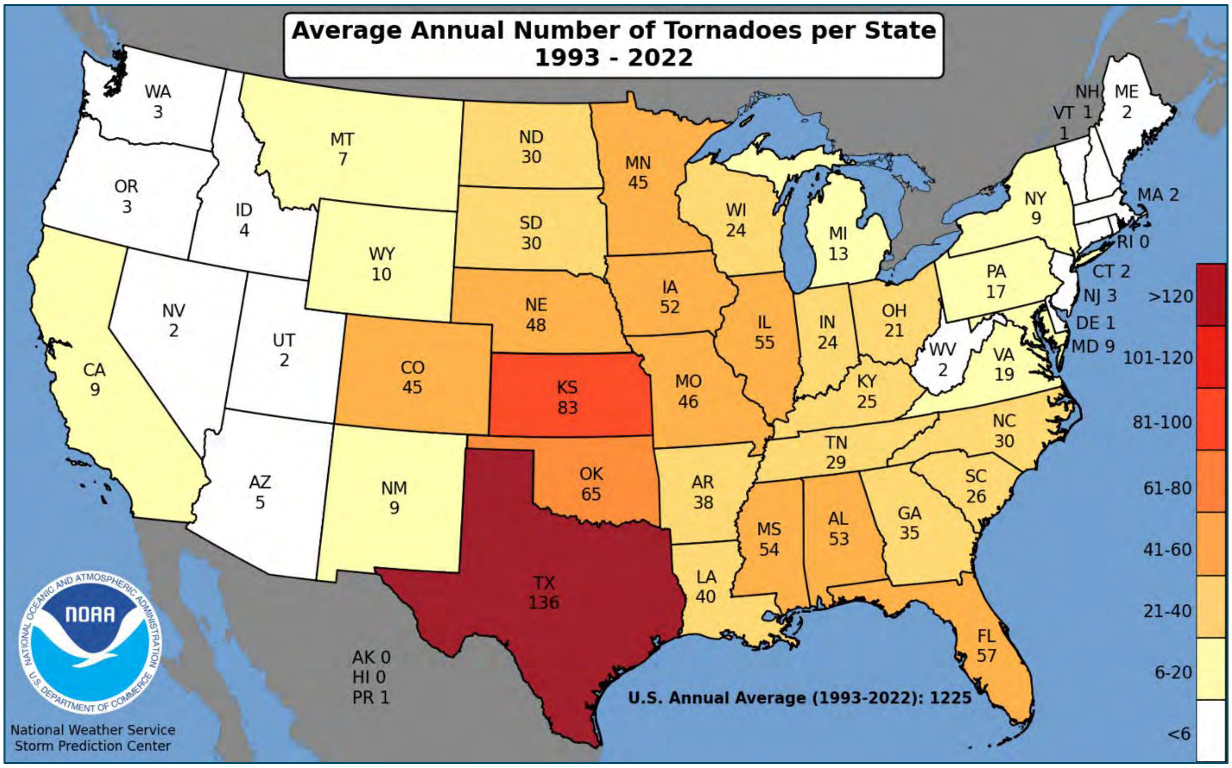
ISSUED PRODUCT[126]	DESCRIPTIONS
Tornado Watch	Tornadoes are possible in and near the watch area. Review and discuss your emergency plans and check supplies and your safe room. Be ready to act quickly if a warning is issued or you suspect a tornado is approaching. Acting early helps to save lives! Watches are issued by the Storm Prediction Center for counties where tornadoes may occur. The watch area is typically large, covering numerous counties or even states.
Tornado Warning	A tornado has been sighted or indicated by weather radar. There is imminent danger to life and property. Move to an interior room on the lowest floor of a sturdy building. Avoid windows. If in a mobile home, a vehicle, or outdoors, move to the closest substantial shelter and protect yourself from flying debris. Warnings are issued by your local forecast office. Warnings typically encompass a much smaller area (around the size of a city or small county) that may be impacted by a tornado identified by a forecaster on radar or by a trained spotter/law enforcement who is watching the storm.

Source: National Weather Service (NWS)

[126] Understand Tornado Alerts (weather.gov) https://www.weather.gov/safety/tornado-ww

iii) Extent

FIGURE 83 - AVERAGE ANNUAL NUMBER OF TORNADOES PER STATE (1993-2022)



Source: NOAA

Small - Tornadoes are associated with a specific region in the known as "Tornado Alley" which encompasses much of central and eastern parts of the United States. The map below depicts the average number of tornadoes that have occurred from 1993 to 2022 for each state.

iv) Past Occurrences

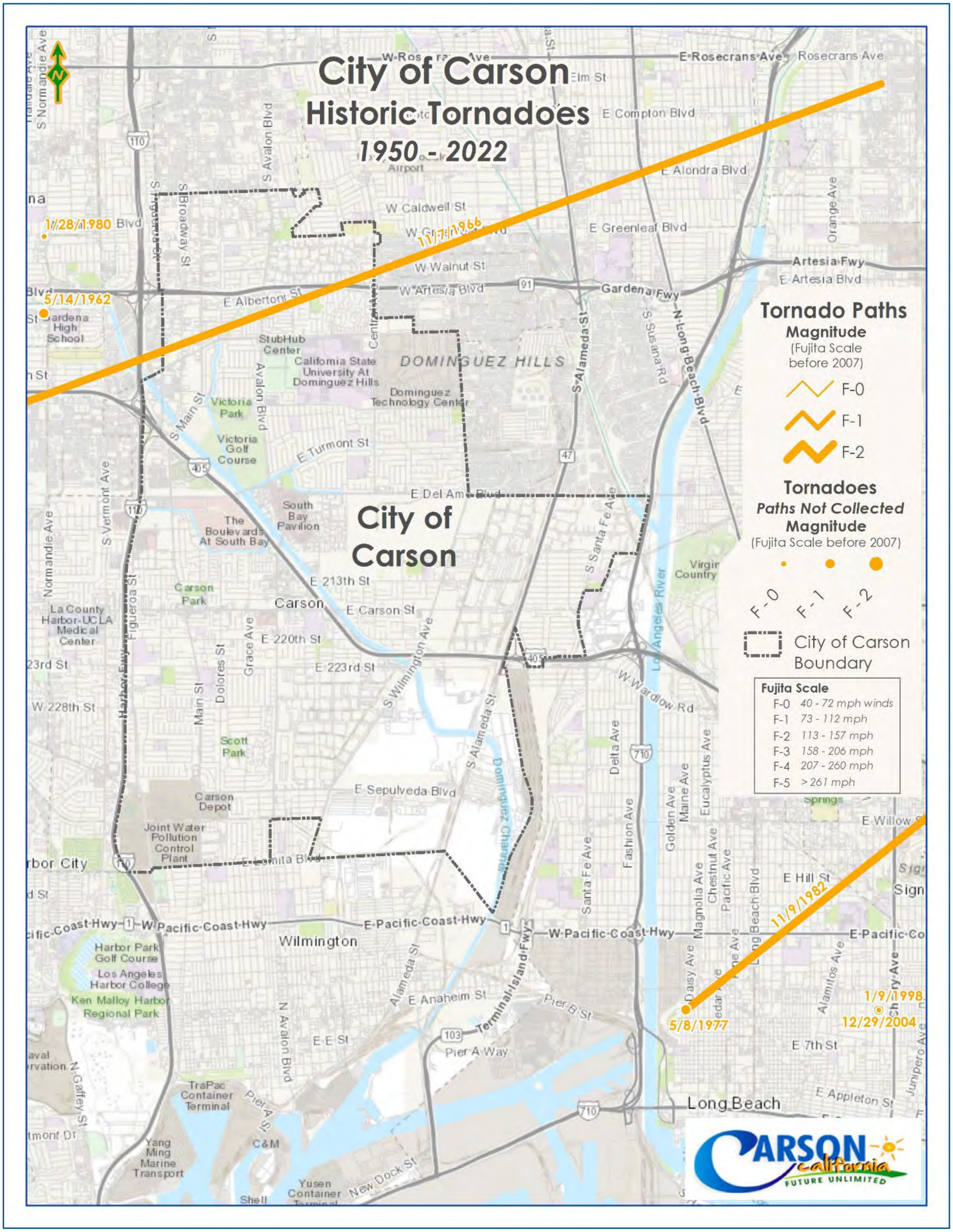
According to the NOAA Storm Events Database, there has been one confirmed tornado that occurred in the City of Carson and two other tornado events that occurred nearby in Long Beach, about 10 miles south of the city, since 1950. Details of the previous occurrences are shown in the table below that were available through the Storm Events Database. Additionally, the map below for tornado events that occurred within and near the City of Carson.

TABLE 85. PREVIOUS TORNADO OCCURRENCES NEAR THE CITY OF CARSON

DATE	EF SCALE	DESCRIPTION
5/4/2023	EF0	A weak tornado developed in the communities of Carson and Compton. The short-lived, EF-0, tornado impacted the area near

DATE	EF SCALE	DESCRIPTION
		the intersection of Avalon Boulevard and East Walnut Street. Minor damage was reported to a couple of buildings and vehicles.
12/28/2004	EF0	There is no data confirming that this tornado impacted the City of Carson, however it did occur nearby in Long Beach. On the coastal plain of Los Angeles County, weak tornados were reported in Long Beach, Inglewood and Whittier. The tornados only produced minor damage including downed trees and damaged roofs.
1/9/1998	EF1	There is no data confirming that this tornado impacted the City of Carson, however it did occur nearby in Long Beach. A small tornado swept through the eastern sections of Long Beach. The tornado developed over Los Altos Park and travelled northeast to Studebaker Road. The most significant damage occurred to Lucky's Supermarket where a 60-foot by 60-foot section of their roof collapsed. Also, Cubberley Elementary School lost a section of its roof. Other minor damage occurred from fallen trees and power lines. One minor injury was reported.

FIGURE 84 - CITY OF CARSON HISTORIC TORNADOES (1950-2022)



*So*urce: NOAA, NCEI, Storm Events Database through 2023

May 4, 2023

The tornado that occurred on May 4, 2023, is the most recent tornado to impact the City of Carson. The tornado touched down on Thursday at 8:45 a.m. in Carson only lasting for a tenth of a mile for about a minute. Estimated peak winds reached 75 miles per hour causing minor damage to vehicles, trees, and buildings, with some small sections of roofing torn off. Another tornado touched down north of Carson in Compton and produced similar damage. Both tornadoes were rated EF0 on The Enhanced Fujita Scale. The storm that produced the tornadoes was a result of a cold spring storm that swept through Southern California bringing gusty winds, thunderstorms, and downpours. [127]

Frequency

According to the National Weather Service (NWS), there are an average of one or two tornadoes per year in the four-county area including Los Angeles, Ventura, Santa Barbara, and San Luis Obispo counties, and an average of seven to 10 per year across the state. [128] Comparatively, the United States averages over 1,200 tornadoes every year, with the most occurring in Texas and Kansas. Based on the data across the Southern California region and the previous occurrences within and near the planning area, tornadoes are unlikely to occur and when they do occur are low in magnitude.

v) Future Probability

Unlikely - As the climate continues to warm, the number of days that are conducive to severe weather is projected to increase, which includes the threat of supercells producing severe rotating thunderstorms. The seasonality of tornadoes is changing and expanding into historically less-active winter months. More tornado outbreaks shifting away from Tornado Alley into the Southeast and Mid-South regions. A new study found that future warming is projected to:

- Nearly 15 percent more supercells are expected in February, 36 percent more in March, and nearly 66 percent more in April by 2100 under a business-as-usual climate warming scenario.
- Under an intermediate warming scenario, the research projects 7 percent more supercells in February, 18 percent more in March, and nearly 37 percent more in April by the end of the century. [129]

[127] Tornadoes hit Carson and Compton, California, causing minor damage | CNN https://www.cnn.com/2023/05/05/us/tornado-carson-compton-california/index.html
[128] Tornadoes in Southern California? Not as rare as many might think - Los Angeles Times (latimes.com) https://www.latimes.com/california/story/2023-03-23/southern-california-tornado-history-not-rare
[129] Severe Storm, Supercell, and Tornado Trends | Climate Central https://www.climatecentral.org/climate-matters/severe-storm-supercell-and-tornado-trends-2023

vi) Secondary Hazards

Secondary hazards resulting from a tornado event include high winds, power outages, poor air quality, and debris related hazards such as hazardous materials and electrical hazards described in the table below.

TABLE 86. SECONDARY HAZARDS OF TORNADOES

HAZARD	DESCRIPTION
High Winds	The majority of the damage from tornadoes is caused by the strong winds and the flying debris they create. Wind speed from tornadoes can reach as high as 300 mph in the most violent tornadoes. Windspeeds that high can airborne cars destroy homes to the foundation and turn broken glass and other debris into lethal missiles.
Power Outages	Strong winds from the tornado can knock out power lines resulting in power outages. Power outages, especially prolonged ones, can pose a risk to populations including individuals that medically depend on electricity.
Poor Air Quality	Powerful tornadoes can also destroy pipelines and other chemical containers that may release toxic pollutants like oil, asbestos, and other hazardous waste which can contaminate the air and impact public health.
Debris Related Hazards	Extreme winds can create a physical hazard after the tornado has passed with all of the debris and damage including electrical hazards, carbon monoxide exposures, and hazardous materials.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

Tornadoes occur relatively infrequently in communities within the County of Los Angeles, including the City of Carson. However, the limited documentation of previous occurrences in the region does mean that the potential impacts of a future tornado in the City of Carson should be overlooked. A weak tornado (EF-0 or EF-1) can cause considerable damage, and a strong tornado (EF-4 or EF-5) could be catastrophic. Potential impacts of a future tornado within the City of Carson include the following:

Displacement of Residents

Tornadoes which affect urban areas frequently damage residential structures, although the severity of the damage can vary based on a wide range of factors. The strength of the tornado, the age of the structures, and the construction and design standards are just a few of the factors which will affect the severity of damage experienced by residential structures. Historical documentation of tornadoes in the City of Carson is extremely limited – this may be an indication that any future tornado occurrences are likely to be relatively weak events (EF-0 or EF-1), but the possibility of a stronger tornado cannot be ruled out. As for building age, a City of Carson Housing Needs Assessment determined that most development that existed in 2021 had already been built by 1981. In addition to the improvements in construction materials that have occurred since 1981, most building codes (including the widely used International Building Code) have been updated multiple times.

It is reasonable to assume that a tornado occurrence in the City of Carson would cause significant damage to residential structures and render many of these buildings uninhabitable. The impact of such an event would be the loss of stable housing for affected residents; this could result in increased homelessness, crowding at local shelters, and a possible exodus of residents. Support for underserved and socially vulnerable individuals should be thoroughly planned, as these populations often have unique needs which may require specialized care.

Disruption of Classes/Educational Activities

There are more than 20 educational facilities in the City of Carson, including a public high school, middle schools, and elementary schools, in addition to several private education institutions. The 2024 International Building Code (IBC) does not consider the City of Carson to be within a tornado-prone region, and this means that schools are not required to be designed and constructed with consideration for tornado loads determined in accordance with the American Society of Civil Engineers. Therefore, all educational facilities in the City of Carson should be considered vulnerable to tornadoes of all strengths (EF-0 through EF-5). The impact of a school being damaged by a tornado is likely to be the disruption of normal operations; this may require students to attend classes at another school, transition to remote (online) learning, or temporarily cease participation in educational activities.

Disruption of Utility Services

One of the common consequences of a tornado in an urban area is damage to utility infrastructure. This typically affects above-ground assets such as electricity and communications infrastructure. Regarding electricity infrastructure, the City of Carson has many miles of overhead distribution lines (less than 33 kilovolts), sub-transmission lines (66 kilovolts), and transmission lines (110 kilovolts or more). Overhead electrical lines can be damaged by the high-speed winds generated by tornadoes as well as by debris that is picked up by these winds. The highest voltage electrical lines in the City of Carson are the Los Angeles Department of Water and Power transmission lines carrying 115 kilovolts along E. Del Amo Blvd, Interstate 405, and a north-south easement beginning approximately where Carson Blvd meets Interstate 405 and terminating at E Lomita Ave.

Reduction of Economic Activity

Tornadoes can damage commercial buildings and interrupt business operations. According to the 2024 International Building Code (IBC), the City of Carson is not considered to be within a tornado-prone region. Therefore, buildings and structures classified as Risk Category III or IV are not required to be designed and constructed with consideration for tornado loads determined in accordance with the American Society of Civil Engineers. Businesses in the City of Carson impacted by tornadoes may no longer be able to safely operate, and it can take years for normal operations to resume. As an example, an Amazon Warehouse in Illinois which was partially destroyed by an EF-3 tornado in 2021 did not resume operations until 2024. This event is relevant to the City of Carson because the community contains multiple warehouses and distribution facilities. Specific examples of these types of businesses include Damco Distribution Services Inc., NFI Cal Cartage, and C.H. Robinson. Business disruptions at distribution facilities have the potential to cause further disruptions to the entities they support, including those both within and outside of the City of Carson.

Outbreak of Urban Fires and Exposure to Hazardous Materials

Tornadoes are capable of generating forces which may exceed the anticipated operating conditions for various components of industrial infrastructure. If a tornado strikes these assets, it is possible that stored hazardous and flammable materials will be released. This can have several consequences including ignition of fires and exposure of the surrounding community to hazardous materials. This is a particularly acute vulnerability for the City of Carson, which has a significant volume of industrial facilities including manufacturing, primary processing, warehousing, distribution, and fossil fuels refinement and storage sites. Specific examples of these sites include:

- Los Angeles Refinery
- Kinder Morgan Carson Terminal
- Shell Carson Distribution Complex
- Ventura Transfer Company
- Tri-Modal Transportation Services
- Old Dominion Freight Line
- Yusen Logistics
- Clean Energy – Carson Compressed Natural Gas Station
- Union Pacific Dolores Locomotive Facility
- SOS Metals
- Pepsi Bottling Group
- INEOS Olefins & Polymers USA
- Linde Dry Ice Distribution Center
- Howmet Aerospace
- GEON Performance Solutions

The entities listed above are just a small selection of the industries in the City of Carson, and the list is not intended to be an exhaustive inventory of sites containing hazardous and flammable materials that could cause secondary hazards in the event of a tornado impact.

(1) People

Based on the single tornado event that occurred in the city, no injuries or fatalities were reported. However, one tornado that struck the City of Montebello, east of Los Angeles claimed five lives in the spring 2023. [130] The possibility of tornadoes posing a threat to populations in the future is possible. Tornadoes typically cause 60 to 80 fatalities per year and injure more than 1,500 people. Most fatalities are attributed to flying or falling debris and occur in the most violent tornadoes. Violent tornadoes, EF-4 and EF-5 comprise of about two percent of all tornadoes, but account for about 70 percent of tornado deaths. [131] Due to the infrequency of tornadoes in the area, it is possible residents may not be prepared to respond to the same extent that they are for more common hazards. A delayed response—particularly to hazards like tornadoes which tend to strike with relatively short notice—can increase overall vulnerability.

(2) Structures and Systems

The City of Carson is at risk of experiencing damage to properties based on one recorded tornado that occurred in 2023. The tornado occurred on May 4, 2023, and caused damage to structures, cars, and businesses by knocking off sections of the roof of one warehouse. There are over eight million mobile homes in the United States and according to a 2018 study, mobile home residents are at increased risk to tornado impacts, injury, and mortality partly because these structures are inadequate to withstand tornadic winds. The likelihood of a tornado-related fatality in a mobile home is 15 to 20 times greater than in permanent homes. In the City of Carson, there are a number of mobile homes in the jurisdiction and would be an increased risk for tornado impacts. [132] Another challenge is that the City of Carson is not considered to be within a tornado-prone region according to the International Building Code (IBC), and this means that there is no IBC requirement for structures to be designed and constructed with consideration for forces produced by tornadoes.

Critical Facilities

There has been only one recorded tornado that has touched down in the City of Carson causing minor damage. According to accounts of the event, no critical facilities were significantly impacted. Tornados have the potential to cause major disruptions to critical facilities and services, all critical facilities are at risk as the direction and path of a tornado is not particularly more likely to occur in one area of the city to another. Tornado can cause power outages, disrupt communications, damage schools, and government facilities. Debris from the tornado

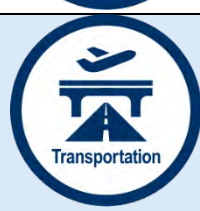
[130] California Atmospheric Rivers | Weather & Climate Satellite Imagery (colostate.edu) https://satlib.cira.colostate.edu/event/westcoastatmosphericriver/

[131] The Effects of Tornadoes on Humans & Nature | Sciencing https://sciencing.com/the-effects-of-tornadoes-on-humans-nature-12552590.html

[132] Severe Storm, Supercell, and Tornado Trends | Climate Central https://www.climatecentral.org/climate-matters/severe-storm-supercell-and-tornado-trends-2023

can block and damage major highways and roads, which can make it difficult for emergency services to reach people in need of medical assistance.

TABLE 87 - POTENTIAL VULNERABILITIES TO LIFELINES FROM A TORANDO

LIFELINES	IMPACT TYPE	DESCRIPTIONS
Safety & Security		Immediate threats to life and property necessitate rapid emergency response, including search and rescue operations, medical assistance, and maintaining public order to prevent looting or other crimes in affected areas.
Health & Medical		Tornadoes can cause injuries ranging from minor to severe, placing a sudden demand on healthcare facilities. Hospitals and clinics must be prepared for an influx of patients and possible damages to their own infrastructure.
Housing & Building Infrastructure		Tornadoes can cause significant damage to homes, businesses, and public buildings, leading to displacement of residents and the need for temporary shelters and long-term rebuilding efforts.
Utilities		Tornadoes can disrupt essential services by damaging power lines, water mains, and communication networks. Restoring these services is crucial for recovery and supporting other lifeline sectors.
Transportation		Damage to roads, bridges, and transportation infrastructure can hinder emergency response efforts and the movement of goods and people. Clearing debris and repairing infrastructure are critical post-tornado activities.

(3) Natural, Cultural, and Historical Resources

There are 49 identified historical and cultural properties within the City of Carson. Tornados can damage cultural and historic properties which can cause structural damage, debris damage, power outages, tree damage from high winds, and accessibility issues which can pose a risk for public safety and cause financial impacts.

(4) Risk Analysis

Low - Tornadoes pose a low risk of impacting the City of Carson. Tornadoes occurring in the State of California are rare, with only about 10 tornadoes touching down per year. Based on data from the NOAA Storm Events Database, there has only been one recorded tornado to have hit the City of Carson and two have hit neighboring communities in the past several decades. When the rare sighting of a tornado occurred, they produced minor damage and have not exceeded past an EF 0 or EF 1. As climate change drives changes in weather patterns, it is possible to see an increase of tornado events in the State of California and in Southern California as the frequency of storm systems increase. Additionally, based on future development trends, it is likely that tornados will increase in risk as the population increases, along with housing and property. While the risk of tornados occurring within the planning area is low and previous occurrences have caused minimal damage, destructive tornados can occur within the city.

Q) TSUNAMI / SEICHE

i) Hazard Profile

A tsunami is a wave triggered by any form of land displacement along the edge or bottom of an ocean or lake. Submarine landslides or submarine seismic events can move the overlying water to the surface and cause a tsunami. Tsunamis can be highly destructive, causing extensive damage to property, the environment, and people. Some waves can travel as fast as 600 mph and can grow over 50 feet in height once they approach a shallow shoreline. Tsunami impacts include coastal flooding, strong damaging currents, extreme water level fluctuations, eddies, erosion, and sedimentation. Once coastal areas become flooded, any subsequent, tsunami-induced hazards can include free-floating debris and environmental contamination from spills.[133]

A seiche is a large wave in a body of water that has been disturbed by wind, atmospheric pressure variations, or seismic activity. The waves travel the length of the water basin and reflect off the other end or sides. These waves then can interfere with each other and create amplified standing waves.

(1) Duration

A tsunami can last for several hours or days, depending on the location or wave train. The time between tsunami waves can range from five minutes to two hours.

(2) Seasonality

Tsunamis and seiches do not have a seasonality and can occur at any point in time as most tsunamis are caused by earthquakes which also do not have a season or time of year in which they are more likely to occur.

(3) Speed of Onset

A tsunami can happen almost immediately after being triggered (i.e., earthquake). However, can travel over 500 miles per hour and cross an entire ocean in less than a day.

(4) Location

While the surge of water brought on by a tsunami is unlikely to reach the northern portions of the planning area, the entirety of the City of Carson is considered vulnerable to this hazard due to the impact that would be felt by displaced individuals and the rapid loss of many critical

[133] caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf

facilities and services. Additionally, this hazard will likely impact many neighboring communities, and it can be anticipated that the strain placed on the Los Angeles Metropolitan Area would affect virtually all residents of the City of Carson.

ii) Magnitude

Generally, the height of the tsunami is used as a measurement for the magnitude. In the deep ocean it is difficult to detect tsunamis to the human eye as the waves are very small. However, there are instruments to detect tsunamis which includes, DART system, tidal gauges, and satellites.

To communicate the danger tsunamis can pose to communities, the Tsunami Warning Centers issued tsunami alerts following a tsunami event, described in the table below.

TABLE 88. TSUNAMI ALERTS

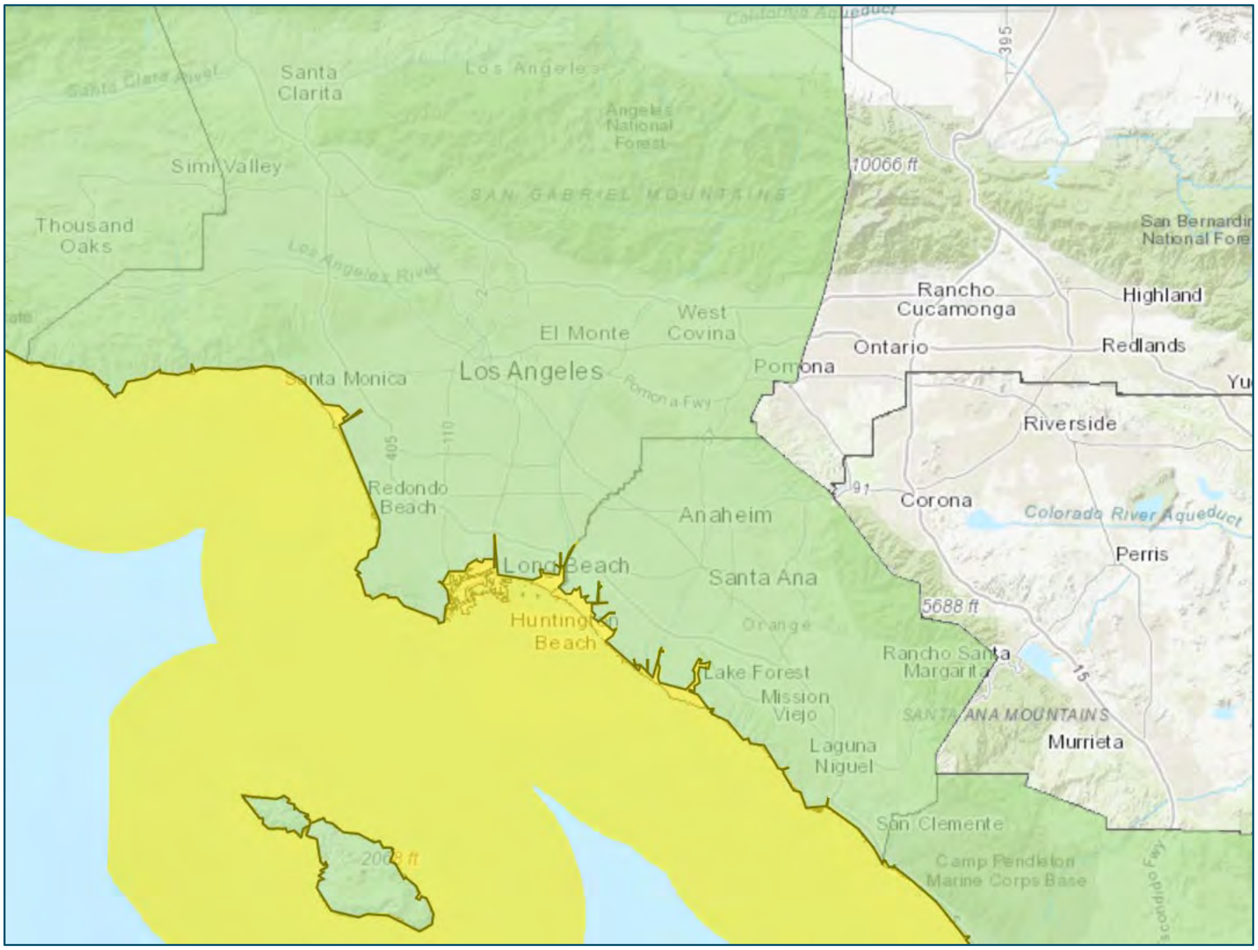
TSUNAMI ALERT	DESCRIPTION
Tsunami Warning (Dark Red)	A tsunami that may cause widespread flooding is expected or occurring. Dangerous coastal flooding and powerful currents are possible and may continue for several hours or days after initial arrival.
Tsunami Advisory (Orange)	A tsunami with potential for strong currents or waves dangerous to those in or very near the water is expected or occurring. There may be flooding of beach and harbor areas.
Tsunami Watch (Yellow)	A distant earthquake has occurred. A tsunami is possible
Tsunami Information Statement (Green)	An earthquake has occurred, but there is no threat, or it was very far away, and the threat has not been determined. In most cases, there is no threat of a destructive tsunami.

Source: NOAA

iii) Extent

Small - Tsunami's can originate locally, near the impact shoreline or distant source tsunamis that travel far distances. The Cascadia Subduction Zone is the most significant local tsunami source for the California coast north of Cape Mendocino. This subduction zone stretches from the coast of British Columbia to offshore of California north of Cape Mendocino. It could generate large tsunami surges onshore within minutes after an earthquake. The most significant tsunami source region for the entire State from a distant-source event is the subduction zone off the coast of the eastern Aleutian Islands. The largest historical local-source tsunami on the west coast was caused by the 1927 Point Arguello, California, earthquake that produced waves of about 7 feet in the nearby coastal area.

FIGURE 85 - REGIONAL TSUNAMI HAZARD AREA MAP AS OF 2024



Source: California Department of Conservation

As mentioned in previous sections, there is a general tsunami risk for Los Angeles County near the coastline, affecting neighboring communities like Long Beach, shown on the Map above. The City of Carson is in a seismically active area due to the many faults along the Pacific Coast. Tsunami's can pose a significant threat to Southern California especially low-lying areas near the coast such as Santa Monica, Malibu, Venice, Marina Del Rey, Redondo Beach, Long Beach, Seal Beach and Newport Beach. While these communities are close in proximity to the City of Carson, based on the latest tsunami hazard maps developed by the California Geological Survey, the city is not located within the tsunami inundation zone and therefore it is unlikely to be directly impacted by a tsunami. However, it is possible that the City of Carson could experience secondary impacts in the future from a tsunami affecting neighboring communities. However, the City of Carson is not directly within the tsunami inundation zone and therefore is unlikely to be directly affected by tsunami impacts as depicted in the map below. The tsunami inundation zone stops short of the jurisdiction from the south within the Dominguez Channel and the Los Angeles River.

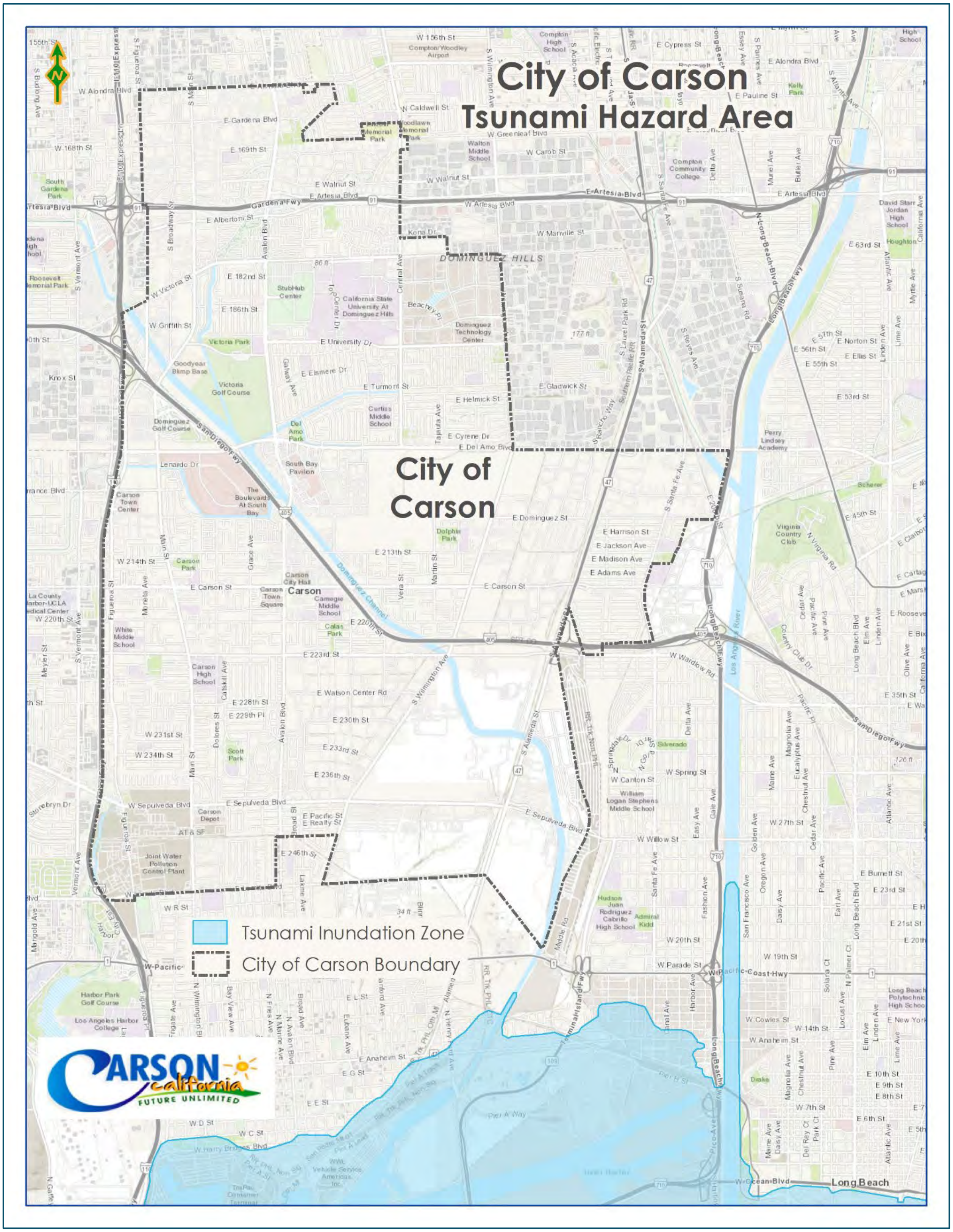


FIGURE 86 - CITY OF CARSON TSUNAMI HAZARD AREA AS OF 2024

iv) Past Occurrences

There have been no previous occurrences of tsunamis or seiches that have impacted the planning area. However, there have been 11 major tsunami events that have occurred in Los Angeles County, described in the table below.

TABLE 89. TSUNAMI PAST OCCURRENCES

HAZARD	DATE	INJURIES, DAMAGES, AND DEATHS	DESCRIPTION
Tsunami	March 11, 2011	N/A	M 9.0 earthquake in Japan caused tsunamis with run-up amplitudes ranging from 2 to 3 feet in Catalina Island, Los Angeles, Long Beach, Redondo Beach, and Santa Monica, damaging docks and boats.
Tsunami	February 27, 2010	Minor damage to docks and boats.	M 8.8 earthquake in Chile caused tsunamis with run-up amplitudes ranging from 1 to 3 feet in Catalina Island, Los Angeles, Long Beach, and Santa Monica.
Tsunami	September 29, 2009	N/A	M 8.0 earthquake in Samoa caused a tsunami with a 1-foot run-up amplitude in Los Angeles.
Tsunami	November 29, 1975	Damage to docks and boats.	a M 7.1 earthquake in Hawaii caused a tsunami with a run-up amplitude of 4 feet in Catalina Island.
Tsunami	March 28, 1964	One longshoreman was killed, 100 boats were unmoored, and 7 boats sunk. The event caused $350 thousand dollars in damages.	M 9.2 earthquake in Alaska caused tsunamis with run-up amplitudes ranging from 2 to 3 feet in Catalina Island, Los Angeles, Long Beach, and Santa Monica.
Tsunami	May 22, 1960	One person died, 800 small craft were unmoored, 200 boats were damaged, and 40 boats were sunk. The event caused $1 million dollars in damages.	M 9.5 earthquake in Chile caused tsunamis with run-up amplitudes ranging from 2 to 5 feet in Catalina Island, Los Angeles, Long Beach, and Santa Monica.
Tsunami	March 9, 1957	N/A	M 8.6 earthquake in the Aleutian Islands caused tsunamis with run-up

HAZARD	DATE	INJURIES, DAMAGES, AND DEATHS	DESCRIPTION
			amplitudes ranging from 1 to 2 feet in Santa Monica, Los Angeles, and Long Beach.
Tsunami	November 4, 1952	N/A	M 9.0 earthquake in Kamchatka caused tsunamis with run-up amplitudes ranging from 1 to 2 feet in Santa Monica, Los Angeles, and Long Beach.
Tsunami	April 1, 1946	Event caused ships to break from their moorings.	M 8.8 earthquake in the Aleutian Islands caused tsunamis with run-up amplitudes ranging from 1 to 6 feet in Catalina Island, Los Angeles, and Long Beach.
Tsunami	August 30, 1930	N/A	Probable meteotsunami (i.e., a tsunami of meteorological origin) with a 10-foot run-up amplitude hit Santa Monica.
Tsunami	April 13, 1923	N/A	M 7.2 earthquake in Kamchatka caused a tsunami in Los Angeles.

Source: LA County All-Hazard Mitigation Plan

Frequency

There have been no previous tsunami events that impacted the City of Carson and therefore the frequency of occurrence is zero.

v) Future Probability

Unlikely - Tsunamis are rare in California, but the entire coastline of the state is exposed to potential tsunami occurrences. As climate change continues to increase sea level rise globally, the risk of tsunami impacts may increase for the planning area especially if collectively greenhouse gas emissions are not reduced in the next couple of decades. [134]

vi) Secondary Hazards

The City of Carson is not within the tsunami inundation zone. However, the surrounding coastal communities such as the City of Long beach may experience secondary or cascading impacts from tsunamis which can include flooding, erosion, and debris movement, described more in the table below.

[134] Waves tackling the future of tsunami monitoring and modeling | PreventionWeb https://www.preventionweb.net/news/new-research-makes-waves-tackling-future-tsunami-monitoring-and-modeling

TABLE 90- SECONDARY HAZARDS FROM TSUNAMI / SEICHE

HAZARD	DESCRIPTION
Flooding	Tsunami's can produce unusually strong currents, rapid flood and cause destruction which can contaminate drinking water.
Erosion	Tsunamis can cause erosion by severely altering the coastal landscape through rapid erosion and deposition of sediment.
Debris Movement	The flow and force of water and the debris can destroy boats, vehicles, buildings and other structures, cause injuries; and take lives as the tsunami moves across the land.
Land Subsidence	Land subsidence can occur in various ways during an earthquake. Large areas of land can subside drastically during an earthquake because of offset along fault lines. Land subsidence can also occur as a result of settling and compacting of unconsolidated sediment from the shaking of an earthquake.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

As shown in Figure 86, a hypothetical tsunami wave is not anticipated to directly impact the City of Carson. This is also supported by the California Department of Conservation modeling of potential tsunami impacts, which shows that the City of Carson is considered outside of the hazard area and will not need to be evacuated. However, this does not mean that life in the City of Carson would be unaffected if a tsunami impacts the coast along Los Angeles County – there are multiple indirect impacts that such an event would have on the City of Carson. Potential indirect impacts include the following:

Damage to the Dominguez Channel

The Dominguez Channel flows into the Los Angels Harbor, and a tsunami could conceivably push debris up the channel. Due to the plethora of variables, it is extremely difficult to accurately predict how far north debris could travel in the Dominguez Channel because of a tsunami. Debris can include a litany of items that are present at the Los Angeles Harbor such as marine fuel and other hazardous liquids, electronic components and lithium batteries, perishables, construction materials, and a wide range of consumer goods. In addition to creating unsafe conditions for populations living along the Dominguez Channel, debris could essentially clog the channel and block the natural flow of water from north to south. This may result in water flowing from the north overtopping the channel banks, which may result in widespread flooding and further spread hazardous debris across the area.

Strain on Utilities

Simulated tsunami waves show that communities near the City of Carson, including portions of the City of Los Angeles, the City of Long Beach, and Ranchos Palos Verdes, will likely be inundated by water. It is reasonable to conclude that the inundation of parts of these communities will result in damage to facilities which support the normal operation of utility services. Damage to power generation stations, pumping stations, natural gas pipelines, electric transmission lines, and other similar infrastructure will place strain on the rest of the system, and it is possible that the demand may exceed what can be supplied. It is also possible that it may be necessary to temporarily suspend these services to address hazardous conditions like leaking pipelines and downed live power lines.

Strain on Transportation

In the event an incoming tsunami is detected, evacuation orders should be issued by the relevant authorities. While the City of Carson will likely not be ordered to evacuate, several of the surrounding communities will be. The sudden surge of individual trying to move away from the coast will likely result in major traffic congestion. Interstate 110 and California State Route 103 are two of the largest roadways facilitating travel away from the coast and will likely be heavily utilized. Movement along these routes will become increasingly difficult as traffic congestion spikes, and many individuals will likely begin looking for alternative routes, and this will create additional traffic along other major north-south routes passing through the City of Carson such as Wilmington Blvd, Avalon Blvd, and Figueroa St.

Strain on Emergency Services

The rapid evacuation of residents in tsunami hazard areas would be a major challenge for communities, and it is reasonable to expect that City of Carson emergency services may be asked to assist with this process. This would include clearing the dedicated emergency routes, directing traffic to control vehicle congestion, assisting with the evacuation of vulnerable populations including the elderly, individuals with disabilities, those with medical conditions requiring close monitoring, and children at schools and care facilities. Following a tsunami, the City of Carson may be asked to assist with search and rescue, prevention of looting and lawlessness, and restoration of critical infrastructure. Any emergency services which are allocated to assist outside of the City of Carson will have a reduced capability to respond to events within the community.

Strain on Medical Facilities and Services

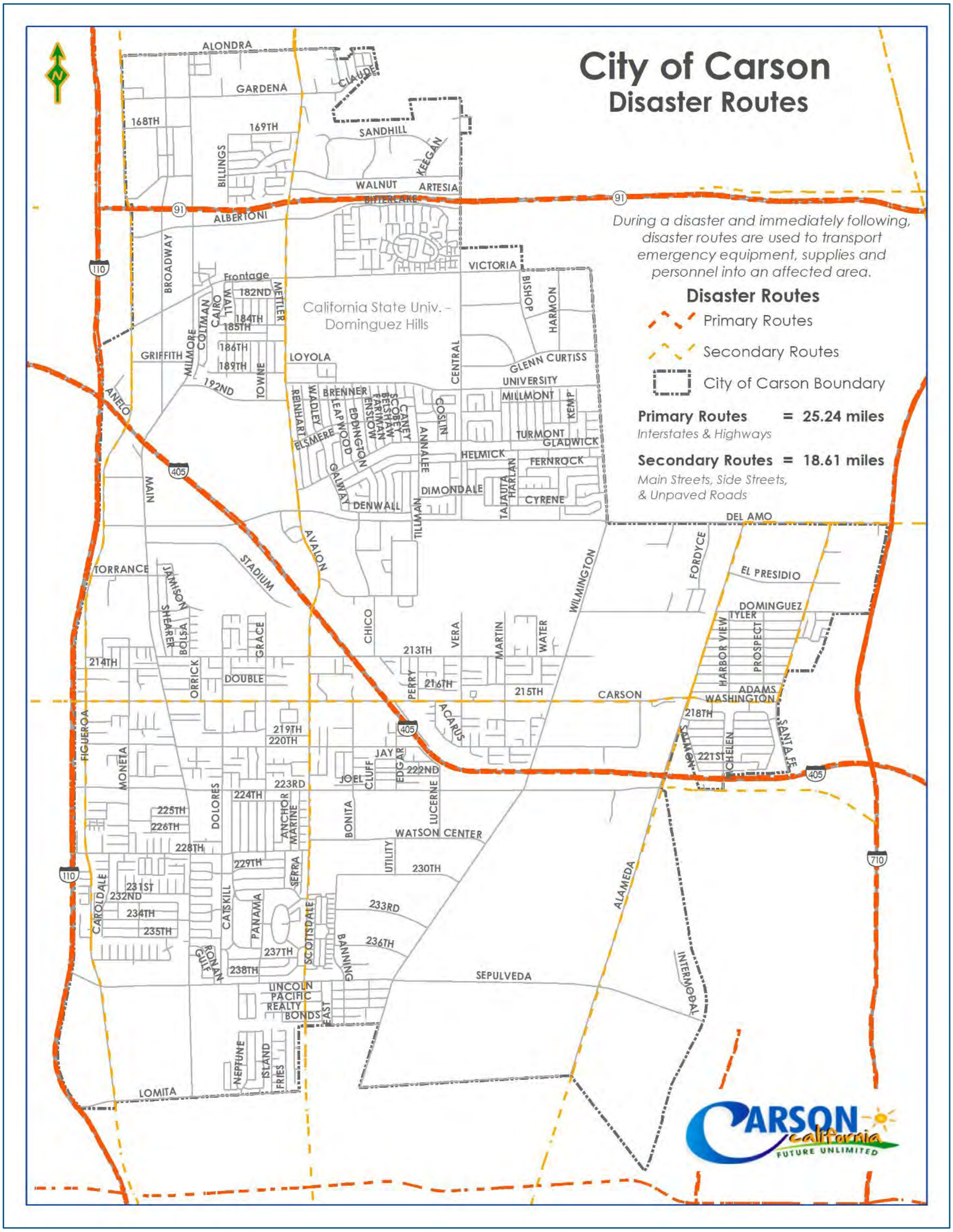
Following a tsunami, medical facilities in and around the City of Carson may experience a surge of patients due to both the number of injuries resulting from the tsunami and the loss of medical facilities that have been damaged. Within the County of Los Angeles there are 69 different medical facilities identified as 911 receiving centers. None of these facilities are within the City of Carson's formal city limits, but the Harbor-UCLA Medical Center is in the neighboring, unincorporated community of West Carson. In addition to official 911 receiving centers, other medical facilities may be asked to take in patients or share available medical supplies to support 911 receiving centers.

(1) People

Since there have been no previous occurrences of tsunamis or seiches in the planning area, there is no historical data on how these events have impacted the population. However, in Los Angeles County there have been two deaths from tsunami events since 1923. For future planning and considerations population impacts include primary public health concerns such as lack of clean drinking water, and lack of access to adequate food, shelter, and medical for injuries. Loss of shelter can leave individuals exposed and vulnerable to adverse weather events and other environmental hazards. Most fatalities that occur due to tsunamis are related to drowning and injuries mostly caused by debris. [135] Additionally, surrounding communities may need to evacuate inland due to tsunami warnings to seek safety. The map below shows major roadways that would be used for disasters to transport emergency equipment, supplies and personnel into an affected area. In addition to evacuations, shortly after the disaster, emergency services would use these routes for immediate response operations and may impact the planning area.

[135] Health Effects of Tsunamis | CDC https://www.cdc.gov/disasters/tsunamis/healtheff.html

FIGURE 87 - DISASTER ROUTES WITHIN THE CITY OF CARSON AS OF 2024



(2) Structures and Systems

The tsunami hazard area does not include any areas within the City of Carson and therefore no properties are at risk of impacts directly from a tsunami event. However, based on previous occurrences in Los Angeles County, tsunami damages ranged from $350,000 to $1,000,000 dollars and commonly damages ports, boats, and property near a harbor or dock. While properties in the planning area are not currently at risk, future sea level rise, driven by climate change, could change the risk landscape of tsunamis in the future.

Critical Facilities

The tsunami hazard zone does not include any areas within the City of Carson and therefore none of the critical facilities are at risk of tsunami impacts. Critical facilities and infrastructure that could be at risk of disruptions or damage including loss of utilities, power, sewer, and water. Local emergency services may be overwhelmed by 911 calls from individuals that are in of medical support. [136] As the City of Carson may not experience direct impacts of a tsunami, the city may experience significant impacts to traffic patterns as individuals from coastal areas evacuate up north towards Carson due to the close proximity of highways 405 and 110.

TABLE 91. POTENTIAL VULNERABILITY OF LINESLINES FROM A TSUNAMI LIFELINES

LIFELINES	IMPACT TYPE	DESCRIPTIONS
Water & Wastewater Systems		Tsunamis can damage water supply infrastructure, such as pipes and treatment plants, leading to contamination of drinking water. Wastewater systems can also be damaged, causing sewage spills and environmental contamination.
Food, Shelter, & Housing		Tsunamis can destroy homes and displace thousands of people, leading to a need for temporary shelter. Agricultural land near the coast can be inundated with saltwater, affecting food production and supply.
Health & Medical		The immediate aftermath of a tsunami can overwhelm health services with injuries. Infrastructure damage can limit access to medical facilities, and the risk of waterborne diseases can increase due to water contamination.

[136] Tsunami Dangers | National Oceanic and Atmospheric Administration (noaa.gov) https://www.noaa.gov/jetstream/tsunamis/tsunami-dangers

LIFELINES	IMPACT TYPE	DESCRIPTIONS
Communications	Communications	Tsunamis can knock out communication infrastructure, including cell towers and internet cables, making it difficult to coordinate rescue and relief efforts and for people to contact loved ones.
Energy	Energy (Power & Fuel)	Energy facilities, including power plants and electrical substations near the coast, can be damaged by tsunamis, leading to widespread power outages, and affecting other critical sectors that rely on electricity.
Safety & Security	Safety and Security	The immediate chaos and destruction caused by tsunamis can challenge public safety and security efforts, complicate evacuation, and rescue operations, and increase the risk of looting and other security issues in the aftermath.
Transportation	Transportation	Tsunamis can severely damage ports, roads, bridges, and railways, disrupting transportation networks both locally and regionally. This impacts emergency response, evacuation efforts, and the supply chain for goods and services.

(3) Natural, Cultural, and Historical Resources

Since the tsunami inundation zone is outside of city boundaries, it is unlikely that tsunamis and seiches will cause a significant impact to cultural and historic properties.

(4) Risk Analysis

Low - Tsunamis pose a low risk to the planning area as there have been no previous occurrences in the planning area. There have been previous occurrences near Long Beach which is only a couple of miles south of the City of Carson and may result in some disruptions to the city from evacuations. While future development will result in an increase in population, housing, and properties, it is unlikely to have a significant impact to tsunami risk as the tsunami hazards zone is outside of jurisdictional boundaries. Additionally, the tsunami inundation zone does not include any areas within the planning area and therefore the city has a low risk of experiencing inundation from a tsunami. However, is it possible that in the future, due to sea level rise driven by climate change, the tsunami inundation zone could extend north impeding jurisdictional boundaries.

R) URBAN FIRE

i) Hazard Profile

An urban fire involves a structure or property within an urban or developed area. Urban fires are classified as an uncontrolled burning in a residence or building from a natural, human, or technical causes. Urban fires can damage and destroy homes, schools, commercial buildings, and vehicles. Urban fires can increase the risk of severe explosions due to flammable and explosive hazardous materials.

Not all fires start or burn in the same way. There are a couple of different types of fires including electrical, spontaneous, combustion, chemical, oil and gas.

- **Oil and gas fires:** often involve flammable or combustible liquids such as natural gas and other combustible liquids. According to the NFPA, every year more than 50,000 fires start as the result of flammable gas while more than 160,000 fires start as the result of flammable or combustible fires.
- **Spontaneous combustion and chemical reactions:** these fires amount to more than 14,000 fires per year. The exact cause is difficult to determine, however spontaneous heating is frequently the catalyst and occurs when a material increases in temperature without pulling heat from its surroundings (i.e., hay, oil rags, agricultural products, and trash).
- **Electrical fires:** fires that start as the result of electrical failure or malfunction. More than 45,000 home structure fires ignite every year due to an electrical failure or malfunction (i.e., fans, washers, dryers, space heaters, and air-conditioning units) causing more than 1.4 million dollars in property damages and more than 400 deaths and 1,300 injuries. [137]

(1) Duration

Urban fires can burn for up to several hours or until the fuel source is depleted.

(2) Seasonality

Urban fires can occur at any time. However, home fires are more common to occur in the cooler months when people spend more time inside as well as in the hours when people are awake in

[137] Effects of Fire | Home Fire Statistics | The Hartford https://www.thehartford.com/about-us/junior-fire-marshal/the-power-of-fire

the home. In 2016-2020, 46 percent of home structure fires and 55 percent of home structure fires deaths occurred in the five-month span from November to March. [138]

(3) Speed of Onset

Urban fires can start in an instant. According to Ready.gov, a small flame can turn into a major fire in less than 30 seconds, and it only takes minutes for thick black smoke to fill a house or for it to be engulfed in flames.

(4) Location

Broadly, the entirety of the planning area is considered vulnerable to urban fire.

ii) Magnitude

Urban fires have the potential to cause extensive damage to residential, commercial, or public property. Damages range from minor smoke and/or water damage to the destruction of buildings. People are often displaced for several months to years, depending on the magnitude of the event. Urban fires and explosions can also cause injuries and death.

iii) Extent

Small - Urban fires pose a more significant threat in areas where a relatively high number of buildings are more than 50 years old, as older structures that were built with lower standards for building construction and materials have created a threat of fire loss that is occurring on a regular basis. This can create challenges for communities with historic districts or structures, as the desire to retain historical value can result in low utilization of fire-resiliency measures which have since emerged. According to the California Historical Resources, the City of Carson, has two historical landmarks which include Site of the Initial United States Air meet and the Suangna Indian Village.

iv) Past Occurrences

There have been 99 urban fire events from 1992-2020 within the City of Carson, caused by recreation and ceremony, misuse of fire by a minor, debris and open burning, arson and incendiarism, equipment and vehicle use, smoking, and undetermined. The map below displays the number of urban fire incidents and their location. Of the 99 events, there have been five reported urban fire events in the last several decades within the City of Carson that have

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[138] Home Structure Fires | NFPA Research https://www.nfpa.org/education-and-research/research/nfpa-research/fire-statistical-reports/home-structure-fires?l=45

descriptions or news articles to describe the impact. The table below provides more details on each of the events and their impacts.

FIGURE 88 - CITY OF CARSON HISTORIC URBAN FIRES (1992-2020)

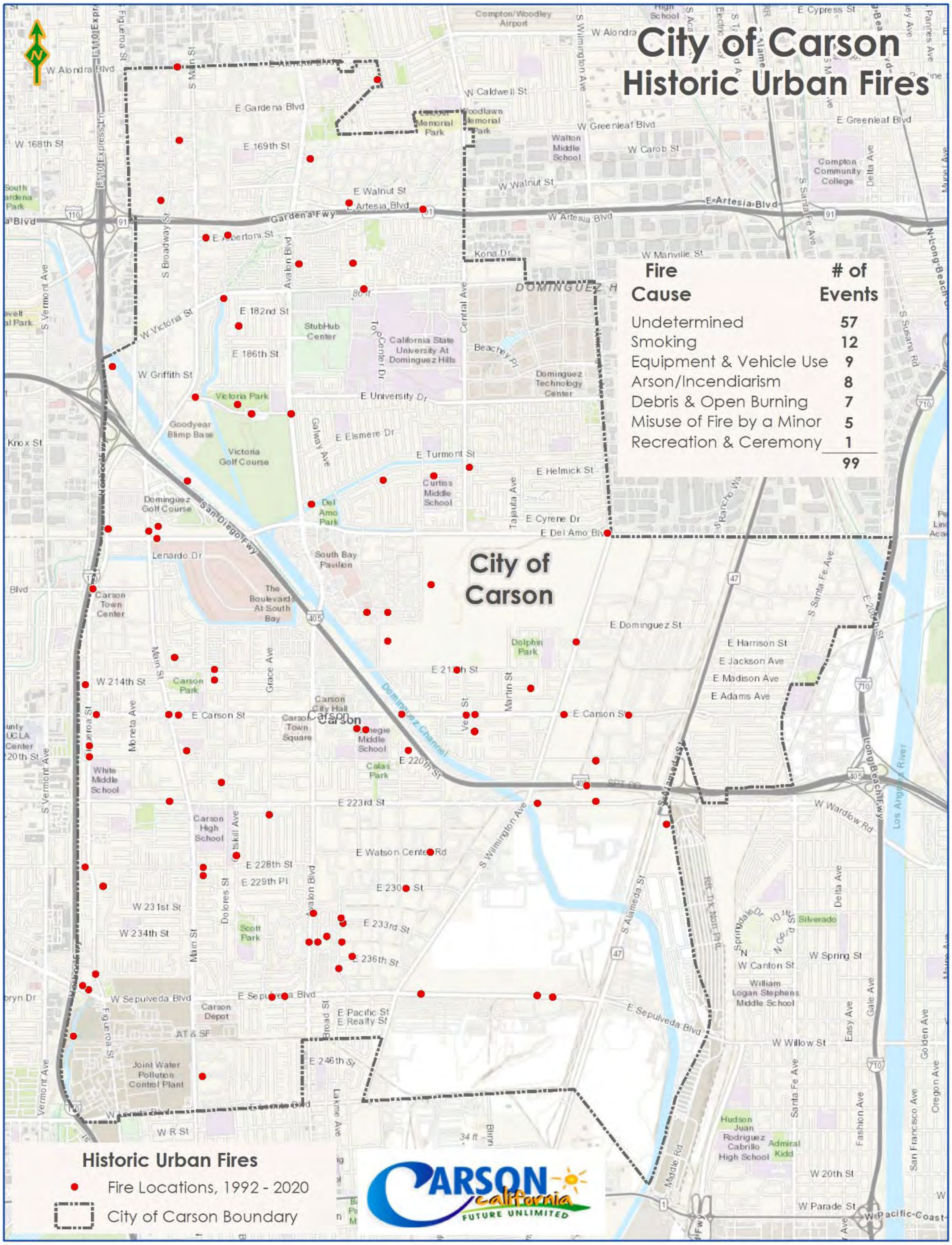

TABLE 92. CITY OF CARSON URBAN FIRE INCIDENTS WITH DESCRIPTIONS

DATE	DESCRIPTION
November 29, 2023	A fire erupted in a carport at an apartment complex in Carson, leaving at least three vehicles destroyed. No one was injured in the blaze. Due to the fire, a power outage occurred at a nearby building that house five apartment units. [139]
September 30, 2021	On September 30, 2021, the greater-alarm fire was reported at 2:12pm at 16325 South Avalon Boulevard near the back of a commercial distribution center. Lack stacks of densely packed cardboard were seen burning and gusty wind execrated the fire. The flames sparked dangerously close to electrical lines, several truck-trailers were destroyed, and many businesses nearby had to evacuate. Four firefighters were injured trying to battle the fire and two of them were hospitalized. This event led to chemical runoffs through the sewer system into the Dominguez Channel, a nearby flood control channel, and caused weeks of devasting air pollution. The leaked chemical in the channel triggered an enormous release of hydrogen sulfide that lingered in the air for weeks, sickening residents. Additionally, more than 3,000 families had to temporarily relocate. [140]
February 26, 2020	Los Angeles County firefighters responded to a large refinery fire that temporarily closed all lanes of the 405 Freeway Tuesday night in the city of Carson. an explosion went off before the fire began burning in a cooling tower at the refinery. Marathon is the largest refinery on the West Coast with a crude oil capacity of 363,000 barrels per calendar day. It manufactures gasoline and diesel fuel, along with distillates, petroleum coke, anode-grade coke, chemical-grade propylene, fuel-grade coke, heavy fuel oil and propane. [141]
August 26, 2016	An explosion and fire Friday at the Tesoro refinery in Carson prompted a hazardous materials response, but there were no immediate reports of injuries. Initially, evacuations were ordered for a quarter-mile radius around the refinery, which is in a commercial area, but the order was lifted just after 2:40 p.m. and those at nearby properties were advised to shelter in place. [142]
November 28, 2015	A house fire occurred that led to one fatality and one person injured.[143]

Source: Local News Articles

[139] Fire engulfs carport at Carson apartment complex; 3 vehicles destroyed - ABC7 Los Angeles https://abc7.com/cason-carport-care-fire-apartment-complex/14122857/

[140] Residents Sue Prologis Over Carson Warehouse Fire (therealdeal.com) https://therealdeal.com/la/2023/07/11/reckless-and-illegal-residents-sue-prologis-over-warehouse-fire/

[141] Massive fire breaks out at Marathon refinery in Carson - 6abc Philadelphia https://6abc.com/refinery-fire-carson-marathon-california/5968665/

[142] Explosion, fire at Carson refinery - MyNewsLA.com https://mynewsla.com/business/2016/08/26/explosion-fire-at-carson-refinery/

[143] Carson (CA) House Fire Kills One - Fire Engineering: Firefighter Training and Fire Service News, Rescue https://www.fireengineering.com/firefighting/carson-ca-house-fire-kills-one/#gref

Frequency

Based on the number of urban fire events that have occurred over a 28-year period (99), there is over a 100 percent chance of these events occurring every year.

v) Future Probability

Highly Likely - Urban fires are human-caused, and it is difficult to estimate the future probability of these events occurring but are likely to continue to be a hazard and pose a risk to the planning area in the future. Based on previous occurrences, urban fire events have occurred throughout the entire jurisdiction. Several urban fire events have occurred near industrial structures. The City of Carson has many warehouses, refineries, and other industrial uses that may pose a risk for urban fires to occur in the future. These properties may hold high quantities of flammable material, such as the incident that occurred on September 30th, where large stacks of cardboard were set ablaze. Additionally, while building codes have improved and fire-resistant materials are more commonly used in construction than in previous decades, these measures are not fire-proof as even the materials inside the buildings can ignite.

vi) Secondary Hazards

Urban fires not only pose a risk to the planning area by the direct impacts from burning, but also can cause secondary hazards and impacts that can significantly impact the community. The list of secondary hazards that can occur as a result of urban fires are listed in the below table.

TABLE 93. SECONDARY HAZARDS FROM URBAN FIRES

HAZARDS	DESCRIPTIONS
Power Outage	Urban fires can damage power lines which can lead to power outages in impacted communities.
Hazardous Materials	Urban fires can cause exposure to asbestos, hazardous vapor, and explosion, risking the health and safety of those around the fire and especially to those who are responding to the incident. Additionally, like the Dominguez Channel Incident, fires may trigger secondary impacts to occur. Chemical runoffs from the fire seeped into the sewer system and the Dominguez Channel causing major health concerns for residents.
Evacuation	Urban fires will likely lead to evacuations from houses, businesses, and other buildings to improve the health and safety of the individuals inside of the structure. If residential properties are destroyed, residents will be displaced and may struggle to find shelter.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets in order to better understand and mitigate risk from hazards.

The City of Carson faces significant risks from urban fire due to a variety of factors. First, the overall density of the community means that there is a large volume of structures including homes, businesses, and industrial facilities in close proximity to one another. Dense development increases the likelihood of a fire at one structure spreading to other nearby structures, and this can quickly turn a small fire into a major incident requiring a large-scale response. On particularly windy days, embers can travel several thousand feet before landing and possibly igniting additional fires, further complicating firefighting efforts.

The City of Carson occasionally experiences traffic congestion (jams) along major roadways including Interstate 405, Interstate 110, Main St, Sepulveda Blvd, 223rd St, and others. Firefighting services are accustomed to the traffic conditions in the community, but the combination of heavy traffic congestion and a large urban fire can produce a dangerous situation. Civilians may find it difficult to safely evacuate, and emergency responders may find it difficult to reach the fire. This is particularly true along the eastern boundary of the City of Carson, where there is a limited number of places where the Dominguez Channel can be crossed.

Second, large sections of the City of Carson are utilized for both light and heavy industry. Industrial facilities can increase a community's vulnerability to urban fires, as it is common for these operations to use and store flammable products. Industrial facilities also commonly produce heat sources (such as running engines, manufacturing processes, sparks, etc.) that can ignite fires. According to the City of Carson zoning code, light industry generally consists of a wide variety of industrial uses with limited hazardous or nuisance effects. Examples of light industry include research and development, wholesaling, and warehousing. Heavy industry is generally more intensive and may have hazardous or nuisance characteristics. Examples of heavy industry include mineral extraction, rail operations, primary processing, and construction yards.

A significant portion of the land zoned for industrial use in the City of Carson is occupied by facilities which support the petroleum and natural gas industries. These facilities include:

<u>Shell Carson Distribution Complex</u>

The Shell Carson Distribution Complex was originally built as a refinery, but the refinery was decommissioned in 1992. Today, the facility functions as a distribution facility which receives and delivers fuels throughout Southern California via pipeline and truck delivery. The site occupies more than 400 acres and can store several million barrels of products.

Marathon Los Angeles Refinery

The Marathon Los Angeles Refinery is the largest refinery on the West Coast. The facility can process 365,000 barrels of crude oil per calendar day, and it manufactures a range of products including diesel fuel, gasoline, heavy fuel oil, and propane. On February 25, 2020, a flash fire and ensuing process fire occurred at the facility due to ignition of light hydrocarbon material released at the site. The fire did not result in any injuries or fatalities, but the event was deemed a “major incident” pursuant to 8 CCR 5189.1 and 19 CCR 2735.1. In 2023, four facility employees were taken to local medical facilities after exposure to butane and hydrogen sulfide gases leaking at the site.

Kinder Morgan Carson Terminal

The Kinder Morgan Carson Terminal occupies approximately 100 acres and has a total storage capacity exceeding 5 million barrels. According to Kinder Morgan, products at the Carson Terminal include crude oil, gasoline, gasoline blending components, diesel, and refinery feedstocks. Products stored at the site arrive via pipelines from other terminals and refineries, as well as from tankers/barges unloading at the nearby Port of Los Angeles. Products are distributed from the facility via pipelines and trucks.

The owners and operators of petroleum and natural gas facilities in the City of Carson have numerous safety measures in place to reduce the likelihood of accidents. However, such events are still possible, and they can result in major urban fires due to the volume and characteristics of the materials present. The 2020 fire at the Los Angeles Refinery was less than 2,000 feet from Interstate 405, and safety concerns arising from the short distance between the interstate and the fire prompted officials to temporarily close all lanes of Interstate 405. This roadway is a major transportation route for both the City of Carson and the Los Angeles metro area, and its closure can significantly disrupt the movement of goods and people. Additional potential impacts of urban fires at industrial sites in the City of Carson include shelter in place orders, evacuations of homes and businesses, utility interruptions, cancellation of classes, disruption of community events, and decreased availability of medical, fire, and law enforcement services.

(1) People

Urban fires can cause injuries and fatalities. Every year, there are more than 180,000 fatalities due to fires or from burn-related injuries, worldwide. The most notable urban fire incident was the Dominguez Channel incident that forced over 3,000 to temporarily relocate to the harmful subsequent impacts that the warehouse fire caused. Residents were burdened by the adverse health effects such as nausea, dizziness, headaches, eye irritation, and additional symptoms from the foul smell coming from the Dominguez Channel as a result of elevated levels of hydrogen sulfide (H2S). This incident posed a risk not only for Carson residents but nearby communities as over 4,700 odor complaints were submitted from residents in Carson, Gardena, Long Beach, Redondo Beach, Torrance, and Wilmington. [144] Additionally, the City of Carson is densely populated which increases the risk of urban fires occurring in residential structures.

People will likely need to evacuate during an urban fire impacting a business, building, or residential structure. Evacuating safely may mean a matter of minutes or seconds as fires can engulf the entire structure very quickly, depending on certain circumstances and conditions. It is important for people to evacuate as quickly as possible to get to safety. Certain populations may have a difficult time self-evacuating and are more at-risk. Populations that may have a difficult time self-evacuating include but are not limited to older adults, children, and individuals with physical disabilities, and individuals with limited mobility.

(2) Structures and Systems

Urban fires can cause widespread damage to property, contents, and the buildings themselves, leaving significant amounts of debris and smoke damage. Previous occurrences have damaged homes, cars, and buildings such as businesses, warehouses, and refineries.

Critical Facilities

Based on historical data available through news articles on previous urban fire incidents, there have been no urban fires directly impacting critical facilities in the city. However, if fires were to ignite at any of the critical facilities within the city, disruptions and damage would cause significant impacts. Additionally, depending on the severity of the urban fire incident, critical facilities and services could be overwhelmed and stressed.

TABLE 94 - POTENTIAL VULNERABILITIES OF LIFELINES DUE TO URBAN FIRES

LIFELINES	IMPACT TYPE	DESCRIPTION
Safety & Security	Safety and Security	Fires pose immediate threats to life and property. Emergency services, including fire departments and law enforcement, are crucial for firefighting, evacuation, and maintaining public order. Ensuring the safety of residents and responders is the top priority.
Health & Medical	Health and Medical	Fires can result in injuries from burns and smoke inhalation, necessitating emergency medical response and treatment. Healthcare facilities must be prepared for the sudden influx of patients during major fire incidents.

[144] Dominguez Channel Odor Event (aqmd.gov) https://www.aqmd.gov/home/news-events/community-investigations/dominguez-channel

Housing & Building Infrastructure		Fires can destroy homes and businesses, leading to displacement and long-term housing needs for affected residents. The rebuilding process can be lengthy and complex, involving insurance claims, construction services, and community support.
Utilities		Fires can damage utility infrastructure, leading to disruptions in electricity, gas, water supply, and telecommunications. Restoring these services is critical for recovery and normalcy.

(3) Natural, Cultural, and Historical Resources

There are 49 identified historical and cultural properties within the City of Carson. Urban fires can cause devastating impacts to cultural and historic properties due to structural damage from fires. Impacts can range from structural damage to destroying historical documents and artifacts.

(4) Risk Analysis

High - Urban fires pose a high risk to the planning area. While it is difficult to predict future occurrences since most urban fires are human caused, based on previous occurrences of urban fires, it is very likely that these hazard events will continue and occur multiple times a year. Significant events such as the Dominguez Channel incident, had a wide range of devastating impacts to the community, including adverse health impacts, but also the surrounding areas. Urban fires have occurred throughout the city and have been caused mostly by undetermined causes (57 incidents) and smoking (9 incidents). These incidents can cause injuries and deaths among Carson residents, especially if individuals are not able to evacuate in time. Populations can be displaced after urban fires and individuals possibly unemployed if a fire destroys workplaces. Additionally, based on future development trends, it is likely that urban fire incidents will increase in risk as the population increases, along with housing and properties. Inadequate planning, infrastructure, and construction practices related to fire prevention and mitigation significantly increase the risk. Therefore, it is important to invest in preventative measures to improve fire safety.

S) WILDFIRE

i) Hazard Profile

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie. Wildfires can start from natural causes, such as lightning, but most are caused by humans, either accidentally or intentionally. Wildfires can damage natural resources, destroy homes, and threaten human lives and safety. Most fires in the United States have been found to be caused by humans. [145] The conditions for wildfires to ignite and their behavior is based on several factors including fuel, weather, and topography. The table below breaks down the factors affecting fire behavior.

TABLE 95. FACTORS AFFECTING WILDFIRE BEHAVIOR

WILDFIRE FACTOR	DESCRIPTION
Fuel	Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases can be more susceptible to wildfire. Structures in the human-built environment also represent a fuel component.
Weather	Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. When the temperature is high, relative humidity is low, wind speed is increasing and coming from the east (offshore flow), and there has been little or no precipitation, so vegetation is dry, conditions are very favorable for extensive and severe wildfires. These conditions occur more frequently inland where temperatures are higher, and fog is less prevalent.
Topography	Topography includes slope and elevation. The topography of a region influences the amount of moisture retained in fuels; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as roads, vineyards, and lakes; and elevation and slope of landforms (fire spreads more easily uphill than downhill). In steep terrain, common geographic features such as drainages, gulches and canyons can funnel air to act as chimneys, pulling hot air, gases, and embers ahead or outside of the main fire. The direction that a slope faces also has a major influence on fire behavior. South-facing slopes receive heating and drying solar radiation

[145] Wildfire | What (fema.gov) https://community.fema.gov/ProtectiveActions/s/article/Wildfire-What

WILDFIRE FACTOR	DESCRIPTION
	from early in the morning until sunset, whereas north-facing slopes only receive solar radiation during a short period of the day when the sun is high in the sky.

Source: FEMA

(1) Duration

Due to climate change, wildfires are lasting on average longer. In 1986 wildfires last an average of 6 days between 1973 to 1982 and in 2013 the average burn time increased to 52 days between 2003 and 2012.

(2) Seasonality

Wildfire season in the United States lasts longer with every passing year, especially in California State. Due to changing weather patterns and conditions (i.e., rising temperatures, reduced winter snowpack, earlier snowmelt, reduced summer precipitation, and increased evaporation) driven by climate change, fire seasons are more lasting over 7 months in length compared to about five months in previous decades. Additional to longer wildfire seasons, wildfires are lasting on average longer. In 1986 wildfires last an average of 6 days between 1973 to 1982 and in 2013 the average burn time increased to 52 days between 2003 and 2012. [146]

(3) Speed of Onset

Wildfires can ignite and burn at an incredibly fast rate. Wildfires spread on at an average of 14.27 miles per hour depending on several factors such as weather conditions, fuel type, and terrain. [147]

(4) Location

Due to the urban nature of the City of Carson, the risk of a wildfire igniting within the planning area is low. However, the entirety of the planning area is considered vulnerable to this hazard due to the potential for smoke from nearby wildfires to pose health risks to the entire population of the City of Carson.

ii) Magnitude

The California Department of Forestry and Fire Protection (CAL FIRE) developed a Fire Hazard Severity Zones Map based on fuel loading, slope, fire weather, and other relevant factors present, including areas where winds have been identified by the department as major cause of

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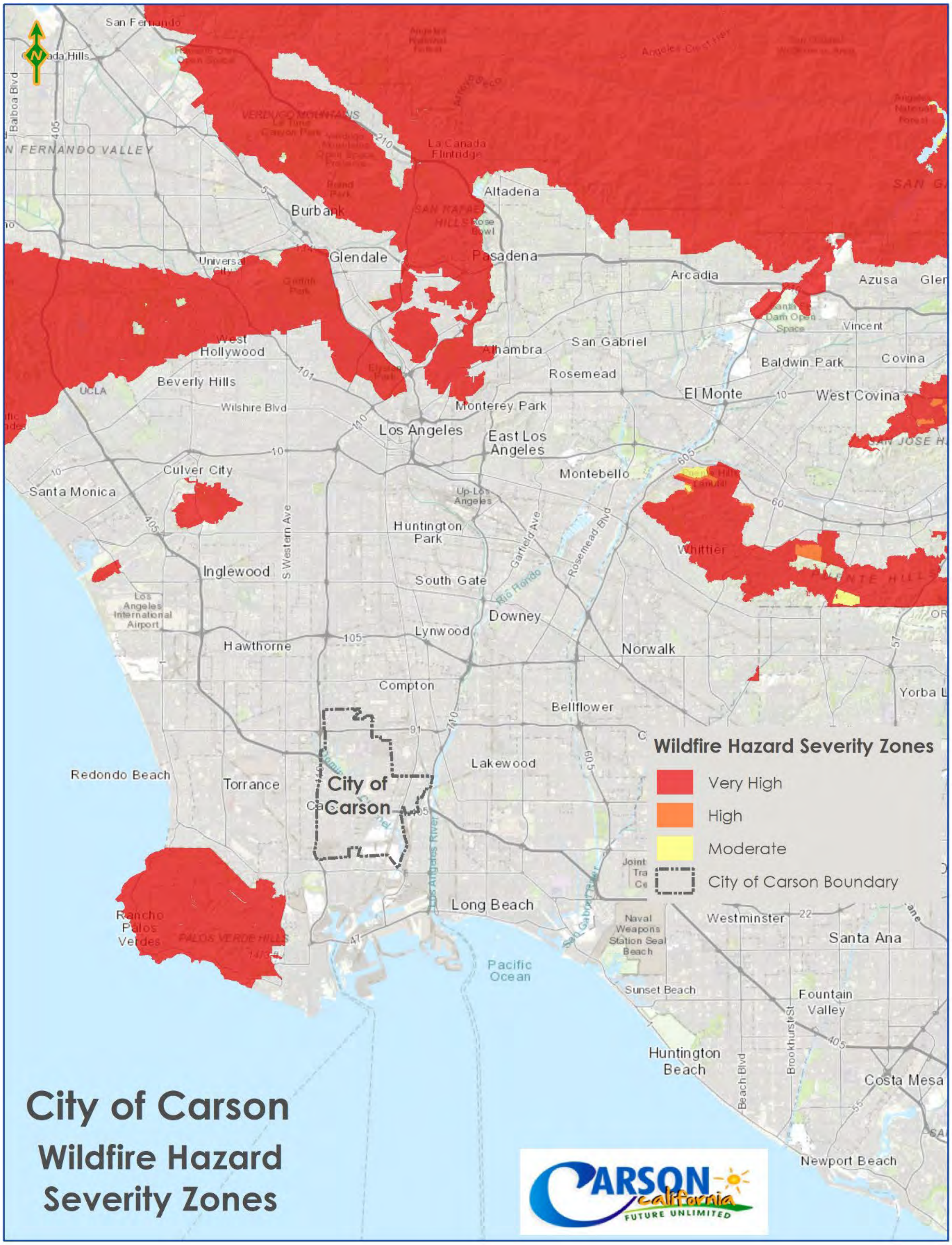
[146] Wildfire | USDA Climate Hubs https://www.climatehubs.usda.gov/taxonomy/term/398
[147] How Fast do Wildfires Spread? | WFCA https://wfca.com/wildfire-articles/how-fast-do-wildfires-spread/

wildfire spread. Fire Hazard Severity Zones (FHSZ) classify areas as moderate, high, or very high fire hazard. The Los Angeles County's Fire Hazard Severity Zones Map shows the moderate to very high areas near Puente Hills and very high in the Palo Verdes Hills and in the San Gabriel Mountains and Angeles National Forest areas. The City of Carson and the surrounding communities are not within any fire hazard severity zones, shown in the map below.

FIGURE 89 - CITY OF CARSON WILDFIRE HAZARD SEVERITY ZONES AS OF 2024



Since 1974, five rating levels have been used to describe potential danger levels in public information releases and fire prevention signing to reduce wildfire risk and inform the public on the likelihood of wildfires occurring. The rating levels are described in the table below.

TABLE 96. WILDFIRE RISK RATING LEVELS

RATING	DESCRIPTION
Low (Green)	Fire starts are unlikely. Weather and fuel conditions will lead to slow fire spread, low intensity, and relatively easy control with light mop up. Controlled burns can usually be executed with reasonable safety.
Moderate (Blue)	Some wildfires may be expected. Expect moderate flame length and rate of spread. Control is usually not difficult and light to moderate mop up can be expected. Although controlled burning can be done without creating a hazard, routine caution should be taken.
High (Yellow)	Wildfires are likely. Fires in heavy, continuous fuel, such as mature grassland, weed fields, and forest litter, will be difficult to control under windy conditions. Control through direct attack may be difficult but possible and mop up will be required. Outdoor burning should be restricted to early morning and late evening hours.
Very High (Orange)	Fires start easily from all causes and may spread faster than suppression resources can travel. Flame lengths will be long with intensity, making control very difficult. Both suppression and mop up will require an extended and very thorough effort. Outdoor burning is not recommended.
Extreme (Red)	Fires will start and spread rapidly. Every fire that starts has the potential to become large. Expect extreme, erratic fire behavior. No outdoor burning should take place in areas with extreme fire danger.

Source: Western Fire Chiefs Association

In order to communicate the danger that wildfires pose and the urgency for communities to evacuate, local jurisdictions use three levels of wildfire evacuation, 1 being the lowest level and 3 being the highest level. The table below provides more information on what each level means for evacuation.

TABLE 97. WILDFIRE EVACUATION LEVELS

LEVEL	DESCRIPTION
Level 1	**Be Ready**. A wildfire threat is in your area. You should monitor the news, plan and pack for evacuation if necessary.
Level 2	**Be Set.** A wildfire is approaching your area. You should be ready to leave at a moment's notice. You should have your belongings and vehicles prepared.
Level 3	**Go.** A wildfire poses an immediate threat to you and your home. You should evacuate immediately and follow the instructions of emergency personnel.

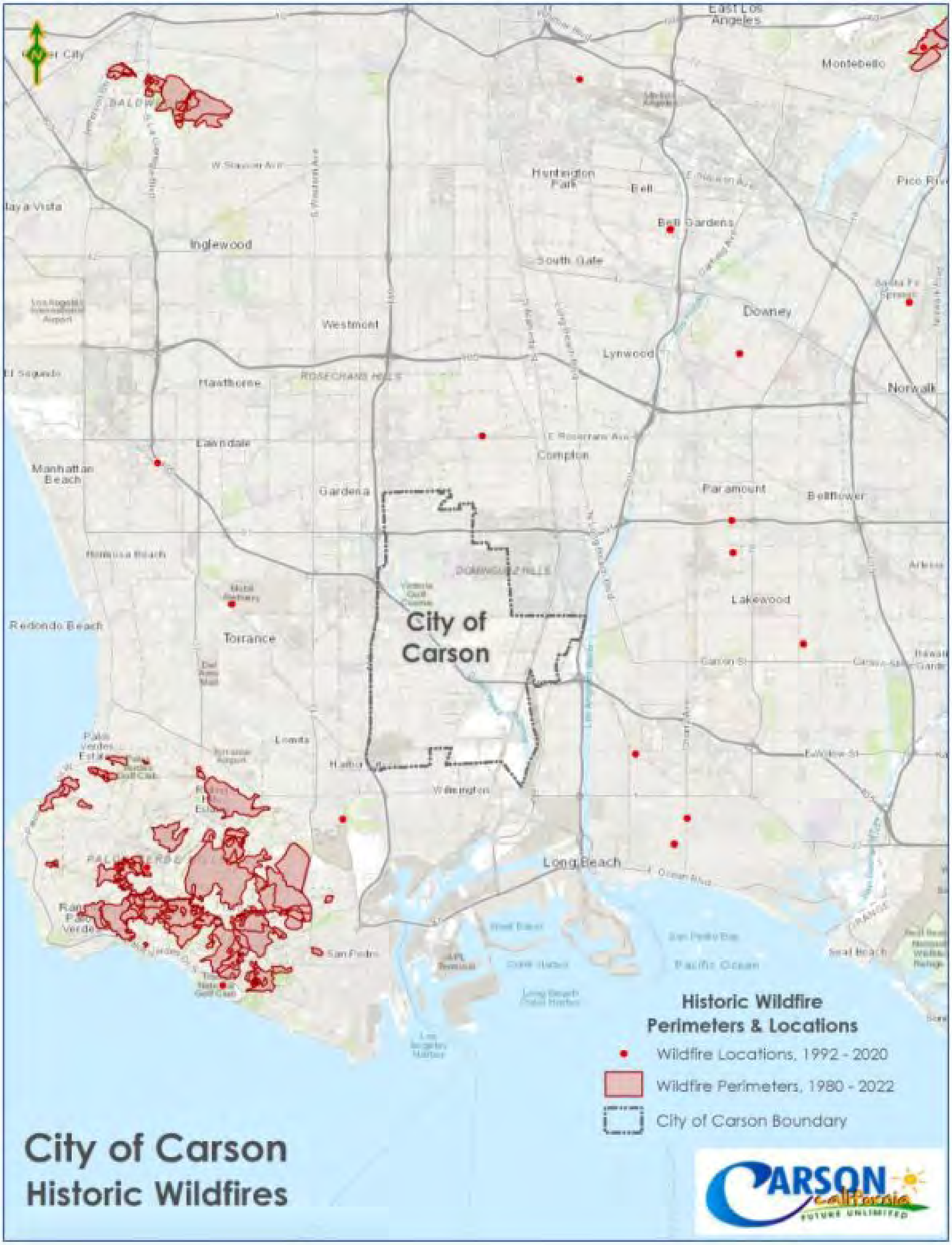
Source: U.S. Forest Service

iii) Extent

Large - The majority of wildfires in Los Angeles County occur near the Angeles National Forest, Santa Monica Mountains, and other nearby mountains and forests, shown in the map below. There have been no wildfires recorded in the City of Carson, most likely due to the highly urbanized area. However, there have been wildfires nearby around Rancho Palos Verdes, about 10 miles southwest of the city. [148] In addition to the wildfires themselves, the city can be negatively impacted by poor air quality which is an existing concern for the planning area.

[148] California Wildfire History Map (capradio.org) https://projects.capradio.org/california-fire-history/#6/38.58/-121.49

FIGURE 90 - CITY OF CARSON HISTORIC WILDFIRES



iv) Past Occurrences

Within the state of California, there have been 6,999 wildland fires (year to date December 2023). No wildfire events have occurred within the City of Carson.

v) Future Probability

Unlikely - Wildfires are projected to increase as well as the acreage of land burned by wildfires. According to the California Fourth Climate Change Assessment, by 2100, if greenhouse gas emissions continue to rise, the frequency of extreme wildfires would increase, and the average area burned statewide would increase by 77 percent found by one study. [149]

vi) Secondary Hazards

Wildfires can produce a range of secondary hazards that can cause more widespread damage and impacts to the community. Wildfires can cause damage to people, property, and the environment resulting in economic damage, public health concerns in the form of wildfire smoke, poor air quality, drinking water quality, and increasing risk to slope failures and runoff. Additionally, major landslides can occur as a result of wildfires, up to several years after they occur. The table below describes each of the secondary hazards from wildfires.

TABLE 98. SECONDARY HAZARDS FROM WILDFIRES

HAZARD	DESCRIPTION
Wildfire Smoke	Wildfire smoke is comprised of a mixture of gaseous pollutants (i.e., carbon monoxide), hazardous air pollutants (HAPS), water vapor, and particle pollution. Particle pollution is the main component of wildfire smoke and can also be referred to as particulate matter. There is evidence that wildfire smoke can increase the risk of both cardiovascular and respiratory-related effects in response to wildfire smoke exposure. Wildfire smoke is a significant risk to public health and can cause short and long-term health impacts. Wildfire smoke can not only affect the communities directly impacted by the wildfire, but it can travel up to hundreds of miles and cause health impacts. [150]
Poor Air Quality	Wildfire smoke can contribute to poor air quality and pose significant impacts on population health. Poor quality due to air pollutants such as ozone and particulate matter increases the amount of lung and heart disease and other

[149] California's Fourth Climate Change Assessment, California's Changing Climate 2018 https://www.energy.ca.gov/sites/default/files/2019-11/20180827_Summary_Brochure_ADA.pdf

[150] Wildfire Smoke and Your Patients' Health: The Air Quality Index | US EPA https://www.epa.gov/wildfire-smoke-course/wildfire-smoke-and-your-patients-health-air-quality-index

HAZARD	DESCRIPTION
	health problems, especially for populations that are already exposed to a higher level of pollution. [151]
Landslides	Post wildfire landslides hazards include fast moving, highly destructive debris flows that can occur in the years after the event in response to high intensity rainfall events, and those flows that are generated over longer time periods accompanied by root decay and loss of soil strength. Landslides can be particularly dangerous due to the short warning time and can block drainage ways, damage structures, and endanger human life. [152]
Flooding	Flood risks can increase after wildfires since the landscape and vegetation is charred and unable to absorb water which creates conditions ripe for flash flooding and mudflow. [153]
Land Subsidence	Land subsidence (thermokarst) and thermal erosion can also be caused by forest and tundra fires. These fires destroy the insulating layers of humus, peat, grass and roots that safeguard the permafrost, and thus effectively accelerate its thawing over the long term.

vii) Vulnerability & Impact Assessment

Vulnerability is defined as risk from the effects of hazards. The term applies to assets such as structures and populations. In this section, population, properties, and critical facilities are evaluated to better understand vulnerabilities to such assets and mitigate risk from hazards.

The City of Carson is most likely to be impacted by smoke generated by wildfires rather than the flame front – this is due to the jurisdiction's urban setting, being bounded on all sides by extensive development. This assessment is supported by historical data of wildfires in California. None of the more than 20,000 wildfires in California documented by Cal Fire, the National Parks Service, the U.S. Forest Service, the Bureau of Land Management, and the U.S. Fish and Wildfire Service between 1878 and 2020 burned within the jurisdictional boundaries of the City of Carson. Historical data does not guarantee that the flames from wildfires will never reach the City of Carson, but such an event remains unlikely. At a minimum, a wildfire would have to burn across development in the neighboring communities to reach the City of Carson, and an event of this magnitude would likely require a coordinated response from multiple state and local agencies.

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[151] Research on Health Effects from Air Pollution | US EPA https://www.epa.gov/air-research/research-health-effects-air-pollution

[152] What should I know about wildfires and debris flows? | U.S. Geological Survey (usgs.gov) https://www.usgs.gov/faqs/what-should-i-know-about-wildfires-and-debris-flows

[153] Flood Risks Increase After Fires - Fact Sheet (fema.gov) https://www.fema.gov/sites/default/files/documents/fema_flood-after-fire_factsheet_nov20.pdf

The adverse health effects of smoke can sometimes be difficult to recognize, as they are not always outwardly visible. However, for highly urban communities like the City of Carson, smoke is often the aspect of wildfires that has the greatest impact on community members. Wind in the Los Angeles area typically blows from the west, but events like Santa Ana winds can result in strong winds blowing from east. Because wildfire smoke can travel for hundreds of miles, the City of Carson can be affected by wildfires far afield from the community.

Wildfire smoke contains numerous harmful air pollutants, with particulate matter equal to or smaller than 2.5 micrometers in diameter (PM2.5) being a particular concern. Exposure to PM2.5 can result in both short-term and long-term health effects including eye and respiratory tract irritation, worsening asthma, and increased risk of stroke and heart attack. The association between PM2.5 and heart and lung disease has been well documented in scientific literature.[154] Populations that are particularly vulnerable to PM2.5 include the elderly, children, and those with pre-existing medical conditions. Medical and education facilities in the City of Carson should operate and maintain adequate HVAC systems which can filter out PM2.5 and other air pollutants. If the air quality is particularly severe, it may be appropriate for community leaders to move outdoor community events indoors or postpone them. Such activities may include the Halloween Carnival, Laugh and Learn for Seniors – Laughter Yoga, Samoan Heritage Festival, Jazz Festival, and Country Western Fest.

(1) People

Since there have been no previous wildfire occurrences within the City of Carson, there is no historical data on wildfire impacts to the population. Wildfires can be deadly to populations and pose a risk to public health. However, in the planning area, it is more likely that the planning area will be impacted by poor air quality driven by wildfire smoke from near wildfires in the county or state. However, if a wildfire were to impact the planning area, the below section outlined possible impacts to the population.

Evacuation

Communities may need to evacuate their homes in order to remove themselves from the direct path of the wildfire. However, some individuals may not have the resources or access to emergency information in order to evacuate. Unfortunately, in some cases, there may not be enough warning time for people to safely evacuate before the wildfire burns through. Populations that may have difficulty, may not have the resources, or may experience barriers to evacuation, include but are not limited to:

- Individuals with disabilities
- Individuals with limited English proficiency

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[154] California Air Resources Board. “Smoke Ready California.” Smoke Ready California, 2024. https://ww2.arb.ca.gov/smokereadyca.

- Individuals with limited or no access to the internet or emergency information
- Individuals with no access to personal transportation
- Older adults

Additionally, individuals and communities may not be aware of shelters to evacuate to or have friends or family to stay with during the evacuation. Furthermore, individuals attempting to evacuate may encounter traffic congestion which can prevent efficient movement away from the hazard. Traffic congestion may be the result of a surge of vehicles attempting to use roadways to evacuate or more routine causes such as roadway construction or traffic accidents which create obstacles.

Wildfire Smoke and Poor Air Quality

Particulate matter from wildfire smoke can worsen air quality and cause adverse health effects to population health. Wildfire exposes communities to multiple environmental hazards from combustion due to the fire itself to air pollution from smoke and byproducts of combustion and ash. Approximately 90 percent of total particle mass emitted from wildfires consists of fine particles (i.e., PM2.5). Impacts of poor air quality from wildfire smoke include the following:

- Eye and respiratory tract irritation
- Reduced lung function
- Bronchitis
- Exacerbation of asthma
- Heart failure
- Premature death
- Aggravation of pre-existing respiratory and cardiovascular disease
- Persistent cough, phlegm, wheezing, and difficulty breathing

The Air Quality Index (AQI) measures the severity of air quality and is broken down into 6 categories to communicate the level of health concern for public health, shown in the table below.

TABLE 99. AIR QUALITY INDEX

AIR QUALITY INDEX LEVELS OF HEALTH CONCERN	NUMERICAL VALUE	DESCRIPTION
Good (Green)	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate (Yellow)	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.

AIR QUALITY INDEX LEVELS OF HEALTH CONCERN	NUMERICAL VALUE	DESCRIPTION
Unhealthy for Sensitive Groups (Orange)	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy (Red)	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy (Light Purple)	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous (Dark Red)	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

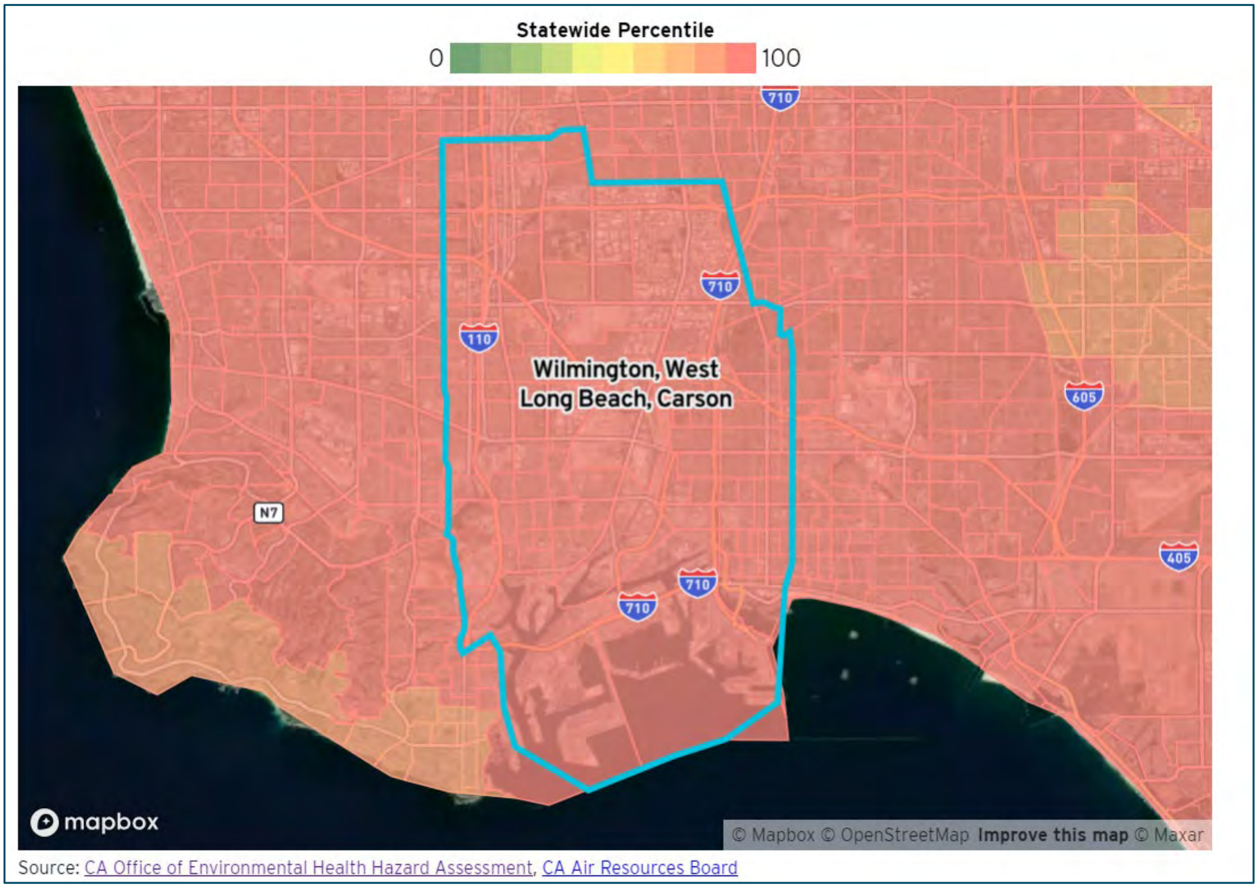
Source: AirNow.gov

The majority of healthy adults and children will recover quickly from wildfire smoke exposure and poor air quality and will not experience long-term health consequences. However, certain at-risk populations may be at greater risk of experiencing severe acute and chronic symptoms which include individuals with asthma and other lung disease, children, older adults, individuals experiencing homelessness and outdoor workers. [155]

Air pollution in and around the City of Carson is already elevated due to the refineries and industrial uses and potential wildfire smoke in the future will exacerbate existing health disparities in communities that are disproportionately exposed to environmental hazards. The area encompassing Wilmington, Carson, and West Long Beach, live with major sources of pollution due, shown in the map below, due to the close proximity of major ports in the nation, five oil refineries, nine rail yards, four major freeways, and several chemical refineries, as well as the third largest oilfield in the contiguous United States. Residents in these areas more frequently suffer from asthma attacks compared to cleaner cities. Additionally, cancer risk, predominantly from diesel exhaust spewed by trucks, ships, and trains, is 98 percent higher in Wilmington than in the rest of the Los Angeles basin.

[155] WILDFIRE SMOKE: A GUIDE FOR PUBLIC HEALTH OFFICIALS (airnow.gov)
https://www.airnow.gov/sites/default/files/2021-05/wildfire-smoke-guide-revised-2019-chapters-1-3.pdf

FIGURE 91 - STATEWIDE PERCENTILE OF TOXIC AIR RELEASES FROM FACILITIES WITHIN WILMINGTON, WEST LONG BEACH, AND CARSON



Source: CA Office of Environmental Health Hazard Assessment, CA Air Resources Board 2024

(2) Structures and Systems

There are no previous occurrences that have occurred in the City of Carson and therefore there is no data on property damage from wildfires. However, wildfires can completely burn properties, including homes leaving many without housing. According to a new study, the amount of property in the United States at risk from a 5 percent or greater chance of being impacted by a wildfire over the course of a 30-year mortgage is expected to more than double by 2050. [156] Another study found that wildfires are predicated damage upwards of 22 billion dollars' worth of property by 2049, especially in the Western United States. [157] Secondary impacts from wildfires such as poor air quality from wildfire smoke is more likely to occur than a wildfire itself in the City of Carson. Buildings may experience poor quality and wildfire smoke

[156] Billions Worth of Property At Risk From Climate-Fueled Fires | TIME https://time.com/6305819/climate-change-wildfires-property-value-at-risk

[157] Wildfires Could Damage $11 Billion Worth Of Properties In Coming Decades, Study Finds (forbes.com) https://www.forbes.com/sites/darreonnadavis/2023/08/17/wildfires-could-damage-11-billion-worth-of-properties-in-coming-decades-study-finds/?sh=5f3c52922449

seeping into the indoor space as well as may consider HEPA air purifiers for buildings that may not have a robust HVAC system. Additionally, many homes may not have adequate HVAC systems and may experience negative side effects from exposure to poor air quality and wildfire smoke.

Critical Facilities

There are no previous occurrences that have occurred in the City of Carson and therefore there is no data on damage to critical facilities from wildfires. Secondary impacts from wildfires such as poor air quality from wildfire smoke is more likely to occur than a wildfire itself. Critical facilities may need to put protections in place to reduce exposure to poor air quality and wildfire smoke to continue services and operations. Additionally, the city may consider opening clean air shelters for individuals or families that may not have access to clean indoor air, especially at-risk populations that might experience chronic health conditions when exposed to poor air quality.

TABLE 100 - POTENTIAL VULNERABILITIES OF LIFELINES TO WILDFIRE

LIFELINES	IMPACT TYPE	DESCRIPTION
Safety & Security	Safety and Security	Wildfires pose immediate threats to life and property, requiring significant emergency response efforts. Evacuations, rescue operations, and law enforcement to maintain order and prevent looting in evacuated areas are critical.
Health & Medical	Health and Medical	Smoke and air quality issues from wildfires can lead to respiratory problems and exacerbate chronic health conditions. There's also a risk of burns and other injuries directly caused by fires. Healthcare facilities must be prepared for an influx of patients and potential relocation if in the path of a fire.
Housing & Building Infrastructure	Food, Hydration, Shelter	Wildfires can destroy homes and buildings, leading to displacement and the need for temporary housing. The rebuilding process can be extensive and resource intensive.

(3) Natural, Cultural, and Historical Resources

Since the wildfire severity zone is outside of city boundaries, it is unlikely that wildfires will cause a significant impact to cultural and historic properties.

(4) Risk Analysis

Moderate - Wildfires pose a moderate risk to the planning area as there have been no previous occurrences in the planning area. However, the City of Carson is more likely to be at risk, less from the direct impacts of wildfire burning, but from wildfire smoke and poor air quality impacts on population health. Wildfire smoke worsening the air quality can pose a serious risk to the planning area as the city experiences existing environmental health concerns such as pollution, due to the many refineries and industrial uses nearby. Most wildfires in Los Angeles County occur near mountains and forests noted in previous maps in this section but have not occurred in the City of Carson. Additionally, based on future development trends, it is likely that wildfires could increase in risk as the population increases, along with housing and properties. With climate changing driving warmer temperatures and drier conditions, wildfire trends could shift in the future and pose a larger risk to the planning area, especially as previous wildfire events have occurred near jurisdictional boundaries in the Ranch Palos Verdes area.

T) HAZARD VULNERABILITY SUMMARY

i) Methodology

Prioritizing hazards plays a crucial role in helping communities establish objectives and mitigation strategies based on their vulnerabilities. The City of Carson employed the Risk Factor (RF) methodology, as described below, to assess and rank hazards according to their threat levels. This ranking underwent scrutiny and evaluation by the Hazard Mitigation Planning Team and all stakeholders during the Draft Plan Review phase.

The RF methodology generates numerical values that facilitate the comparison of identified hazards. These values reflect the relative risk posed by each hazard, with higher RF values indicating a greater level of hazard risk. RF values are determined by attributing varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and duration. Each degree of risk within these categories is assigned a value ranging from 1 to 4, accompanied by a corresponding weighting factor. The RF approach is summarized in the table below. To calculate the RF value for a particular hazard, one must multiply the assigned risk value for each category by its respective weighting factor. The summation of these values across all five categories yields the final RF value, as illustrated in the following example equation:

TABLE 101: RISK FACTOR METHODOLOGY EQUATION

RF VALUE = [(PROBABILITY X .30) + (IMPACT X .30) + (Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]				
RISK ASSESSMENT CATEGORY	DEGREE OF RISK			WEIGHT VALUE
	LEVEL	CRITERIA	INDEX	
Probability: What is the likelihood of a hazard event occurring in a given year?	Unlikely Possible Likely Highly Likely	Less than 1% annual probability Between 1% and 49.9% annual probability Between 50% and 90% annual probability Greater than 90% annual probability	1 2 3 4	30%
Impact: In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when	Minor Limited	Very few injuries, if any. Only minor property damage and minimal disruption to quality of life. Temporary shutdown of critical facilities. Minor injuries. More than 10% of property in affected area damaged or destroyed.	1 2	30%

RF VALUE = [(PROBABILITY X .30) + (IMPACT X .30) + (Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]					
RISK ASSESSMENT CATEGORY	**DEGREE OF RISK**				**WEIGHT VALUE**
	LEVEL	CRITERIA		INDEX	
a significant hazard event occurs?		Complete shutdown of critical facilities for more than one day.			
	Critical	Multiple deaths / injuries possible. More than 25% of property in affected areas was damaged or destroyed. Complete shutdown of critical facilities for more than a week.		3	
	Catastrophic	High number of deaths / injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.		4	
Spatial Extent: How large of an area could be impacted by a hazard event? Are impacts localized or regional?	Negligible	Less than 1% of the area affected.		1	20%
	Small	Between 1% and 10.9% of area affected		2	
	Moderate	Between 11% and 25% of area affected		3	
	Large	Greater than 25% of area affected		4	
Warning Time: Is there usually some lead-time associated with the hazard event? Have warning measures been implemented?	More than 24 hours	Self-Defined	Note: Levels of warning time and criteria that define them may be adjusted based on the hazard addressed.	1	10%
	12 to 24 hours	Self-Defined		2	
	6 to 12 hours	Self-Defined		3	
	Less than 6 hours	Self-Defined		4	
Duration: How long does the hazard event usually last?	Less than 6 hours	Self-Defined	Note: Levels of warning time and	1	10%
	Less than 24 hours	Self-Defined		2	

RF VALUE = [(PROBABILITY X .30) + (IMPACT X .30) + (Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]					
RISK ASSESSMENT CATEGORY	DEGREE OF RISK				WEIGHT VALUE
	LEVEL	CRITERIA		INDEX	
	Less than 1 week More than 1 week	Self-Defined Self-Defined	criteria that define them may be adjusted based on the hazard addressed.	3 4	

ii) Ranking Results

Using the methodology described above, the following table lists the Risk Factor calculated for each of the 17 potential hazards identified in the 2024 update. Hazards identified as high risk have risk factors greater than or equal to 2.5. Risk Factors ranging from 2.0 to 2.4 are considered moderate risk hazards. Hazards with Risk Factors less than 2.0 are considered low risk. According to the default weighting scheme applied, the highest possible RF value is 4.0.

TABLE 102: RISK RESULTS

HAZARD	0.3 PROBABILITY	0.3 IMPACT	0.2 SPATIAL EXTENT	0.1 WARNING TIME	0.1 DURATION	OVERALL RISK
Earthquakes	3	1	4	1	4	**3.7**
Extreme Heat	4	4	4	4	1	**3.3**
Pandemic/ Epidemic	2	4	4	1	4	**3.1**
Industrial Pollution/ Chemical Release	2	3	3	4	4	**2.9**
High Wind	3	2	4	1	4	**2.8**
Urban Fire	4	2	2	4	2	**2.8**
Drought/Water Shortage	3	1	4	1	4	**2.5**
Hurricane	2	2	4	1	3	**2.4**
Wildfire	1	1	4	4	4	**2.2**
Severe Storm/ Thunderstorm/ Lightning	2	1	4	1	1	**1.9**

Landslide/ Mudflow	1	1	1	4	1	**1.9**
Land Subsidence/Karst	0	1	4	4	4	**1.9**
Flood	2	1	2	2	3	**1.8**
Extreme Winter Weather (Cold)	4	3	4	1	3	**1.7**
Hail	1	1	4	1	1	**1.6**
Tornado	1	1	2	4	1	**1.5**
Tsunami/Seiche	1	1	2	2	2	**1.4**

Note: A zero was given to land subsidence as the hazard is an ongoing process and continuously occurring.

iii) Hazard Vulnerability Conclusion

Drought & Water Shortages

The City of Carson is susceptible to droughts due to its semi-arid climate and reliance on imported water sources. Droughts can have profound impacts on the city's population, economy, infrastructure, and environment.

TABLE 103: DROUGHT HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Reliance on Imported Water Supplies	**PROBLEM STATEMENT**	The City of Carson relies heavily on imported water from the Metropolitan Water District of Southern California, which sources water from the Colorado River and the State Water Project. Drought conditions can reduce these supplies, making Carson vulnerable to regional water shortages.
	IMPACT	Reduced availability of imported water during droughts can lead to mandatory water restrictions, affecting residential, commercial, and industrial users. Dependence on external sources limits the city's control over its water supply, increasing vulnerability to statewide drought impacts.
Public Health Risks from	**PROBLEM STATEMENT**	The 2021 Dominguez Channel incident, partially exacerbated by drought

		DESCRIPTION
Environmental Hazards		conditions, resulted in the release of hydrogen sulfide gas due to decaying organic matter in low-flow conditions, causing health issues for nearby residents.
	IMPACT	Drought-induced low water levels can lead to the accumulation of pollutants and organic matter in water bodies, increasing the risk of hazardous gas emissions. Residents experienced symptoms such as nausea, headaches, and respiratory issues, highlighting the intersection of drought and public health risks.
Industrial Water Usage	**PROBLEM STATEMENT**	Carson's significant industrial sector, including refineries and manufacturing facilities, consumes large quantities of water, placing additional strain on the water supply during droughts.
	IMPACT	High water usage by industrial facilities can lead to conflicts over resource allocation between industrial, residential, and environmental needs. Industries may face operational challenges due to water restrictions, potentially leading to economic impacts such as reduced production and job losses.

Earthquake

The City of Carson, situated in the South Bay region of Los Angeles County, California, is located in one of the most seismically active areas in the United States. The city's proximity to several active fault lines, such as the Newport-Inglewood Fault Zone, places it at significant risk for earthquakes. Earthquakes pose a substantial threat to Carson's population, infrastructure, economy, and environment.

TABLE 104: EARTHQUAKE HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Critical Infrastructure	**PROBLEM STATEMENT**	Major transportation routes in Carson, including Interstate 405 (I-405), Interstate 110 (I-110), and the Alameda Corridor rail

		DESCRIPTION
Located in High Liquefaction Zones		line, traverse areas with high liquefaction potential.
	IMPACT	During an earthquake, soil liquefaction can cause ground failure, leading to severe damage or collapse of highways, bridges, and rail lines. Disruption of these critical transportation corridors would impede emergency response, evacuation efforts, and economic activities reliant on the movement of goods to and from the nearby Ports of Los Angeles and Long Beach.
Presence of Unreinforced Masonry Buildings and Older Structures	**PROBLEM STATEMENT**	A significant number of buildings in Carson were constructed before the implementation of modern seismic building codes, including unreinforced masonry (URM) buildings and non-ductile concrete structures.
	IMPACT	These older buildings are highly susceptible to damage or collapse during strong seismic shaking, posing risks of injury or death to occupants and bystanders. Collapse of commercial buildings can lead to substantial economic losses and long-term business closures, affecting the local economy.
Industrial Facilities Housing Hazardous Materials	**PROBLEM STATEMENT**	Carson hosts several major industrial facilities, including oil refineries like the Marathon Petroleum Refinery, chemical plants, and storage facilities that handle large quantities of hazardous materials.
	IMPACT	An earthquake could damage these facilities, leading to leaks, spills, fires, or explosions involving hazardous substances. Such incidents would pose immediate health risks to nearby communities, contaminate the environment, and require extensive emergency response and cleanup efforts.

Extreme Heat

The City of Carson is increasingly vulnerable to extreme heat events due to climate change and urbanization. Extreme heat poses significant risks to public health, infrastructure, the economy, and the environment.

TABLE 105: EXTREME HEAT HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Urban Heat Island Effect Amplifying Temperatures	**PROBLEM STATEMENT**	Carson's extensive industrial areas, asphalt surfaces, and limited green spaces contribute to the urban heat island effect, causing higher local temperatures compared to surrounding rural areas.
	IMPACT	Elevated temperatures exacerbate heat stress on residents, particularly during heatwaves, increasing the risk of heat-related illnesses. The lack of vegetation and tree canopy reduces natural cooling, leading to higher energy consumption for air conditioning and escalating utility costs for residents and businesses.
Vulnerable Populations Lacking Access to Cooling Centers	**PROBLEM STATEMENT**	A significant portion of Carson's population, including low-income households, the elderly, and individuals without reliable transportation, lack access to cooling centers or air-conditioned environments during extreme heat events.
	IMPACT	These vulnerable groups face increased health risks, including heat exhaustion and heatstroke. Social inequities are amplified as those without resources are disproportionately affected, potentially leading to higher morbidity and mortality rates during heatwaves.
Strain on Energy Infrastructure Leading to Power Outages	**PROBLEM STATEMENT**	Increased demand for electricity during extreme heat overwhelms Carson's aging electrical grid, leading to power outages and rolling blackouts.
	IMPACT	Power disruptions disable air conditioning systems, refrigeration, and medical equipment, exacerbating health risks. Businesses suffer from operational interruptions, leading to economic losses.

		DESCRIPTION
		Residents may be left without essential services during critical periods.

Extreme Cold

While the City of Carson, located in Los Angeles County, California, is known for its mild Mediterranean climate, it is not entirely immune to extreme cold and winter weather events. Although such occurrences are rare, they can have significant impacts on the community's population, infrastructure, economy, and environment when they do happen.

TABLE 106: EXTREME COLD HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Limited Preparedness Among Residents for Cold Weather	**PROBLEM STATEMENT**	Many Carson residents are unaccustomed to extreme cold temperatures and may lack appropriate winter clothing, heating systems, and awareness of cold weather safety practices.
	IMPACT	The lack of preparedness increases the risk of hypothermia and frostbite, especially among vulnerable populations such as the elderly, children, low-income households, and those experiencing homelessness. Residents may not recognize the signs of cold-related illnesses or know how to protect themselves adequately.
Inadequate Heating Infrastructure in Older Buildings	**PROBLEM STATEMENT**	A number of older residential and commercial buildings in Carson were constructed without modern insulation or efficient heating systems, making them less capable of retaining heat during cold spells.
	IMPACT	Occupants may face discomfort and health risks due to insufficient indoor temperatures. Increased energy consumption to maintain warmth can lead to higher utility bills, placing a financial strain on residents and businesses, particularly those with limited incomes.
Homeless Population at High Risk During Cold Events	**PROBLEM STATEMENT**	Carson has a population of individuals experiencing homelessness who lack access to adequate shelter during extreme cold weather.

		DESCRIPTION
	IMPACT	Without proper shelter, these individuals are at significant risk of exposure-related illnesses or death. The city may face increased demand for emergency shelter services, potentially exceeding current capacity and straining resources.

Flood

The City of Carson, located in Los Angeles County, California, is susceptible to flooding due to its geographical features, urban development patterns, and proximity to water bodies such as the Dominguez Channel. While Carson does not experience frequent catastrophic flooding, the risk remains significant, particularly in certain areas prone to stormwater overflow and infrastructure limitations.

TABLE 107: FLOOD HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Inadequate Stormwater Drainage Infrastructure	**PROBLEM STATEMENT**	Portions of Carson have outdated or insufficient stormwater drainage systems that are unable to handle heavy rainfall events, leading to localized flooding.
	IMPACT	Flooding of streets and properties during heavy rains can disrupt transportation, damage homes and businesses, and pose safety hazards to residents.
Proximity to the Dominguez Channel and Floodplains	**PROBLEM STATEMENT**	Residential and industrial areas adjacent to the Dominguez Channel are at risk of flooding due to potential overtopping or breaches during extreme weather events.
	IMPACT	Floodwaters can inundate homes and industrial facilities, leading to property damage, environmental contamination from industrial sites, and displacement of residents.
Aging Infrastructure Susceptible to Failure	**PROBLEM STATEMENT**	Aging sewer and water systems may be prone to failures during flood conditions, leading to sewage overflows and contamination.

		DESCRIPTION
	IMPACT	Infrastructure failures can result in environmental hazards, public health crises, and costly repairs for the city.

Hail

While hail is a relatively rare occurrence in Southern California, the City of Carson is not entirely immune to hail events. Hail can cause significant damage to property, disrupt transportation, and pose risks to public safety. Given the city's urban setting and industrial infrastructure, even infrequent hailstorms can have noticeable impacts.

TABLE 108: HAIL HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Exposure of Industrial Facilities to Hail Damage	**PROBLEM STATEMENT**	Carson's numerous industrial facilities, including refineries, warehouses, and manufacturing plants, have extensive outdoor equipment and storage areas that are vulnerable to hail damage.
	IMPACT	Damage to equipment and storage containers can lead to operational disruptions, financial losses, and potential environmental hazards if materials are exposed or released.
Vulnerability of Residential Properties with Aging Roofs	**PROBLEM STATEMENT**	Many residential homes in Carson have aging roofing materials that may not withstand hail impact, even from smaller hailstones.
	IMPACT	Damaged roofs can lead to leaks, water intrusion, and costly repairs, disproportionately affecting homeowners who may lack sufficient insurance coverage or financial resources for repairs.
Limited Historical Data Leading to Underestimation of Risk	**PROBLEM STATEMENT**	The rarity of hail events in Carson leads to limited historical data, which may result in underestimation of the risk by city planners and emergency management.
	IMPACT	Underpreparedness at the municipal level can hinder effective response and recovery efforts when hail events do occur.

High Wind

The City of Carson is prone to high wind events that can have significant impacts on the community. High winds in Carson are primarily associated with Santa Ana winds, Pacific storms, and occasionally thunderstorms. These winds can cause property damage, disrupt transportation and utilities, exacerbate wildfire risks, and pose safety hazards to residents.

TABLE 109: HIGH WIND HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Vulnerability of Mobile Homes and Older Residential Structures	**PROBLEM STATEMENT**	Carson has several mobile home parks such as Colony Cove Mobile Estates, and older residential areas where structures may not be built to current wind-resistant standards.
	IMPACT	These homes are more susceptible to wind damage, which can lead to injuries, displacement of residents, and financial hardship due to repair costs or loss of housing.
Increased Wildfire Risk During Santa Ana Winds	**PROBLEM STATEMENT**	Santa Ana winds are known to exacerbate wildfire conditions by providing dry, hot, and fast-moving air that can ignite and spread fires rapidly.
	IMPACT	Wildfires can threaten homes, businesses, and lives, particularly at the urban-wildland interface areas. The economic and environmental costs of wildfires are substantial, and recovery can take years.

Hurricane

While hurricanes are rare on the West Coast of the United States, recent events such as Tropical Storm Hilary in August 2023 have demonstrated that the City of Carson in Southern California is not entirely immune to the impacts of tropical cyclones. Climate change may increase the frequency of such unusual weather patterns, making it imperative for Carson to assess its vulnerabilities to hurricanes and tropical storms.

TABLE 110: HURRICANE HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Inadequate Stormwater Infrastructure for	**PROBLEM STATEMENT**	Carson's existing stormwater drainage systems may not be designed to handle the extreme rainfall associated with tropical

		DESCRIPTION
Extreme Rainfall Events		storms or weakened hurricanes, leading to urban flooding.
	IMPACT	Flooding can damage homes and businesses, disrupt transportation, and pose safety risks to residents, particularly in low-lying areas.
Low-Lying Areas Susceptible to Flooding	**PROBLEM STATEMENT**	Certain parts of Carson, especially those near the Dominguez Channel and areas below sea level, are at higher risk of flooding due to storm surge and heavy rainfall.
	IMPACT	Increased flood risk can lead to property damage, displacement of residents, and potential loss of life.

Industrial Pollution / Chemical Release

The City of Carson, located in Los Angeles County, California, is a hub for industrial activities, hosting oil refineries, chemical plants, manufacturing facilities, and significant transportation corridors.

TABLE 111: INDUSTRIAL POLLUTION / CHEMICAL RELEASE HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
High Concentration of Industrial Facilities Handling Hazardous Materials	**PROBLEM STATEMENT**	Carson's dense industrial zones include numerous facilities that store, process, and transport hazardous substances, increasing the potential for accidental releases.
	IMPACT	Accidental spills, leaks, or explosions can result in immediate health hazards, environmental contamination, property damage, and necessitate large-scale evacuations.
Proximity of Residential Areas to Industrial Sites	**PROBLEM STATEMENT**	Many residential neighborhoods in Carson are located adjacent to industrial facilities, refineries, and chemical plants.
	IMPACT	In the event of a hazardous materials incident, nearby residents are at higher risk of exposure to toxic substances, with limited time for warning and evacuation.

		DESCRIPTION
High Volume of Hazardous Materials Transportation	**PROBLEM STATEMENT**	Major transportation routes, including highways and rail lines, pass through Carson, carrying significant quantities of hazardous materials.
	IMPACT	Transportation accidents involving hazardous materials can occur, leading to spills or explosions that affect both the transportation network and surrounding communities.

Landslide / Mudflow

The extent of the City of Carson susceptible to landslides is relatively small due to the community being on largely flat terrain. However, the limited areas where landslides are more likely are near important infrastructure including railways, roadways, and flood channels.

TABLE 112: LANDSLIDE / MUDFLOW HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Sloped Terrain Near Interstate 405 and Alameda Corridor	**PROBLEM STATEMENT**	Some of the steepest slopes found within the City of Carson are those which form the banks of the Interstate 405 bridge over the Alameda Corridor railway system.
	IMPACT	Landslides or mudflows at the steepest slopes in the City of Carson can degrade the integrity of Interstate 405 and the Alameda Corridor. Depending upon the severity of the event, it may be necessary to halt use of these two transportation routes. Millions of vehicles use this section of Interstate 405 each year, and the Alameda Corridor is critical for transporting cargo to and from the Port of Los Angeles.

Land Subsidence / Karst

Land subsidence is a common hazard across large portions of the State of California, including land in and around the City of Carson. Land subsidence affecting the City of Carson is primarily the result of groundwater pumping and mineral and oil extraction.

TABLE 113: LAND SUBSIDENCE / KARST HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Groundwater Pumping and Oil Extraction	**PROBLEM STATEMENT**	Groundwater pumping and the extraction of oil and minerals contributed to land subsidence in many areas of California, including a majority of the City of Carson.
	IMPACT	Land subsidence can cause damage to residential and commercial buildings, critical infrastructure, and other components of urban development due to uneven forces applied. The impacts of land subsidence can range from uneven sidewalks to fractured foundations resulting in the loss of structural integrity.

Pandemic / Epidemic

The City of Carson is a highly urban setting in which people live, work, and recreate in close proximity to others. Additionally, the City of Carson is bordered on all sides by other communities which are pieces of the larger Los Angeles metropolitan area, and many individuals travel around the metro for work and other purposes. The density of people within the City of Carson and the connections with other nearby communities can increase vulnerability to communicable diseases.

TABLE 114: PANDEMIC / EPIDEMIC HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Dense Population with the City of Carson	**PROBLEM STATEMENT**	The density of people living with the City of Carson increases the speed at which an infectious disease can spread.
	IMPACT	A contagious disease generally spreads through close contact between infected individuals and others. As a highly-urbanized area, residents in the City of Carson frequently come in close contact with one-another—this can make it difficult for medical professionals to respond to an outbreak before it has reached large swaths of residents in the community.
High Connectivity with External Jurisdictions	**PROBLEM STATEMENT**	The City of Carson is bordered on all sides by urban communities and has multiple connections to external jurisdictions which

		DESCRIPTION
		could potentially be avenues through which infectious diseases enter the community.
	IMPACT	There is a significant possibility that new diseases reach the City of Carson through infected individuals which enter the community from outside areas. Even with advanced notice of a disease spreading outside of the community, closing off the City of Carson requires considerable resources. There are hundreds of points where vehicles can enter the City of Carson, and pedestrians can theoretically enter the community virtually anywhere along its borders.

Severe Storm / Thunderstorm / Lightning

Although the climate surrounding the City of Carson is primarily associated with warm and sunny conditions, the region does experience infrequent storms, some of which may be severe. Severe storms can bring high winds, hail, heavy rain, and lightning.

TABLE 115: SEVERE STORM / THUNDERSTORM / LIGHTNING HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Large Inventory of Industrial Assets Sensitive to Heat	**PROBLEM STATEMENT**	Large portions of the City of Carson are occupied by industrial facilities, and many of these facilities use and store materials which can ignite if exposed to the heat produced by lightning.
	IMPACT	Adequate safety features are necessary to prevent fires resulting from lightning strikes at warehouses, oil and gas terminals, and refineries if these safety features fail, a major fire can ignite, and the nature of the burning material may make it difficult for first responders to quickly extinguish the blaze.
Large Inventory of Assets Sensitive to Electricity Surges	**PROBLEM STATEMENT**	Like most communities, the City of Carson relies on technology for a wide range of purposes. Surges in electrical currents—

		DESCRIPTION
		such as those resulting from a lightning strike—can damage or destroy technology.
	IMPACT	If an electrical surge is not mitigated by safety features, the resulting damage can damage or destroy technology. The resulting impacts can range from interrupted wifi and cellular service to inoperable medical equipment like ventilators and dialysis machines. Gridlock can occur if traffic lights no longer function properly, and business operations may be severely disrupted if they rely on damaged or destroyed computer systems.
Changing Climate Conditions	**PROBLEM STATEMENT**	Changing climate conditions may make severe storms more frequent or severe.
	IMPACT	If the overall trend is that severe storms become more common and are more energetic then the City of Carson will likely face increased costs resulting from the damage from lightning strikes, flash flooding, high winds, and hail.

Tornado

Tornadoes are violently rotating columns of air which are typically produced in severe storms or supercells. Tornadoes are uncommon in Southern California, but they are not unprecedented. While tornadoes typically last a matter of minutes, they can cause significant damage while on the ground. Additionally, as climate conditions shift, tornadoes may become more common events in the region.

TABLE 116: TORNADO HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Limited Volume of Assets Designed and Constructed to Handle Tornadoes	**PROBLEM STATEMENT**	The International Building Code (IBC) applicable within the City of Carson does not consider the region to be tornado prone. Therefore, structures built in the community are not required to be designed and constructed with consideration for tornado loads.
	IMPACT	Tornadoes can generate wind speeds well above those normally encountered in the

		DESCRIPTION
		City of Carson, even on gusty days. Structures which are not designed to withstand these forces—which could be a significant portion of the community—may be heavily damaged by tornadoes. Damage can result in injuries and fatalities to those inside, and airborne debris can cause additional damages and injuries to people and property nearby.
Changing Climate Conditions	**PROBLEM STATEMENT**	Changing weather patterns may increase the frequency and severity of tornadoes in the region.
	IMPACT	While the exact impacts of changing climate conditions on tornado events are not fully known, it is possible that these events may become more frequent and severe. The lack of previous events may mean that residents and community officials are not adequately prepared to take immediate action, and delays in issuing warnings or seeking shelter can increase the likelihood of injuries.

Tsunami / Seiche

Tsunamis occur when a large amount of water is rapidly displaced, typically by earthquakes or volcano eruptions. The resulting wave can travel at speeds in excess of 500 miles per hour in deep water, although it will slow down as the depth becomes shallower. When a tsunami reaches a coastline, the surge of water can extend multiple miles inland, and the force of the water can carry away entire structures. The warning time ahead of a tsunami largely depends on where it originates and can range from minutes to hours.

TABLE 117: TSUNAMI / SEICHE HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Damage to the Dominguez Channel	**PROBLEM STATEMENT**	The only portion of the City of Carson projected to be inundated by a tsunami is along the Dominguez Channel.
	IMPACT	The Dominguez Channel may be damaged by the surge of water produced by a tsunami. Additionally, debris from around the Port of Los Angeles may be swept up

		DESCRIPTION
		the Dominguez Channel—debris may include hazardous materials which put the surrounding areas at risk of exposure. Additionally, debris pushed into the channel may restrict the normal flow of water, which may result in local flooding around the channel.
Impact on Neighboring Communities will Extend Beyond Political Boundaries	**PROBLEM STATEMENT**	If a tsunami impacts the coast Los Angeles County, the effects will likely extend across political boundaries and beyond the areas inundated by water.
	IMPACT	Following the alert signalling an impending tsunami but prior to the impact, many residents will attempt to evacuate further inland. This can create major traffic congestion along roadways in the City of Carson, which will likely be exacerbated by fear. First responders may also be asked to help evacuate elderly care facilities, schools, and other assets housing vulnerable populations. Following a tsunami, the City of Carson—like many other inland communities in the county—may need to accommodate displaced individuals and offset the loss of medical services in areas inundated by seawater.

Urban Fire

Urban fires are among the most common emergencies that communities face. Many of these fires are relatively minor in nature, but the possibility exists for large fires that can engulf large structures like malls and spread across multiple buildings. Additionally, the City of Carson faces unique vulnerabilities stemming from the large portion of industrial facilities within its boundaries. These facilities may store large volumes of materials which may complicate firefighting efforts.

TABLE 118: URBAN FIRE HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Density of Structures in the City of Carson	**PROBLEM STATEMENT**	The City of Carson is a highly urban setting where many homes and businesses are located close to other structures.

		DESCRIPTION
	IMPACT	The proximity of structures can increase the likelihood of an urban fire in one structure spreading to another. Building codes are meant to reduce this risk, but enforcement of applicable building codes can be time consuming. Furthermore, enforcement of building codes may be unpopular among community members, especially if the purpose is not properly communicated.
Industrial Facilities within the City of Carson	**PROBLEM STATEMENT**	The City of Carson contains a variety of industrial facilities which may store significant amounts of hazardous and flammable materials.
	IMPACT	An urban fire at an industrial facility or nearby structure may damage the infrastructure storing hazardous and flammable materials. This can lead to an uncontrolled release of these materials, and they may ignite. Fires involving petroleum products, industrial solvents, and other materials common in industrial operations often have properties which may create unique challenges for emergency responders.

Wildfire

Wildfires are well-known hazards in California, although the impact of wildfires can vary. For the City of Carson, the primary concern related to wildfire is the smoke that can blow over the community. Smoke produced by wildfires contains a variety of air pollutants which are harmful when ingested. Potential impacts of prolonged exposure to wildfire smoke include eye irritation, respiratory issues, headaches, and nausea.

TABLE 119: WILDFIRE HAZARD VULNERABILITY AND IMPACTS

		DESCRIPTION
Santa Ana Winds can Carry Air Pollutants	**PROBLEM STATEMENT**	Santa Ana winds are particularly strong easterly winds which generally affect the region multiple times per year. Santa Ana winds can carry embers and air pollutants across large distances.

		DESCRIPTION
	IMPACT	Smoke produced by wildfires contains a wide variety of air pollutants that are harmful when ingested. These pollutants can be carried across large distances by the powerful Santa Ana winds, and this can result in City of Carson residents experiencing the negative health effects associated with exposure to wildfire smoke. Populations like the elderly, young children, and those with respiratory challenges such as asthma are particularly vulnerable to this hazard.
Changing Climate Conditions	**PROBLEM STATEMENT**	Climate change can bring about conditions which are more conducive for wildfire ignition.
	IMPACT	According to the California Office of Environmental Health Hazard Assessment (OEHHA), large wildfires (10,000 acres or more) have increased significantly in recent years. Of the 20 largest wildfires in California history, 10 occurred in 2020 and 2021. OEHHA states that climate change is at least partly responsible for this increase. In places like the City of Carson, larger and more frequent wildfires will, over time, increase the number of days per year that residents are exposed to harmful air pollutants.

iv) Changes in Vulnerability Summary

The following table provides a summary of whether the City of Carson's overall vulnerability to each of the hazards profiled in this plan increased, decreased, or stayed the same since the previous hazard mitigation plan. The changes were determined through a review of numerous pieces of information. First, census data between 2010 and 2020 was used to ascertain the changes in housing units and people within the community over time. The 2021 City of Carson Housing Needs Assessment determined that most development that existed in 2021 had already been built by 1981. Second, the characteristics of each hazard were examined to assess whether changes in development or population would affect the frequency and severity of hazard occurrences. For instance, it was determined that changes to the number of structures in the City of Carson would not have a meaningful impact on the frequency and severity of pandemics/epidemics. Finally, available research literature and climate information was used to determine whether a reasonable causal link between climate change and each hazard exists, and if so, how recent climate trends are likely to affect the frequency and severity of these hazards. The following symbols are used to describe how recent development, population, and climate trends may affect the City of Carson's vulnerability to each hazard:

↑ **Increased Risk**

↔ **No Significant Change to Risk**

↓ **Decreased Risk**

TABLE 120. CHANGES IN VULNERABILITY DUE TO RECENT DEVELOPMENT, POPULATION, AND CLIMATE TRENDS

Hazard	Change Variables		
	Development	Population	Climate
Drought & Water Shortage	↑	↑	↑
Earthquake	↑	↑	↔
Extreme Heat	↔	↑	↑
Extreme Cold / Winter Weather	↔	↑	↑
Flooding	↑	↑	↑
Hail	↑	↑	↑
High Wind	↑	↑	↔
Industrial Pollution / Chemical Release	↔	↑	↔
Landslide / Mudflow	↑	↑	↑
Land Subsidence / Karst	↑	↑	↔
Pandemic / Epidemic	↔	↑	↔

Hazard	Change Variables		
	Development	Population	Climate
Severe Storm / Thunderstorm / Lightning	↑	↑	↑
Tornado	↑	↑	↑
Tsunami / Seiche	↔	↑	↔
Urban Fire	↑	↑	↔
Wildfire	↔	↑	↑

5) MITIGATION STRATEGY

A) INTRODUCTION

The Mitigation Strategy functions as a comprehensive guide for future hazard mitigation policies, projects, and administration within the City of Carson and its participating stakeholders and partners. It directly reflects the consensus of the City of Carson Hazard Mitigation Planning Team and incorporates findings from the Hazard Identification and Risk Assessment. The three components of the Mitigation Strategy include:

1. **Mitigation Goals**: These represent the overarching aspirations. Broad policy statements, they depict the long-term outcomes the City of Carson hopes to achieve.
2. **Mitigation Objectives**: Detailing the "paths to success" strategies or steps aimed at realizing the goals.
3. **Mitigation Actions**: Specific and actional "steppingstones" that moves the community along the path toward resiliency goals. These actions make up a "menu" of projects for future implementation or grant funding applications.

B) GOALS

The mitigation plan goals describe the overall direction that the City of Carson can take to work toward mitigating risk from natural hazards. The goals are stepping-stones between the broad direction of the mission statement and the specific recommendations outlined in the action items.

There have not been any substantive changes to the community's overall goals or priorities since the previous plan update that have affected the goals of this plan. The 2024 mitigation strategy goals are listed below.

Protect Life, Environment, and Property

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development in high hazard areas and encouraging preventive measures for existing development in areas vulnerable to natural hazards.

Public Awareness

- Develop and implement education and outreach programs to increase public awareness of risks associated with natural hazards.
- Provide information on tools; partnerships opportunities, and funding resources to assist in implementing mitigation activities.

Natural Systems

- Balance natural resource management and land use planning natural hazard mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interested in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local and regional hazard mitigation activities.

Emergency Services

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

C) MITIGATION ACTIONS

The planning team ranked the various mitigation actions using categories of "low, medium, high" based on the overall value of the action items. See the table below for the action items and rankings.

The Federal Emergency Management Agency's approaches to identify costs and benefits associated with hazard mitigation strategies or projects fall into two categories: benefit cost analysis and cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigation hazards can provide decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

The action items are a listing of activities in which City agencies and residents can be engaged to reduce risk. Items were identified by the planning team that were actionable, realistic, and aligned with other stated City goals - like initiatives identified within the newly updated General Plan. Hazard Mitigation Actions from the last plan were carried over when applicable. However, as seen in the time elapsed since the last update, mitigation efforts within the city have faced various challenges in implementation. This plan update and the actions identified within are the practical steps necessary to move the city forward toward a more resilient future.

Each action item includes an estimate of the timeline for implementation. Short-term action items are activities that the City may implement with existing resources and authorities within one to two years. Long-term action items may require new or additional resources or authorities and may take between one to five years or more to implement. The actions items are organized within the following matrix, which lists all the multi-hazard and hazard-specific action items included in the mitigation plan. Data collection and research and the public participation process resulted in the development of the action items. The matrix includes the following information for each action item:

Funding Sources: The action items can be funded through a variety of sources, possibly including operating budget/general fund, development fees, Community Development Block Grant (CDBG), Hazard Mitigation Grant Program (HMGP), other Grants, private funding, Capital Improvement Plan, and other funding opportunities.

Coordinating Organization: The Mitigation Actions Matrix assigns primary responsibility for each of the action items. The hierarchies of the assignments vary – some are positions, other departments, and other committees. No matter, the primary responsibility for implementing the action items falls to the entity shown as the "Coordinating Organization". The coordinating organization is the agency with regulatory responsibility to address hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Coordinating organizations may include local, county, or regional agencies that are capable of or responsible for implementing activities and programs.

Plan Goals Address: The plan goals addressed by each action item are included to monitor and evaluate how well the mitigation plan is achieving its goals once implementation begins. Each action items are linked to one more of the Plan goals:

- Protect Life, Environment, and Property
- Public Awareness
- Natural Systems
- Partnerships and Implementation

- Emergency Services

Ranking: Each of the mitigation action items is ranked Low, Medium, and High based on the following criteria.

- Solve the problem?
- Address Vulnerability Assessment?
- Reduce the exposure or vulnerability to the highest priority hazard?
- Address multiple hazards?
- Benefits equal or exceed costs?[158]
- Implement a goal, policy, or project identified in the General Plan or Capital Improvement Plan?
- Use existing funds?
- Use existing state or federal grant programs?
- Completed within the 5-year life cycle of the LHMP?
- Use currently available technologies?
- Community buy-in?
- Have a negative impact on certain populations or communities?
- Require change in local ordinances or zoning laws?
- Positive or neutral impact on the environment?
- Comply with all local, state, and federal environment laws and regulations?
- Sufficient staff to undertake the project?
- Existing authority to undertake the project?

[158] Only a general economic cost/benefit review was considered through the process of selecting and prioritizing mitigation actions. Mitigation actions with "high" priority were determined to be the most cost effective and most compatible with the participating jurisdictions' unique needs. Actions with a "moderate" priority were determined to be cost-effective and compatible with jurisdictional needs but may be more challenging to complete administratively or fiscally than "high" priority actions. Actions with a "low" priority were determined to be important community needs, likely included several potential challenges in terms of implementation (e.g. lack of funding, technical obstacles). A more detailed cost/benefit analysis will be applied to particular projects prior to the application for or obligation of funding, as appropriate.

TABLE 121. 2024 MITIGATION ACTIONS

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	Multi-Hazard Mitigation Actions								
MH-1	Integrate the goals and action items from the City of Carson Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Hazard Mitigation Working Groups	Ongoing and continuous	H	2-5 Years
MH-2	Identify and pursue funding opportunities to develop and implement mitigation activities	Multi-Hazards	Partnerships and Implementation	N/A	General Funds	Public Services, Finance and Administrative Working Groups	Ongoing, as opportunities are made available	H	Continuous
MH-3	Establish a formal role for the Emergency Management Services Division to develop a sustainable process for implementing, monitoring, and	Multi-Hazards	Partnerships and Implementation	N/A	General Funds	Emergency Management Services Division	Completed	M	Completed

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	evaluating citywide mitigation activities.								
MH-4	Identify, improve, and sustain collaborative programs focusing on the real estate and insurance industries, public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards	Multi-Hazard	Protect Property and Life, Public Awareness, Partnerships, and Implementation	N/A	General Funds	Economic Development Working Group, PIO	Not started	L	Continuous
MH-5	Develop public and private partnerships to foster natural hazard mitigation program coordination and collaboration in the city	Multi-Hazard	Partnerships and Implementation	N/A	General Funds, HMA Grants	Hazard Mitigation Working Groups	Initiated	H	10 Years
MH-6	Develop inventories of at-risk buildings and infrastructure and prioritize mitigation projects	Multi-Hazard	Partnerships and Implementation	N/A	General Funds, FEMA HMA Grants	Hazard Mitigation Working Groups	Initiated	H	1-2 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
MH-7	Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs and enhancing public education on a regional scale.	Multi-Hazard	Emergency Services	N/A	General Funds, CDBG	Hazard Mitigation Working Groups	Initiated	H	5 Years
MH-8	Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies, private property owners, businesses, and schools	Multi-Hazard	Public Awareness	N/A	General Funds, HMA Grants	Hazard Mitigation Working Groups	Ongoing and continuous	M	1-2 years
MH-9	Use technical knowledge of natural ecosystems and events to link natural resource management and land use organizations to mitigation activities	Multi-Hazard	Natural Systems	N/A	General Funds	Hazard Mitigation Working Groups	Not started	L	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	and technical assistance								
MH-10	Install and Improve back-up power in critical facilities	Multi-Hazards	Protect Life and Property	N/A	General Funds, FEMA HMA Grants	Public Works / Facilities	No Progress	H	Long term; 10+ Years
MH-11	Provide additional sheltering facilities	Multi-Hazards	Partnerships and Implementation	N/A	General Funds	Emergency Management Services Division, and Parks & Recreation	Ongoing	M	5 years
MH-12	Promote public education to increase awareness of hazards and opportunities for mitigation	Multi-Hazards	Partnerships and Implementation	N/A	General Funds, HMA Grants	Public Services/Public Safety-Emergency Services	Ongoing and continuous	M	1-2 years
MH-13	Promote business mitigation awareness to increase knowledge of public facilities managers	Multi-Hazard	Public Awareness	N/A	General Funds, HMA Grants	Public Services, Emergency Management Services Division, and Economic Development	Ongoing and continuous	M	1-2 years
MH-14	Write and administer appropriate grants to	Multi-Hazard	Emergencies Services	N/A	General Funds	Public Services, Emergency	Initiated	L	5 years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	enhance all agencies/departments' incident response capabilities					Management Services Division			
MH-15	Engage the private sector to contribute to disaster preparedness and loss reduction at the local level	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Public Services, Emergency Management Services Division, and Economic Development	Not started	M	2-5 years
MH-16	Conduct benefit/cost analysis for a mitigation activity to assist the community in determining whether a project is worth undertaking now, in order to avoid disaster -related damages later	Multi-Hazard	Protect Life and Property	N/A	General Funds	Redevelopment	Ongoing, as needed	L	5 Years
MH-17	Purchase a complete GIS/GPS setup and provide training on said setup to all pertinent community personnel	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Information Technology, GIS	Planning	M	1 year

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
MH-18	Partner with other organizations and agencies in the community to identify grant programs and foundations that may support mitigation activities	Multi-Hazard	Partnerships and Implementation	N/A	General Funds, BRIC	Emergency Management Services Division	Not started	L	7 years
MH-19	Determine how, when, and under what circumstances government will demolish structures	Multi-Hazard	Protect Life and Property	N/A	General Funds	Building and Safety	Not started	L	5 Years
MH-20	Educate the public about emergency sheltering and evacuation procedures	Multi-Hazards	Public Awareness	N/A	General Funds	Public Services, Emergency Management Services Division	Ongoing and Continuous	M	Continuous and routine
MH-21	Educate the public about hazards prevalent to their area.	Multi-Hazard	Protect Life and Property, Public Awareness	N/A	General Funds, HMA	Public Services, Emergency Management Services Division	Ongoing and Continuous	L	Continuous and routine
MH-22	Hold a city-sponsored hazard mitigation seminar for the community residents	Multi-Hazard	Public Awareness	N/A	General Funds, HMA	Public Service Emergency Management Services Division	Ongoing, Planned for 2024	M	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
MH-23	Publicize the documents associated with emergency response and mitigation	Multi-Hazard	Public Awareness	N/A	General Funds	Public Services Emergency Management Services Division	Ongoing, Planned for 2024	M	1 Year
MH-24	Develop website and social media postings that provide information about the community's SEMS Plan and Hazard Mitigation Plan.	Multi-Hazard	Public Awareness	N/A	General Funds, HMA Planning grants	Emergency Management Services Division	Ongoing and continuous	H	5 Years
MH-25	Develop a "how to" mitigation display booth to be used at special events. This display would include pictures and information, such as that contained in FEMA's Retrofitting for Homeowners Guide, Elevating Your Flood Prone Home, how to elevate critical	Multi-Hazard	Public Awareness	N/A	General Funds, HMGP	Emergency Management	Ongoing, Planned for 2024-2025	M	2 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	structures and utilities and information on the NFIP								
MH-26	Develop a Debris Management Plan	Multi-Hazard, Landslide, Wildfire, Flood, Winter Weather	Emergency Services	N/A	General Funds	Development Services/Public Works Division	Initiated	L	1 Year
MH-27	The Public Safety Department website has information about disaster preparedness and related links. The plan to expand and update the website as needed and as appropriate in a timely manner to benefit all City residents	Multi-Hazard	Public Awareness	N/A	General Funds	Emergency Management Services Division	Initiated	L	1 Year
MH-28	Involve private businesses throughout the county in mitigation planning	Multi-Hazard, Drought, Hail,	Public Awareness, Partnerships and Implementation	N/A	General Funds, HMA	Emergency Management Services Division	Initiated	L	7 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
		Extreme Winter Weather (Cold)			planning grant				
MH-29	Provide schools with seasonal disaster preparedness literature for students to take home to their families	Multi-Hazard	Public Awareness	N/A	General Funds, HMGP	Emergency Management Services Division	Initiated	L	1 Year
MH-30	Distribute preparedness literature, from FEMA to the local Chamber of Commerce to prepare businesses for emergencies and disasters.	Multi-Hazard	Public Awareness, Partnerships and Implementation	N/A	General Funds	Emergency Management Services Division	Initiated	M	1 Year
MH-31	Hold workshops about hazard mitigation and family disaster planning with the boys' and girls' clubs, scouting organizations, churches, PTA, Red Cross Youth Corps,	Multi-Hazard	Public Awareness, Partnerships and Implementation	N/A	General Funds, volunteers	Emergency Management Services Division	Planning	M	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	VOAD, Chamber of Commerce, Rotary, Kiwanis, and Lions Club. The City maintain ongoing relationships with VOAD, Red Cross, and the Department of Health.								
MH-32	Train in-house shelter staff to work as a shelter team with courses including the American Red Cross's Introduction to Disasters, Shelter Operations, Mass Care and Donations Management	Multi-Hazard	Participation and Implementation, Emergency Services	N/A	General Funds, volunteers	Parks & Recreation Division	Initiated	M	5 Years
MH-33	Identify and prioritize needs for additional shelter supplies to include but not limited to additional cots, blankets, and shelter kits	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Parks & Recreation	Initiated	M	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
MH-34	Develop and present guidance from the American Red Cross to homeowner associations, Parent Teacher Associations, the Boards of Education, Chamber of Commerce's etc. to educate on shelter in-place procedures	Multi-Hazard	Public Awareness	N/A	General Funds, volunteers	Emergency Management Services Division	Initiated	L	1 Year
MH-35	Develop and promote a communications plan to recruit and train more volunteers for sheltering assistance.	Multi-Hazard	Public Awareness, Partnerships and Implementation, Emergency Services	N/A	General Funds, volunteers	Emergency Management Services Division	Planning	L	5 Years
MH-36	Work with the American Red Cross to hold work session to share information about local shelters, Information to include the site of each shelter, how many people it	Multi-Hazards	Partnerships and Implementation, Emergency Services	N/A	General Funds, volunteers and donations	Parks & Recreation Division	Planning	M	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	can house and feed, if it has back-up available on site, completed site survey forms and types of resources that they have or that all they need. This will benefit all areas of the County in the need to open shelters								
MH-37	Conduct annual disaster exercises with local law enforcement emergency managers, city, and county officials, the LEPC and other disaster response agencies.	Multi-Hazards	Partnerships and Implementation, Emergency Services	N/A	General Funds, EMPG	Emergency Management Services Division	Ongoing, annual	M	5 Years
MH-38	Maintain NIMS compliance to guide all levels of government, nongovernmental organizations and the private sector to work together to prevent,	Multi-Hazard	Protect Life and Property, Partnerships and Implementation, Emergency Services	N/A	General Funds, EMPG	Emergency Management Services Division	Ongoing, annual	H	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	protect against, mitigate, respond to and recover from incidents. The city has maintained NIMS compliance since 2012.								
MH-39	Maintain and upgrade the Emergency Operations Center (EOC) at the City Hall. In the event the primary sites must be vacated, the off-site back-up centers can be rapidly mobilized in a secured facility. Both centers will duplicate the primary points in operations	Multi-Hazard	Emergency Services	N/A	General Funds	Emergency Management Services Division	Planning	H	Long term; 10+ Years
MH-40	Promote CERT through the Chamber of Commerce Watch to gain business and neighborhood participation	Multi-Hazard	Public Awareness, Partnerships and Implementation, Emergency Services	N/A	General Funds	Emergency Management Services Division, LA County Sheriff and Fire Departments	Initiated	M	5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
MH-41	Coordinate the maintenance of emergency transportation routes with neighboring jurisdictions and CalTrans	Multi-Hazard	Emergency Services	N/A	General Funds	Development Services/Public Works Division	Planning	M	1-3 Years
MH-42	Determine what kinds of minor repairs and temporary protection activities (e.g., temporary roofing, protect against loss of life/injury, shoring, protect contents) can be done in the immediate aftermath of a disaster	Multi-Hazard	Protect Life and Property, Emergency Services	N/A	General Funds	Development Services/Public Works, and Public Services/Parks Maintenance-Building Maintenance Section	Planning	M	7 Years
MH-43	Enhance city response capabilities to improve outcomes for populations with access and functional needs and other identified at-risk	Multi-Hazards	Protect Life and Property, Public Awareness, Partnerships and Implementation, Emergency Services	N/A	General Funds	Emergency Management Services Division	Planning	H	7 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	populations and communities.								
	Earthquake Mitigation Actions								
EQ-1	Integrate earthquake hazard mapping data for Los Angeles County and improve technical analysis of earthquake hazards	Earthquake	Protect Life and Property, Partnerships and Implementation	N/A	General Funds	GIS/USGS	Initiated	H	2 Years
EQ-2	Develop Evacuation Routes into appropriate planning documents	Earthquake	Protect Life and Property, Partnerships and Implementation	N/A	General Funds	Public Works Division and Emergency Management Services Division	Initiated	M	3 Years
EQ-3	Identify funding sources for structural and nonstructural retrofitting of structures that are identified as seismically vulnerable	Earthquake	Protect Life and Property, Public Awareness	N/A	General Funds	Economic Dev./Planning Division, Development Services/Building and Safety Division, and Engineering Services Division	Initiated	M	Long term; 10+ Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
EQ-4	Retrofit homes, schools, business, and government offices to increase earthquake resilience	Earthquake	Protect Life and Property, Public Awareness	N/A	General Funds	Hazard Mitigation Working Groups	Not Started	M	Long term; 10+ Years
EQ-5	Identify activities for private sector and citizen involvement such as nonstructural seismic daycare retrofits	Earthquake	Public Awareness, Partnerships and Implementation	N/A	General Funds	Emergency Management Services Division	Not Started	L	Long term; 10+ Years
	Extreme Heat Actions								
EH-1	Identify and open additional cooling zones and centers within the City of Carson to provide additional capacity of vulnerable populations	Extreme Heat	Protect Life and Property	N/A	General Funds,	Emergency Services	Not Started	M	Long term; 10+ Years
EH-2	Initiate an extreme heat public awareness and educational campaign to discuss the dangers of extreme heat, steps each	Extreme Heat	Protect Life and Property, Public Awareness	N/A	General Funds	Emergency Services/ Public Works	Planning	M	3-5 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	individual can personally take during periods of extreme heat and ways to reduce energy consumption during periods of extreme heat.								
EH-3	Develop/enhance a program which supports local residents and volunteers checking on neighbors during extreme heat events.	Extreme Heat	Protect Life and Property, Partnerships and Implementation	N/A	General Funds,	Emergency Services	Planning	L	5+ Years
EH-4	Support efforts of senior centers to strengthen HVAC systems and incorporate backup power systems to ensure safe conditions during extreme heat events	Extreme Heat	Protect Life and Property, Partnerships and Implementation	N/A	General Funds,	Emergency Services/ Public Works	Planning	M	3-4 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	Flood Mitigation Actions								
FLD-1	Analyze areas prone to urban flooding (ponding etc.) and identify feasible mitigation options	Flood	Protect Life and Property, Partnerships and Implementation	N/A	General Funds	Development Services, Engineering Division, and Public Works	Initiated	M	1-2 Years
FLD-2	Recommend revisions to requirements for development within the flood-prone areas, where appropriate	Flood	Protect Life and Property	N/A	General Funds	Development Services/Public Works Division, and Economic Development/Planning Division	Not started	M	1-2 years
FLD-3	Improve emergency communications for flooding through enhancing data and mapping for floodplain information within the City and identify and map flood prone areas outside of designated floodplains	Flood	Protect Life and Property, Public Awareness, Emergency Services	N/A	General Funds, FEMA HMA Grants	Information Technology Services, and Emergency Management Services Division	Initiated	M	1-2 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
FLD-4	Identify surface water drainage obstruction for all parts of the city	Flood	Protect Life and Property, Natural Systems	N/A	General Funds, FEMA HMA Grants, CDBG	Planning and GIS	Not started	M	5 years
FLD-5	Record and maintain all tax parcel information and floodplain locations in a GIS system in order to build the community's capability to generate maps when needed	Flood	Emergency Services	N/A	General Funds	Information Technology Services and GIS	Ongoing	L	Continuous
FLD-6	Record all structures within the floodplain, as well as areas of repetitive losses due to flooding	Flood	Partnerships and Implementation	N/A	General Funds	Building and Safety	Completed as part of this plan update	M	Complete
	High Wind Mitigation Actions								
WS-1	Develop and implement programs to keep trees from threatening lives,	High Winds	Partnerships and Implementation, Emergency Services	N/A	General Funds	Public Services/Landscape & Building Maintenance	Planning	H	2 Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	property, and public infrastructure during windstorm events					Services, and Development Services/Public Works Division			
WS-2	Support/encourage electrical utilities to use underground construction methods where possible to reduce power outages from high wind events	High Winds	Natural Systems, Partnerships and Implementation	N/A	General Funds	Economic Development/Planning Division and Development Services/Engineering Services	Ongoing	M	5 Years
WS-3	Increase public awareness of high wind mitigation activities	High Winds	Protect Life and Property, Public Awareness	N/A	General Funds	Development Services/Public Works, and Public Services/Landscape & Building Maintenance	Ongoing	L	Continuous
Industrial Pollution/Chemical Release									
IP-1	Support training for all First Responders	Industrial Pollution/ Chemical Release	Emergency Services	N/A	General Funds, Staffing for Adequate Fire and Emergency	Emergency Services	Ongoing	M	5+ Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
					Response (SAFER), FEMA HMA Grants				
IP-2	Identify and increase water management practices that reduce pesticide movement offsite to mitigate hazardous materials impacts.	Industrial Pollution/ Chemical Release	Protect Life and Property, Partnerships and Implementation	N/A	General Funds	Public Works/Land Building Maintenance	Ongoing	L	3+ Years
IP-3	Develop countywide commodity flow study to further understand the quantity and types of hazardous materials being transported through the county to provide the basis for additional mitigation actions.	Industrial Pollution/ Chemical Release	Protect Life and Property, Partnerships and Implementation, Emergency Services	N/A	General Funds	Public Works/Land Building Maintenance/ Planning/Emergency Services	Ongoing	M	5+ Years
Pandemic/Epidemic									

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
PAN-1	Points of Distribution (POD) planning/training	Pandemic/ Epidemic	Partnerships and Implementation, Emergency Services	N/A	General Funds	Emergency Services	Planning	L	5+ Years
PAN-2	Provide unified information to the public regarding personal protective measures and mitigating strategies in accordance with CDC guidelines. Implement public health measures in government facilities	Pandemic/ Epidemic	Project Life and Property, Public Awareness, Partnerships and Implementation	N/A	General Funds, FEMA HMA Grants	Emergency Services/ Public Information Office	Planning	L	5+ Years
Urban Fire									
UF-1	Develop/enhance partnerships for a countywide vegetation management program.	Urban Fire	Natural Solutions, Partnerships and Implementation	N/A	General Funds, FEMA HMA Grants	Public Works/Land Building Maintenance	New	M	5+ Years
UF-2	Educate the public about the need to assess and mitigate their vulnerabilities to	Urban Fire	Protect Life and Property, Public Awareness	N/A	General Funds, Fire Prevention and Safety	Public Works/Land Building Maintenance/	Ongoing	M	5+ Years

NATURAL HAZARD	MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	TIMELINE
	home loss, including the potential for grant funding to carry out mitigation activities.				Grant Program	Public Information Office			

Priority: *H=High, M=Medium, L=Low*

The table below lists the mitigation actions that have either been completed since the last plan update completed in 2018, or removed because the actions were redundant or no longer applicable. Updates on the 2018 mitigation actions were identified by the planning team. These actions listed below are not included in the 2024 mitigation actions table.

TABLE 122. COMPLETED 2018 MITIGATION ACTIONS

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
Multi-Hazard Mitigation Actions								
Incorporate General Plan Safety Element Policies into the Carson	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Public Safety Commission	Completed	H	

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
Natural Hazards Mitigation Plan.								
Adoption of Uniform Building Code by municipality.	Multi-Hazard	Protect Life and Property	N/A	General Funds	Building and Safety	Completed	H	
Develop updates for the Natural Hazards Mitigation Action Plan based on new information	Multi-Hazard	Protect Life and Property, Emergency Services	N/A	General Funds, Grant funding	Economic Development/Planning Division	Completed	H	
Minimize suffering and disruption caused by disasters	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Public Services/Public Safety	Removed	H	This is not an action that can be implemented and tracked
Identify and pursue funding opportunities to develop and implement local mitigation activities.	Multi-Hazard	Protect Life and Property	N/A	General Funds	Economic Services, Planning, and Public Services, Public Safety	Removed		This action is redundant and similar to another mitigation action
Identify all organizations within the jurisdiction that have programs or interests in natural hazards mitigation.	Multi-Hazard	Public Awareness	N/A	General Funds	Public Safety	Removed	L	This action is redundant and similar to another mitigation action

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
Minimize suffering and disruption caused by disasters by developing effective plans, community outreach, education and partnerships, practicing response capabilities and mitigating hazards.	Multi-Hazard	Protect Life and Property	N/A	General Funds	Fire, Law Enforcement, and Public Safety	Removed	H	This action is redundant and similar to another mitigation action
Post the community's Hazard Mitigation Plan on the website	Multi-Hazard	Public Awareness	N/A	General Funds	Information Technology Services	Removed	H	This action is redundant and similar to another mitigation action
Provide a response/reply section on the website where residents can comments on the effectiveness of the current and where they can make suggestions for future revisions of the plan	Multi-Hazard	Public Awareness	N/A	General Funds	Information Technology Services	Completed	L	
Develop and implement education	Multi-Hazard	Public Awareness	N/A	General Funds	Public Safety	Removed	L	This action is redundant and

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
and outreach programs to increase public awareness of the risks associated with natural hazards.								similar to another mitigation action
Update the City's website to include additional hazard related information that is easily accessible	Multi-Hazard	Public Awareness	N/A	General Funds	Public Safety	Removed	L	This action is redundant and similar to another mitigation action
Identify, improve, and sustain collaborative programs focusing on the real estate and insurance industries, public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards	Multi-Hazard	Public Awareness	N/A	General Funds	Planning	Removed	H	This action is redundant and similar to another mitigation action
Advertise the Public Safety Department website by ensuring its address is printed on	Multi-Hazard	Public Awareness	N/A	General Funds	Public Safety	Removed	L	No longer applicable

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
all materials and publications								
Work with the American Red Cross, Board of Education and Fire Department	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Public Safety	Removed	L	This action is redundant and similar to another mitigation action
Develop and deliver information to all county residents, through community groups and/or publications, information on how to shelter in place and when it is appropriate to do so.	Multi-Hazard	Public Awareness, Emergency Services	N/A	General Funds	Public Safety	Removed	L	This action is redundant and similar to another mitigation action
Ensure representatives from the Local Mitigation Planning Committee attend Planning Commission and Technical Advisory Board meetings to provide input on	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Public Safety	Removed	M	No longer applicable

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
development in hazard areas.								
Teach CERT classes to interested citizens in the County to assist their neighbors during emergencies. This course will be taught throughout the county utilizing the County's paramedics, fire fighters, American Red Cross and law enforcement personnel	Multi-Hazard	Public Awareness, Partnerships and Implementation, Emergency Services	N/A	General Funds	Public Safety	Removed	H	No longer applicable
Form a specialized committee within the LEPC to develop strategies to increase LEPC membership and participation	Multi-Hazard	Partnerships and Implementation	N/A	General Funds	Public Safety	Removed	L	No longer applicable
Work with current LEPC business and industry members to network within the community to	Multi-Hazard	Public Awareness, Partnerships and Implementation,	N/A	General Funds	Public Safety	Removed	L	No longer applicable

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
encourage participation and new membership		Emergency Services						
Develop strategies for debris management for natural disasters	Multi-Hazard	Emergency Services	N/A	General Funds	Development Services/Public Works Division	Removed	L	This action is redundant and similar to another mitigation action
Earthquake Mitigation Actions								
Educate public on the California Earthquake Insurance Program	Earthquake	Protect Life and Property, Public Awareness	N/A	General Funds	Hazard Mitigation Working Groups	Removed	M	No longer applicable
Encourage seismic strength evaluations of critical facilities in the City to identify vulnerabilities for mitigation of schools and university, public infrastructure, and critical facilities to meet current seismic standards	Earthquake	Protect Life and Property, Public Awareness	N/A	General Funds	Hazard Mitigation Working Groups	Removed	M	The program is no longer available
Incorporate the building inventory into the hazard assessment	Earthquake	Emergency Services	N/A	General Funds	EOC/GIS Department	Removed	M	This action is redundant and

MITIGATION ACTION	HAZARD(S)	PLAN GOALS ADDRESSED	COST	POTENTIAL FUNDING SOURCES	RESPONSIBLE DEPARTMENT	STATUS	PRIORITY	COMMENT
								similar to another mitigation action
Identify activities for private sector and citizen involvement such as nonstructural seismic daycare retrofits	Earthquake	Public Awareness, Partnerships and Implementation	N/A	General Funds	Public Safety	Removed	L	No longer applicable
Encourage purchase of earthquake hazard insurance	Earthquake	Public Awareness	N/A	General Funds	Public Safety	Removed	L	No longer applicable
Integrate new earthquake hazard mapping data for the County and improve technical analysis of earthquake hazards	Earthquake	Partnerships and Implementation	N/A	General Funds	Carson GIS	Removed	M	This action is redundant and similar to another mitigation action

6) CAPABILITY ASSESSMENT

Capability and capacity are two defining features of a community's resilience. Capability referring to the "tools" available to the community and capacity as the ability to use those tools. This portion of the Plan assesses the current capacity of the City of Carson to mitigate the effects of the natural hazards and implement successful mitigation programs. This assessment includes an examination of:

- **Staff and Technical Assistance**: personnel resources on-staff or available to assist with hazard mitigation efforts.
- **Planning Mechanism**: planning tools are currently in place or under development for your jurisdiction.
- **Regulatory Tools and Programs**: programs are currently in place or under development for your jurisdiction.
- **Fiscal Capacity**: jurisdiction utilizes or has utilized the following financial resources.

Through careful analysis, existing gaps, shortfalls, or weaknesses within existing governmental activities that could exacerbate a community's vulnerability were identified and noted as areas for improvement within the Mitigation Strategy. The previous plan update did not have a robust capability assessment, therefore, there is no previous capability assessment to assess the difference between this plan update and the previous.

The assessment also highlights the positive measures underway at the local level that will continue to be supported and enhanced through future mitigation efforts. Additionally, the capability assessment reviewed existing policies, regulations, plans, and programs to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses. Through this process, it was also noted that while the city has certain capabilities documented, some plans and processes are not always fully utilized. Ensuring these resources are effectively put into practice is key to maximizing our preparedness.

The capability assessment serves as the foundation for designing an effective hazard mitigation strategy. It not only helps inform plan goals to be both achievable but aspirational to reduce the City's exposure to natural hazards. To inform this capability assessment, the city completed an intensive one-on-one comprehensive review of community and government functions, that included their current administrative, technical, fiscal, programmatic, and legal capabilities.

Based on the capability assessment, the City of Carson ranks "moderate" to "high" except for two capabilities that rank "limited". The two capabilities that were ranked "limited" include Available Staff and Political Support and Interest.

A) STAFF AND TECHNICAL ASSISTANCE

For successful implementation of a mitigation program, it is necessary to have a broad range of people involved who can inform and contribute to holistic mitigation actions through diverse backgrounds and experience. People with the necessary expertise to influence outcomes can include local planners, engineers, building inspectors, emergency managers, floodplain managers, Geographic Information Systems (GIS) analysts and grant writers, among others.

GIS systems include the hardware, software and technicians that collect, manage, analyze and display spatially referenced data. GIS is invaluable in identifying areas vulnerable to hazards. Improved online archived technical information has greatly improved update processes and quality of emergency operations plans, continuity of operations plans, hazard mitigation plans and emergency management, resilience, and mitigation messaging. This increases community resiliency, especially outreach efforts using social media.

According to the capability assessment filled out by the City of Carson, shown in the table below, the jurisdiction possesses a diverse staff with varying skills and expertise to support the implementation of a well-rounded mitigation program. Staff that the city does not obtain include: an environmental justice specialist, land surveyors, recreation or green space specialists, and scientists familiar with the hazards of the community. Based on the level of environmental pollution and the high percentage of environmentally disadvantaged communities located within the city, an environmental justice position would be beneficial to reduce further risk to these communities from hazards.

TABLE 123. CITY OF CARSON STAFF AND TECHNICAL ASSISTANCE CAPABILITY

STAFF OR PERSONNEL RESOURCES	YES	NO	DEPARTMENT OR SINGLE STAFF MEMBER
Emergency Manager	X		
Engineers or professionals trained in construction practices related to buildings and/or infrastructure	X		
Environmental justice specialist(s)		X	
Fiscal Management or Procurement Specialist(s)	X		
Floodplain Manager	X		
Housing Specialist(s)	X		
Land Surveyors		X	
Land Use/Management/Development Planning	X		
Planners or engineers with an understanding of natural and/or human-caused hazards	X		
Recreation/Green space specialist(s)		X	
Resource Development Staff or Grant writing	X		

STAFF OR PERSONNEL RESOURCES	YES	NO	DEPARTMENT OR SINGLE STAFF MEMBER
Scientists familiar with the hazards of the community			
Staff experienced with Geographic Information Systems (GIS) or HAZUS	X		
Staff with education or expertise to assess the community's vulnerability to hazards	X		
Transportation Manager/Traffic Engineer	X		

B) PLANNING MECHANISMS

Based on the self-assessment completed by the City of Carson for the planning mechanisms capability, the city has a couple of plans in place and/or adopted by the jurisdiction, shown in the table below. Those plans include the Capital Improvement Plan (CIP), General Plan, Continuity of Operations Plan (COOP), Emergency Operations Plan (EOP), and the Hazard Mitigation Plan.

The City of Carson has made significant strides in updating both its General Plan and Hazard Mitigation Plan (HMP), although integration of the previous HMP into other planning mechanisms was limited. This lack of integration was primarily due to factors such as staff turnover and the absence of a formalized process to track progress. With the 2023 HMP update, the City is placing a renewed emphasis on embedding hazard mitigation strategies into broader planning efforts, including the Capital Improvements Plan, Emergency Operations Plan, and General Plan.

Moving forward, integration of the HMP will be a priority across all city departments to ensure a coordinated and resilient approach to hazard mitigation. The City has identified specific goals for tracking and aligning future development, infrastructure improvements, and public safety efforts with the mitigation objectives outlined in the HMP. As part of these goals, departments will implement regular updates and progress assessments to maintain alignment with the HMP's strategies and objectives, strengthening Carson's overall resilience to hazards.

TABLE 124. CITY OF CARSON PLANNING MECHANISMS CAPABILITY

PLANS	IN-PLACE		ADOPTED/UPDATED	UNDER DEVELOPMENT	
	YES	NO		YES	NO
Capital Improvement Plan (CIP)	X				

PLANS	IN-PLACE		ADOPTED/UPDATED	UNDER DEVELOPMENT	
	YES	NO		YES	NO
Carson Street Mixed Use District Master Plan (2006)		X			
Carson Vision Plan (2016)		X			
Climate Action Plan/Resiliency Plan		X			
Community Wildfire Protection Plan (CWPP)		X			
Comprehensive Emergency Management Plan		X			
General Plan	X				
Continuity of Operations Plan (COOP)				X	
Disaster Recovery Plan		X			
Economic Development Plan		X			
Emergency Operations Plan (EOP)	X				
Environmental Impact Report (EIR)		X			
Evacuation Plan		X			
Flood Response Plan		X			
Floodplain Management Plan/Flood Mitigation Plan		X			
Hazard Mitigation Plan			X		
Historic Preservation Plan		X			
Natural Resource Protection Plan (NRPP)		X			

PLANS	IN-PLACE		ADOPTED/UPDATED	UNDER DEVELOPMENT	
	YES	NO		YES	NO
Open Space Management Plan (Parks & Rec/Green Plan)		X			
Threat Hazard Identification and Risk Assessment (THIRA)		X			
Water Conservation Plan 2023	X		X		

(1) Carson 2040 General Plan

The general plan is a statement of the community's vision of its long-term or ultimate physical form and development policies. The State of California mandates that "…each county and city shall adopt a comprehensive, long-term general plan for the physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning." (Govt. Code 65300). A city's general plan has been described as its development constitution – the set of policies within which development regulations and decisions must fit—and serves to:

- Establish a long-range vision that reflects the aspirations of thew community and outline steps to achieve this vision through its policies.
- Guide decision-making related to development, housing, transportation, environmental quality, public services, parks, open space, and environmental justice.
- Help Carson achieve compliance with applicable State and regional policies, including housing production and environmental regulations.
- Allow City departments, other public agencies, and private developers to design projects that will enhance the character of the community, preserve environmental resources, and minimize hazards; and
- Provide the basis for stablishing and setting priorities for detailed plans and implementing programs, such as the Zoning Ordinance and future specific plans.

The general plan contains 10 elements that align with the guiding principles for the City of Carson. The following elements are listed below.

- Land Use and Revitalization
- Circulation
- Community Character and Design

- Recreation and Active Lifestyle
- Community Health and Environmental Justice
- Community Services, Education, and Safety
- Open Space and Environmental Conservation
- Noise
- Economic Development
- Housing

(2) State of California Safety Element

The state of California requires General Plans to address nine elements which include land use, circulation, housing, conservation, open space, noise, safety, environmental justice, and air quality. The safety elements aim to reduce the potential short and long-term risk of death, injuries, property damage, and economic and social dislocation resulting from fires, floods, droughts, earthquakes, landslides, climate change, and other hazards. The safety elements should contain general hazard and risk reduction strategies complementary to the local hazard mitigation plan. In order to support Carson 2040 General Plan's Safety Element, the local hazard mitigation plan must address parts of the state's safety element requirements. The table below includes the state's Safety Element requirements.

TABLE 125. STATE OF CALIFORNIA SAFETY ELEMENT REQUIREMENTS

STATUTORY CITATION	BRIEF DESCRIPTION OF REQUIREMENTS
Gov. Code 65302(g)(1)	Identification of unreasonable risks and policies for the protection of the community from such risks.
Gov Code 65302(g)(1)	**Slope Instability** Slope instability leading to mudslides and landslides.
Gov. Code 65302(g)(1)	**Seismic Risks, including:** Seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failures; subsidence, liquefaction, and other seismic hazards identified to Chapter 7.8 (commencing with Section 2690) of Division 2 of the Public Resources Code, and other geologic hazards known to the legislative body. • Mapping known seismic and other geologic hazards. • Address o Evacuation routes o Military installations o Peak load water supply requirements and o Minimum road widths and clearances around structures
Gov. Code 65302(g)(2)	**Flooding**

STATUTORY CITATION	BRIEF DESCRIPTION OF REQUIREMENTS
	Identify • Flood Hazard Zones • FEMA Flood Insurance Maps • Army Corps of Engineer Flood Information • Flood maps from the Central Valley Flood Protection Board • Dam Failure Maps (Office of Emergency Services) • DWR Floodplain Maps • Maps of Levee Protection Zones • Areas subject to inundation in the event of the failure of levees and floodwalls • Historic flood information • Existing and planned development in flood hazard areas • Agencies with responsibility for flood protection **Mandatory Goals, Policies, and Objectives** • Avoid and minimize flood risks for new development. • Should new development be located in flood hazard zones? If so, what are appropriate mitigation measures? • Maintain the integrity of essential public facilities. • Locate, when feasible, new essential public facilities outside of flood hazard zones, including hospitals and health care facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities, or identifying mitigation measures. • Establishing cooperative working relationships among public agencies with responsibility for flood protection. Feasible Mitigation Measures, to implement the policies above.
Gov. Code 65302(g)(3)	**Wildland and Urban Fires** Identification of, and policies for, the protection of the community from, unreasonable risks associated with wildland and urban fires. State Responsibility Areas and Very High Fire Hazard Severity Zones Consider advice in OPR's Fire Hazard Technical Advisory Identify • CalFire Fire Hazard Severity Zone Maps • Historical data on wildfires • USGS wildfire hazard areas • Existing and planned development within these areas • Agencies with responsibility for fire protection in these areas

STATUTORY CITATION	BRIEF DESCRIPTION OF REQUIREMENTS
	Mandatory Goals, Policies and Objectives • Protect the community from unreasonable risks. • See mitigation measures below. **Feasible Mitigation** • Avoid and minimize fire risks for new development. • Should new development be located in fire hazard zones? If so, what are appropriate mitigation measures? • Maintain the integrity of essential public facilities. • Locate, when feasible, new essential public facilities outside of fire hazard zones, including hospitals and health care facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities. • If essential facilities are located in high fire zones, identify mitigation measures, such as safe access for emergency response vehicles, visible street signs, and water supplies for structural fire suppression. • Establishing cooperative working relationships among public agencies with responsibility for fire protection.
Gov. Code 65302(g)(4)	**Climate Change Adaptation and Resilience** Address climate change adaptation and resiliency strategies by using the process in the Adaptation Planning Guide and reflected in referenced tools such as Cal-Adapt. **Vulnerability Assessment (Gov Code 65302(g)(4)(A)** Create a vulnerability assessment that identifies the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, the following: • Information that may be available from federal, state, regional, and local agencies that will assist in developing the vulnerability assessment and the adaptation policies and strategies, including, but not to, all the following: (I) Information from the Internet based Cal-Adapt tool. (II) Information from the most recent version of the California Adaptation Planning Guide. (III) Information from local agencies on the types of assets, resources, and populations that will be sensitive to various climate change exposures. (IV) Information from local agencies on their current ability to deal with the impacts of climate change. (V) Historical data on natural events and hazards, including locally prepared maps of areas subject to previous risk, areas that are vulnerable, and sites that have been repeatedly damaged.

STATUTORY CITATION	BRIEF DESCRIPTION OF REQUIREMENTS
	(VI) Existing and planned development in identified at-risk areas, including structures, roads, utilities, and essential public facilities. (VII) Federal, state, regional, and local agencies with responsibility for the protection of public health and safety and the environment, including special districts and local offices of emergency services. **Mandatory Goals, Policies, and Objectives (Gov. Code 65302(g)(4)(B))** • Crete a set of adaptation and resilience goals, policies, and objectives based on the information above for the protection of the community.
Gov. Code 65302(g)(4) **CONTINUED**	**Feasible Mitigation (Gov. Code 65302(g)(4)(C))** • Create a set of feasible implementation measures designed to carry out the goals, policies, and objectives identified above, including but not limited to, all of the following: (i) Feasible methods to avoid or minimize climate change impacts associated with new uses of land. (ii) The location, when feasible, of new essential public facilities outside of at-risk areas, including, but not limited to, hospitals and health care facilities, emergency shelters, emergency command centers, and emergency communications facilities, or identifying construction methods or other methods to minimize damage if these facilities are located in at-risk areas. (iii) The designation of adequate and feasible infrastructure located in an at-risk area. (iv) Guidelines for working cooperatively with relevant local, regional, state, and federal agencies. (v) The identification of natural infrastructure that may be used in adaptation projects, where feasible. Where feasible, the plan shall use existing natural features and ecosystem processes, or the restoration of natural features and ecosystem processes, when developing alternatives for consideration. For the purposes of the clause, “natural infrastructure” means preservation or restoration of ecological systems, or utilization of engineered systems that use ecological processes, to increase resiliency to climate change, manage other environmental hazards, or both. This may include but is not limited to floodplain and wetlands restoration or preservation, combining levees with restored natural systems to reduce flood risk, and urban tree planting to mitigate high heat days. **Other documents (Gov. Code 65302(g)(4)(D)(i), 65302(g)(4)(D)(ii)** • If a city or county has adopted the local hazard mitigation plan, or other climate adaptation plan or document that fulfills commensurate goals and objectives and contains the information required pursuant to this

STATUTORY CITATION	BRIEF DESCRIPTION OF REQUIREMENTS
	paragraph, separate from the general plan, an attachment of, or reference to, the local hazard mitigation plan or other climate adaptation plan or document. • Cities or counties that have an adopted hazard mitigation plan, or other climate adaptation plan or document that substantially complies with this section or have substantially equivalent provisions to this subdivision in their general plans, may use with this section, or have substantially equivalent provisions, climate adaptation plan or document, specifically showing how each requirement of this subdivision has been met.
Gov Code 65302(g)(5) -(g)(8)	**Other Considerations** • Cities and counties that have floodplain management ordinances that have been approved by FEMA that substantially comply with this section, or have substantially equivalent provisions to this subdivision in their general plans, may use that information in the safety element to comply with this subdivision, and shall summarize and incorporate by reference into the safety element the other general plan provisions or the flood plain ordinance, specifically showing how each requirement of this subdivision has been met. • Prior to the periodic review of its general plan and prior to preparing or revising its safety element, each city and county shall consult the California Geological Survey of the Department of Conservation, the Central Valley Flood Protection Board, if the city or county is located within the boundaries of the Sacramento and San Joaquin Drainage District, as set forth in Section 8501 of the Water Code, and the Office of Emergency Services for the purpose of including information known by and available to the department, the agency, and the board required by this subdivision. • To the extent that a county's safety element is sufficiently detailed and contains appropriate policies and programs for adoption by a city, a city may adopt that portion of the county's safety element that pertains to the city's planning area in satisfaction of the requirement imposed by this subdivision. • Review the safety element for fire and flood impacts upon each Housing Element update. • Review the safety element for climate change at each update to the Local Hazard Mitigation Plan, Jurisdiction may also choose to do a comprehensive review of the safety element upon each housing element update to streamline review.

C) FISCAL CAPABILITY

Mitigation projects cannot be implemented without financial capital. A variety of programs and grant funds may be utilized to support mitigation efforts. Ability to identify new applicable programs and familiarity with accessing streams of funding is necessary to achieve better community outcomes. The City of Carson has identified multiple funding streams that may be utilized to support mitigation planning and programming. The funding sources include funding sources from Community Development Block Grant (CDBG) and FEMA Hazard Mitigation Assistance Grants such as the Hazard Mitigation Grant Program, Flood Mitigation Assistance, and Pre-Disaster Mitigation grants. The table below provides a summary of the funding sources the jurisdiction has familiarity utilizing. These include never used, previously used, or currently used funding sources.

TABLE 126. CITY OF CARSON FISCAL CAPABILITY

FISCAL RESOURCES	NEVER USED	PREVIOUSLY USED	CURRENTLY USED	COMMENTS
Capital Improvement Programming			X	ATP, Urban & Community Forestry, EEM, CRC
Community Development Block Grant (CDBG)			X	JAG, STEP
Development Impact Fees	X			
FEMA Hazard Mitigation Assistance Grants (HMGP, FMA, PDM)			X	COVID-19 Emergency Response Grant
Gas/Electric Utility Fees			X	EECBG
General Obligation, Revenue, and/or Special Tax Bonds	X			
Homeland Security Grants (HSGP)		X		
Infrastructure Investment and Jobs Act (IIJA)			X	HUS-Environmental Enhancement & Energy Resilience at Veterans Park and Sports Complex
Infrastructure State Revolving Fund Loan				
Partnering Agreements or Intergovernmental Agreements		X		

FISCAL RESOURCES	NEVER USED	PREVIOUSLY USED	CURRENTLY USED	COMMENTS
Prepare California Grant(s)	X			
Sewer/Water Fees		X		
Special Purpose Taxes (or taxing districts)	X			
Stormwater Utility Fees		X		
USDA Grants		X		
USDA Rural Development Agency Grants	X			
US Economic Development Administration Grants	X			

D) REGULATORY TOOLS AND PROGRAMS

The importance of the planning powers of local governments is illustrated by the requirement that zoning regulations be made in accordance with a comprehensive plan. While the ordinance itself may provide evidence that zoning is being conducted "in accordance with a plan," the existence of a separate planning document is important so that the government is developing regulations and ordinances that are consistent with the overall goals of the community.

Zoning is the traditional and most common tool available to local governments to control the use of land. Land “uses" controlled by zoning include the type of use (e.g., residential, commercial, and industrial) as well as minimum specifications that control height and bulk such as lot size, building height and setbacks, and density of population. Local governments are authorized to divide their territorial jurisdiction into districts, and to regulate and restrict the erection, construction, reconstruction, alteration, repair or use of buildings, structures, or land within those districts. Districts may include general use districts, overlay districts, and special use or conditional use districts. Zoning ordinances consist of maps and written text.

Of note, as of January 1, 2023, the City of Carson officially adopted the California Building Code, 2022 Edition - Part 2 of Title 24 of the California Code of Regulations. This change will benefit the community by increasing newly built and renovated residential and commercial structures’ resilience to hazards. However, a City of Carson Housing Needs Assessment determined that most development that existed in 2021 had already been built by 1981. Although the city is in compliance with up-to-date building codes, renovation of the existing building stock to higher standards will take time.

Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision regulations are included in the floodplain management ordinance, requiring developers to install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. They also may prohibit the subdivision of land subject to flooding unless flood hazards are mitigated through filling or other measures, and they prohibit filling of floodway areas.

The table below summarizes the City of Carson's regulatory tools and programs supporting a mitigation program.

TABLE 127. CITY OF CARSON REGULATORY TOOLS AND PROGRAMS CAPABILITY

TOOL/PROGRAM	IN-PLACE		ADOPTED/ UPDATED	UNDER DEVELOPMENT		EXPECT TO IMPLEMENT
	YES	NO		YES	NO	
Alliance of Regional Collaboratives for Climate Adaptation (ARCCA) activities		X				
Building Code	X					
California Adaptation planning Guide (APG)		X				
Citizen Corps – Community Emergency Response Team	X					
Community Rating System (CRS Program of the NFIP)		X				
Emergency Management Accreditation Program (EMAP)		X				
Fire Code		X				
Firewise Community		X				
Floodplain Management/Flood Damage Prevention Ordinance	X*					
Geological Hazard Assessment District (GHAD)		X				
Land Use Development Planning		X				
Local Coastal Program (LCP)		X				
MyPlan/My Hazards Tool		X				
National Flood Insurance Program (NFIP)	X*					
Post Disaster Redevelopment/Reconstruction Plan/Ordinance		X				
Standardized Emergency Management System (SEMS)	X					
Storm Ready				X		

TOOL/PROGRAM	IN-PLACE		ADOPTED/ UPDATED	UNDER DEVELOPMENT		EXPECT TO IMPLEMENT
	YES	NO		YES	NO	
Stormwater Management Plan/Ordinance		X				
Subdivision Regulations/Ordinance		X				
Unified Development Ordinance		X				
Zoning Ordinance		X				

*The City of Carson is an NFIP participating community. However, The City is reliant on the Los Angeles County Floodplain Manager for technical assistance and floodplain management support.

Community Services, Education, and Safety Element

Public parks, public facilities, and recreational and cultural programming facilitate neighborly interaction and healthy living. Schools, libraries, and educational programs build informed citizens and cater to needs of all ages. Public safety services like police and fire keep the populace safe. Identification and mitigation of environmental safety concerns, like seismic and geologic hazards, fire hazards, and hazardous materials and operations are important to maintaining a safe and healthy city.

The 2024 City of Carson Hazard Mitigation Plan is designed to support the Community Services, Education, and Safety Element of a General Plan. This is done by providing a detailed overview of event characteristics of different hazards, potential impacts of these hazards on the built environment, and the vulnerabilities of community residents, including underserved and socially vulnerable populations.

The reality of changing climate conditions—and the effects this can have on natural hazards—makes it important for the City of Carson to consider the information presented in this plan when making decisions about the community's future. The City of Carson's history and continued presence of heavy industry, including oil extraction and refinement, also emphasizes the need to consider the impacts of human-caused hazards. The Community Services, Education, and Safety Element seeks to enhance the quality of life of all Carson residents and promote a healthy and livable community. Applicable policies are listed below.

TABLE 128. COMMUNITY SERVICES, EDUCATION, AND SAFETY ELEMENT GOALS AND POLICIES

GOAL OR POLICY	DESCRIPTION
Seismic and Geologic, and Soil and Ground Surface Hazards	
CSES-G-10	Proactively minimize risk of seismic and geologic hazards to the property and lives of Carson residents, businesses, and visitors.

CSES-G-11	Seek to reduce potential damage to property and repercussions from damaged heavy industrial facilities due to seismic hazards.
CSES-P-17	Maintain updated maps of known seismic and other geologic hazards such as fault lines to inform land use decisions and monitor the threat of future seismic activity to existing development, especially areas with heavy industrial uses or refineries.
CSES-P-18	In areas of high liquefaction risk, require that project proponents submit geotechnical investigation reports and demonstrate that the project conforms to all recommended mitigation measures prior to City approval. Ensure that sensitive or potentially hazardous facilities, such as refineries, heavy industrial, or former landfills, are prepared for a liquefaction event and designed to mitigate hazardous material releases.
CSES-P-19	Given that a known fault line crosses SR-91, prepare for transportation and infrastructure impacts if a seismic event were to occur.
CSES-P-20	Continue to enforce rules and regulations on designing buildings to the current seismic standards and ensure that erosion is controlled through drainage and grading plans and that all geotechnical design requirements for projects are adhered to.
Flood Hazards	
CSES-G-12	Strive to minimize injury and loss of life, damage to public and private property and infrastructure, and economic and social disruption caused by flood hazards.
CSES-G-13	Incorporate strategies to reduce flooding impacts caused by urban runoff
CSES-P-21	Coordinate with FEMA, the Los Angeles County Flood Control District (LACFCD) and neighboring jurisdictions on flood control maintenance on various flood control channels.
CSES-P-22	Seek to reduce impacts of localized urban flooding by incorporating green infrastructure, limiting impervious surfaces, and promoting pervious surfaces or materials throughout the Planning Area.
CSES-P-23	Ensure that areas experiencing localized flooding problems are targeted for storm drain improvements. To this end, work closely with Los Angeles County Department of Public Works and other cities in the South Bay region to ensure that facilities are adequate to accommodate storm waters.
CSES-P-24	Utilize open space to mitigate flood impacts and preserve as open space areas that cannot be mitigated for flood hazard.
Hazardous Materials	
CSES-G-14	Protect Carson residents and workers from hazardous material exposure and minimize the threat to the public health and safety and to the environment posed by a release of hazardous materials
CSES-G-15	Strive to minimize the effects from natural and anthropogenic disasters to reduce, to the extent possible, the social, safety, health, and economic impacts that these may have on the community.

CSES-G-16	Continue mitigating against and restricting hazardous materials usage in efforts to reduce pollution and hazard burden on Carson residents
CSES-P-25	Coordinate with other jurisdictions and agencies on disaster preparedness regarding heavy industrial uses, including incidents related to the transportation of hazardous materials, pipelines, oil fields, refineries, fires, and methane gas, among others.
CSES-P-26	Minimize the threat to public health and safety and the environment through strict enforcement of rules and regulations and by working closely with first responders.
CSES-P-27	Minimize the threat of a release of hazardous materials through strict enforcement of rules and regulations, monitoring business operations which handle hazardous materials through the permitting process and identifying emergency procedures and evacuation routes.
CSES-P-28	Regulate development on sites with known contamination of soil or groundwater to ensure that construction workers, future occurrences, adjacent residents, and the environment are adequately protected from hazards associated with contamination.
CSES-P-29	Continue to require mediation of hazardous materials releases from previous land uses as part of any redevelopment activities.
CSES-P-30	Continue to work with various City department and other jurisdictions, including the Public Safety Services and County Fire and Sheriff's Departments, to provide Carson residents with updated information regarding emergency preparedness and disaster planning seismic events and responses to hazards.
CSES-P-31	Maintain and update as necessary or produce plans that specifically address hazards and that identifies emergency response and recovery actions in the event of an incident. Such plans include the State Emergency Management Systems (SEMS) Multi-Hazard Function Plan and the Natural Hazards Mitigation Plan
CSES-P-32	Review neighborhood access needs and ensure safe evacuation routes, especially for residential areas near refineries and heavy industrial
CSES-P-33	Strictly enforce federal, State, and local laws and regulations relating to the use, storage, and transportation of toxic, explosive, and other hazardous and extremely hazardous materials to prevent unauthorized discharges.
CSES-P-34	Continue coordination efforts with the LACFD to ensure their capability to address fires and other emergencies at refineries, tank farms, and other heavy industrial facilities within the City.
CSES-P-35	Support environmental remediation of contaminated soils and hazardous waste sites.

E) RESULTS

The results of the capability assessment in described in the table below. Based on the City of Carson's self-assessment, the city's capabilities are moderate with the exception of Available Staff and Political Support/Interest capabilities (Limited) and the Administrative and Technical capability (High).

TABLE 129. CITY OF CARSON CAPABILITY ASSESSMENT RESULTS

AREA	DEGREE OF CAPABILITY		
	LIMITED	MODERATE	HIGH
Planning and Regulatory Capability		X	
Administrative and Technical Capability			X
Fiscal Capability		X	
Available Staff	X		
Political Support/Interest	X		
Community Support		X	

The City of Carson aims to harness its diverse capabilities to advance its mitigation strategy goals. With skilled staff across various departments, including housing specialists, engineers, a transportation manager, an emergency manager, and the County Floodplain Manager, the city is well-positioned to directly support its strategic objectives. To further strengthen these efforts, additional roles—such as an Emergency Management Training and Development Officer, Grant Writer, and Community Outreach Specialist—have been identified as priorities for growth. These roles will enable the city to maintain a skilled emergency management team, increase access to grant funding, and enhance outreach and education efforts.

Carson's planning mechanisms, including the Capital Improvements Plan, Emergency Operations Plan, and General Plan, are instrumental in keeping current and future activities aligned with the hazard mitigation plan's strategic goals. Recent strides in documenting progress and fostering integration across all departments set a strong foundation for future implementation, which will depend on the consistent use and maintenance of these efforts.

Finally, fiscal and regulatory resources are crucial in providing Carson with the necessary funding and authority to drive actions that support its mitigation strategy across all goals.

7) PLAN MAINTENANCE

Implementation of the Plan is critical because it is the roadmap to develop and implement community resilience, reduce future impacts from hazards, and enhance the health, safety, and welfare of the residents in the community. The City of Carson Emergency Management office has been tasked with monitoring and maintenance of the City's Hazard Mitigation Plan. Completion of actions and other data impacting the plan will be tracked by the Department of Public Safety and Office of Emergency Management.

A) COMMUNITY PARTICIPATION

The City of Carson is dedicated to involving the public directly in review and updates of the City of Carson Hazards Mitigation Plan. The City of Carson will evaluate the Hazard Mitigation Plan on an annual basis to determine the effectiveness of the programs and to reflect changes in land development or programs that may affect mitigation priorities.

The public will also continue to have the opportunity to provide feedback about the Plan throughout its effective period. A digital copy of the hazard mitigation plan will be posted on the City's website so that it is publicly available. This site will also contain an email address and phone number to which people can direct their comments and concerns. As with this update, the community will also be invited to substantively participate in the development of the next iteration of the plan in five years.

Public input will also be sought through annual community outreach events - like Senior Preparedness events, All Hazard Community Training, Fire Safety Training, School presentations - and virtual solicitation via social media. This tool was intentionally chosen by the planning team because it offers the greatest opportunity for participation from members of the public, including underserved and socially vulnerable populations. Online connections via social media allow members of the public to engage with the City as part of their regular day-to-day activities and are a convenient connection point for community members seeking to connect directly. Feedback can be provided at any time in the day – this helps ensure that responses are not limited to a selection of the population that is available during one specific time of day, they do not require participants to travel, which may be burdensome for underserved and vulnerable populations including those with physical or mental disabilities, the elderly, those who lack access to transportation or childcare, and economically disadvantaged individuals.

The Hazard Mitigation Planning Team will review and determine relevant comments to include during annual maintenance and during the next update of the hazard mitigation plan.

B) PLAN MONITORING, EVALUATION, AND UPDATE

Monitoring, evaluating, and updating this plan is necessary to maintain visibility on effective implementation and progress, and paves the way for continued momentum while identifying future gaps. Since the previous plan, significant updates were made to reflect the latest requirements and to expand on the number of hazards profiled.

The City of Carson's Hazard Mitigation Planning Team, established during the Plan update, is designated to lead the plan maintenance processes of monitoring, evaluation and updating. Where possible, this process will include support and representation from the general public and community stakeholders. The City's Emergency Manager and staff will coordinate maintenance efforts, but the input needed for effective periodic evaluations will come from community representatives, local emergency management coordinators and planners, the general public, and other important stakeholders.

The City of Carson Community Development Department and Department of Public Safety are responsible for reviewing the planning and land use regulatory element of the municipality's capability assessment to identify potential opportunities for incorporating appropriate elements of this Plan into local planning mechanisms and will also identify locally generated plans, information, and reports.

The Hazard Mitigation Planning Team will oversee the progress made on the implementation of action items identified and modify actions, as needed, to reflect changing conditions to future plan updates. This Plan will be updated by the FEMA approved five-year anniversary date, as required by the Disaster Mitigation Act of 2000, or following a disaster event.

Future plan updates will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. During the five-year review process, the following questions will be considered as criteria for assessing the effectiveness of the City of Carson's Hazard Mitigation Plan.

- Has the nature or magnitude of hazards affecting the County changed?
- Are there new hazards that have the potential to impact the County?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?

Issues that arise during monitoring and evaluation which require changes to the local hazard, risk and vulnerability summary, mitigation strategy, and other components of the plan will be incorporated during future updates.

C) PLAN MAINTENANCE

The plan will be maintained through a formal, annual review process that will ensure that the City of Carson Mitigation Plan remains an active and relevant document. The City will integrate public participation throughout the plan maintenance process as described above. The City of Carson intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the City's General Plan, Capital Improvement Plans, and Building and Safety Codes as these documents and processes come up for adoption or modification by the City on their own maintenance cycles. Any changes made to these documents that would impact the city's risk or Hazard Mitigation strategy and actions will also be incorporated into the Hazard Mitigation Plan annually or reflected during the 5-year update.

The public will have access to the current Plan through the city municipal office and the City of Carson's website. Information on upcoming events related to this Plan or solicitation for comments will be announced via newsletters, newspapers, mailings, and the City's website. The public is encouraged to submit comments on the Plan at any time and may be solicited for feedback via the City's social media.

D) PLAN IMPLEMENTATION

The City of Carson addresses statewide planning goals and legislative requirements through its General Plan, Capital Improvement Program, and City Building and Safety Codes the Mitigation Plan provides a series of recommendations - many of which are closely related to the goals and objectives of existing planning programs. The City of Carson will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

The City of Carson Public Safety Commission will be responsible for coordinating the implementation of Plan action items and undertaking the formal review process. The City Council will assign the existing Hazard Mitigation Planning Team to perform the duties of the Commission. It will be within the Commission's authority to delegate responsibility for Plan maintenance and implementation to the Hazard Mitigation Planning Team.

The City of Carson addresses statewide planning goals and legislative requirements through its General Plan, Capital Improvement Plans, and City Building and Safety Codes. The Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of existing planning programs. The City of Carson will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

E) PLAN ADOPTION

Adoption of the Mitigation Plan by the City's governing body is one of the prime requirements for approval of the plan. Once the plan is completed, the City Council will be responsible for adopting the City of Carson Natural Hazards Mitigation Plan. The governing body has the responsibility and authority to promote sound public policy regarding hazards. The local agency governing body will have the authority to periodically update the plan as it is revised to meet changes in the hazard risks and exposures in the City. The approved Mitigation Plan will be significant in the future growth and development of the City. The City Council will adopt the City of Carson Natural Hazards Mitigation Plan and the Public Safety Commission will take responsibility for plan maintenance and implementation.

The City Council will be responsible for adopting the Mitigation Plan. This governing body has the authority to promote sound public policy regarding hazards. Once the plan has been adopted, the City's Public Safety and Community Services Manager (or a designee) will be responsible for submitting it to the State Hazard Mitigation Officer at California Emergency Management Agency (Cal EMA). Cal EMA will then submit the plan to the Federal Emergency Management Agency (FEMA) for review and approval. This review will address the requirements set forth in 44 C.F.R. Section 201.6 (Local Mitigation Plans). Upon acceptance by FEMA, the City will gain eligibility for Hazard Mitigation Grant Program funds.

CITY OF CARSON, CALIFORNIA

2024 HAZARD MITIGATION PLAN

Appendix A – Planning Team

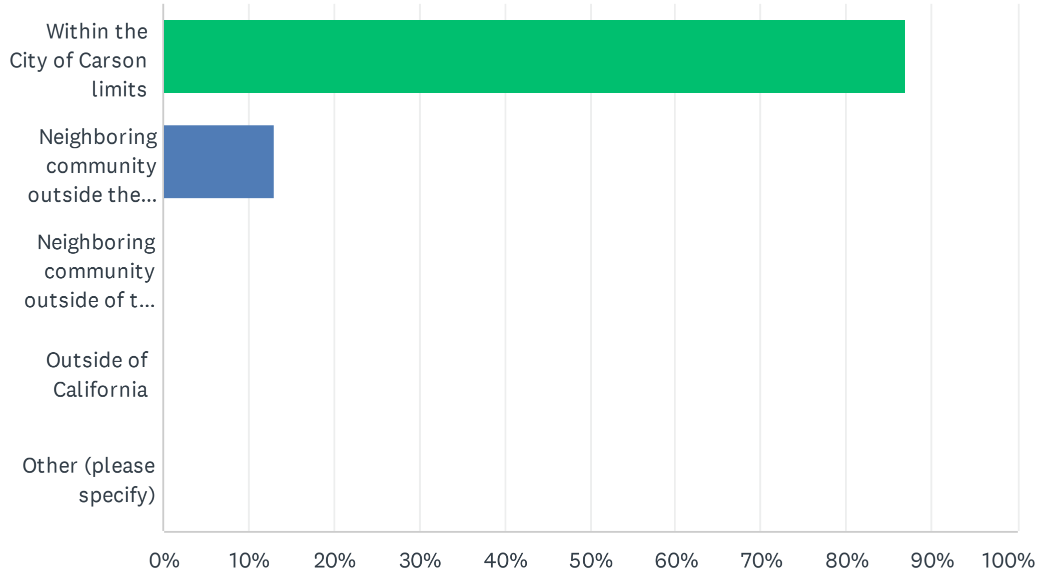
City of Carson 2024 Hazard Mitigation Planning Team

Note – participants whose information is in italics participated at some point during the process, but are no longer in the listed job titles as of the publication of this plan.

Participant	Participant Title	Department	Organization	Email
Nora Garcia	Emergency Services Manager	Emergency Management	City of Carson	ngarcia@carsonca.gov
Stephanie Cardona	Emergency Management Specialist	Emergency Management	City of Carson	scardona@carsonca.gov
Raeann Munoz	Public Safety Supervisor	Public Safety	City of Carson	rmunoz@carsonca.gov
Alex Rocco	GIS Administrator	Information Technology	City of Carson	arocco@carsonca.gov
Kevin Kennedy	IT Manager	Information Technology	City of Carson	kkennedy@carsonca.gov
Tim Grierson	Recreation Superintendent	Recreation	City of Carson	tgrierson@carsonca.gov
Dara Sandoval	Recreation Program Manager	Recreation	City of Carson	dsandoval@carsonca.gov
Margie Revilla	Public Information Officer Manager	Sustainability Innovation	City of Carson	mrevilla@carsonca.gov
Reata Kulcsar	Innovation & Sustainability Manager	Sustainability Innovation	City of Carson	rkulcsar@carsonca.gov
Gilbert Marquez	City Engineer	PW/Engineering	City of Carson	gmarquez@carsonca.gov
Freddy Loza	L&B Maintenance Superintendent	PW/Operations	City of Carson	floza@carsonca.gov
Raymond Velasco	Operations Manager	PW/Operations	City of Carson	rvelasco@carsonca.gov
Roland Jen	Stormwater Engineer	PW/Operations	City of Carson	rjen@carsonca.gov
Adriana Perez	Sanitation Services Coordinator	PW/Operations	City of Carson	Aperez2@carsonca.gov
Robin Wilson	Public Works Programs Administrator	PW/Administration	City of Carson	rwilson@carsonca.gov
Jason Jo	Transportation Services Supervisor	Transportation	City of Carson	jjo@carsonca.gov
Roobik Galoosian	Risk Manager	Risk Management	City of Carson	rgaloosian@carsonca.gov
Cristine Gaiennie	Revenue Manager	Finance	City of Carson	cgaiennie@carsonca.gov
Michael Dorta	Senior Civil Engineer	Building & Safety	LA County	mdorta@dpw.lacounty.gov
Pasqual Aiello	Lieutenant	Sheriff's Department	Carson Sheriff Station	pdaiello@lasd.org

Q1 What community do you currently live in?

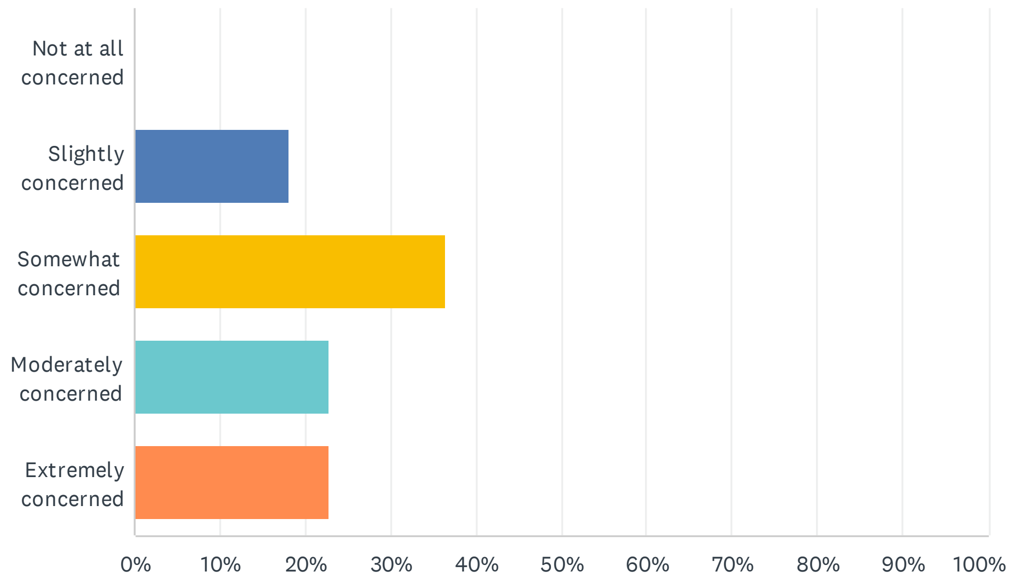
Answered: 23 Skipped: 0



ANSWER CHOICES	RESPONSES	
Within the City of Carson limits	86.96%	20
Neighboring community outside the City of Carson limits, but within the greater LA area	13.04%	3
Neighboring community outside of the greater LA area	0.00%	0
Outside of California	0.00%	0
Other (please specify)	0.00%	0
TOTAL		23

Q2 Natural hazards are natural phenomenon that might have a negative effect on humans and other animals, or the environment (like flood, fire, drought, or earthquake). Generally speaking, how concerned are you about the City of Carson being impacted by a natural disaster?

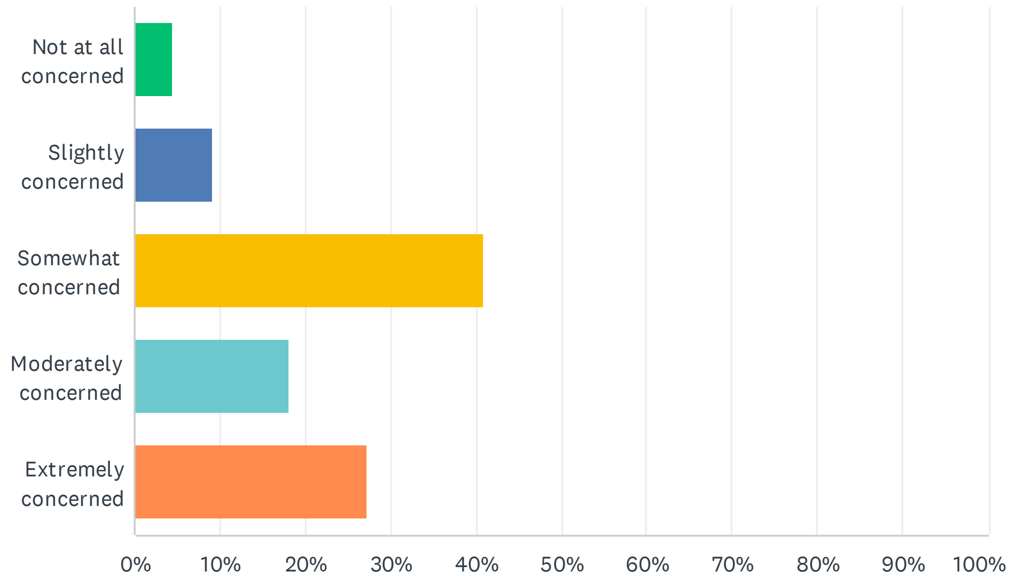
Answered: 22   Skipped: 1



ANSWER CHOICES	RESPONSES	
Not at all concerned	0.00%	0
Slightly concerned	18.18%	4
Somewhat concerned	36.36%	8
Moderately concerned	22.73%	5
Extremely concerned	22.73%	5
TOTAL		22

Q3 How concerned are you about natural hazard impacts from climate change within the City of Carson?

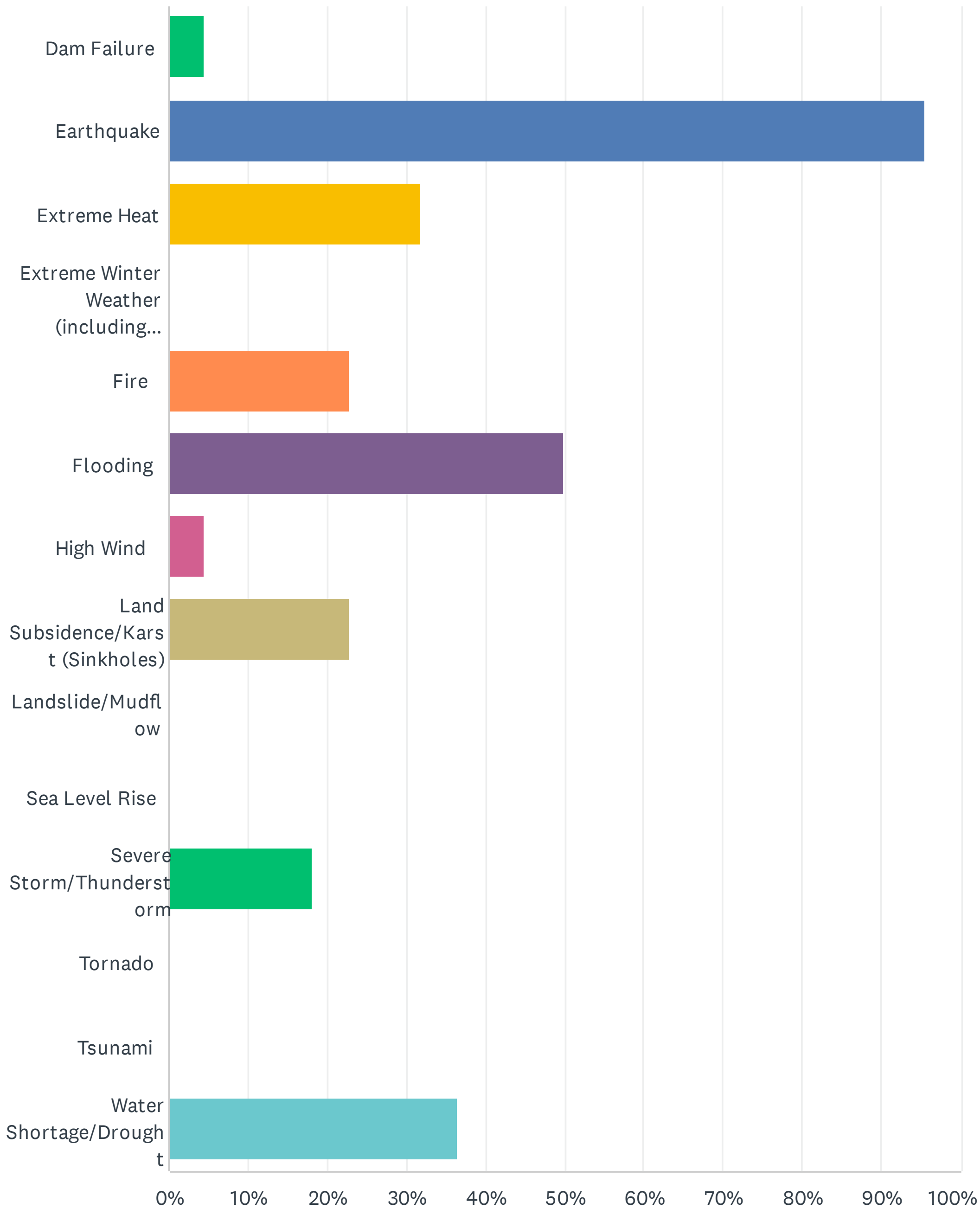
Answered: 22 Skipped: 1



ANSWER CHOICES	RESPONSES	
Not at all concerned	4.55%	1
Slightly concerned	9.09%	2
Somewhat concerned	40.91%	9
Moderately concerned	18.18%	4
Extremely concerned	27.27%	6
TOTAL		22

Q4 Please select the top three (3) natural hazards that you think present the greatest threat to the City of Carson. Please select only 3.

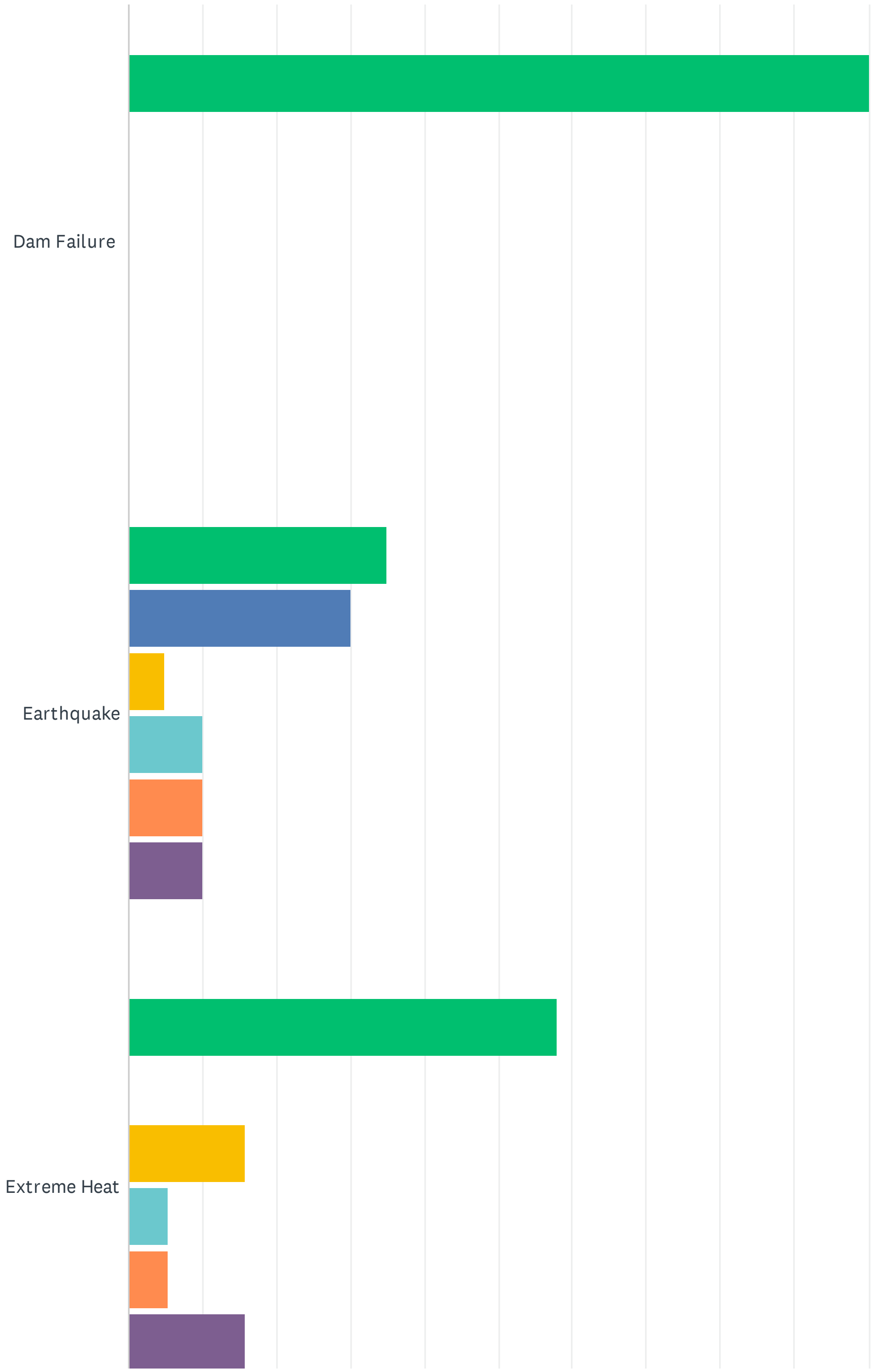
Answered: 22 Skipped: 1

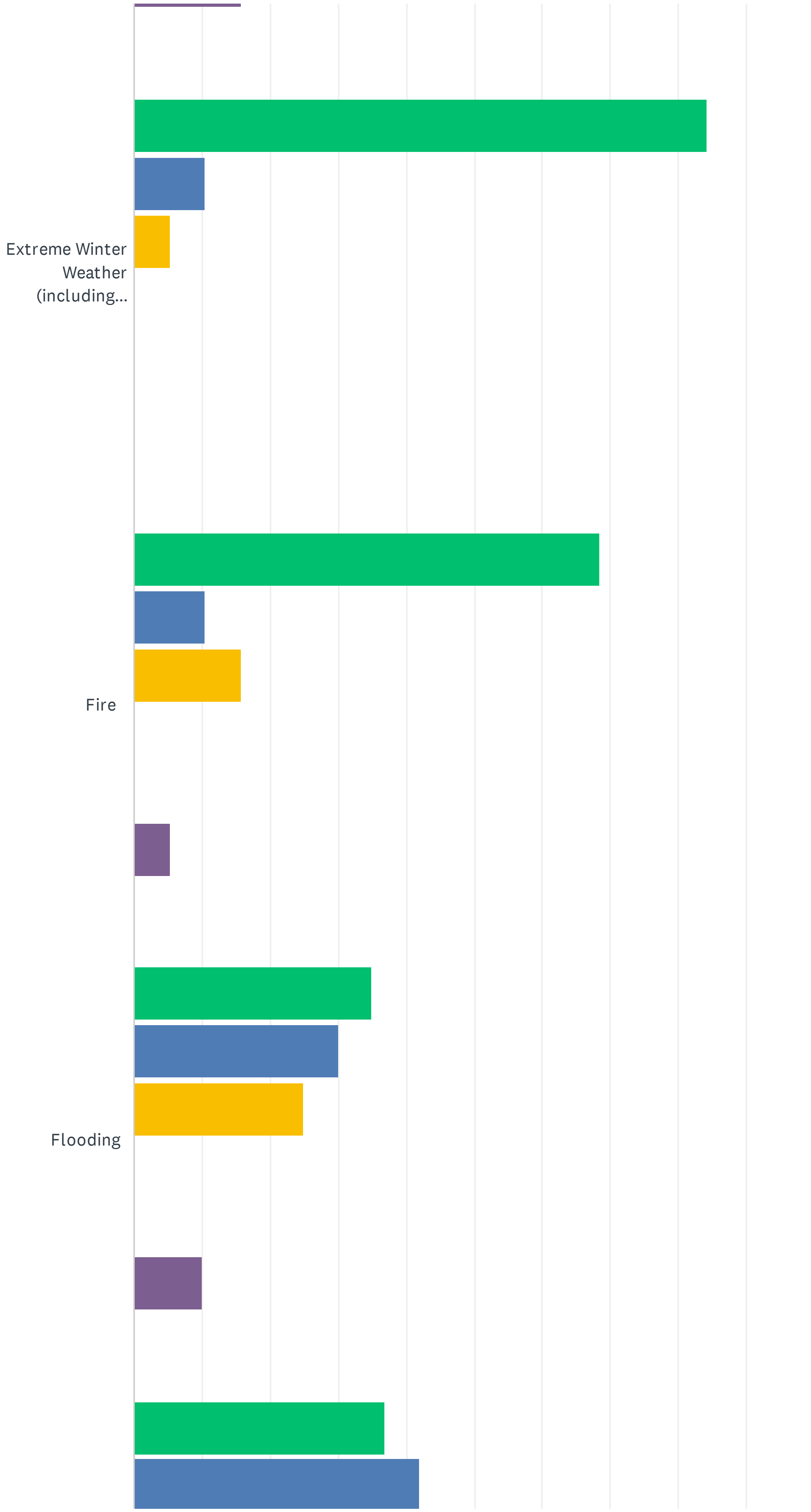


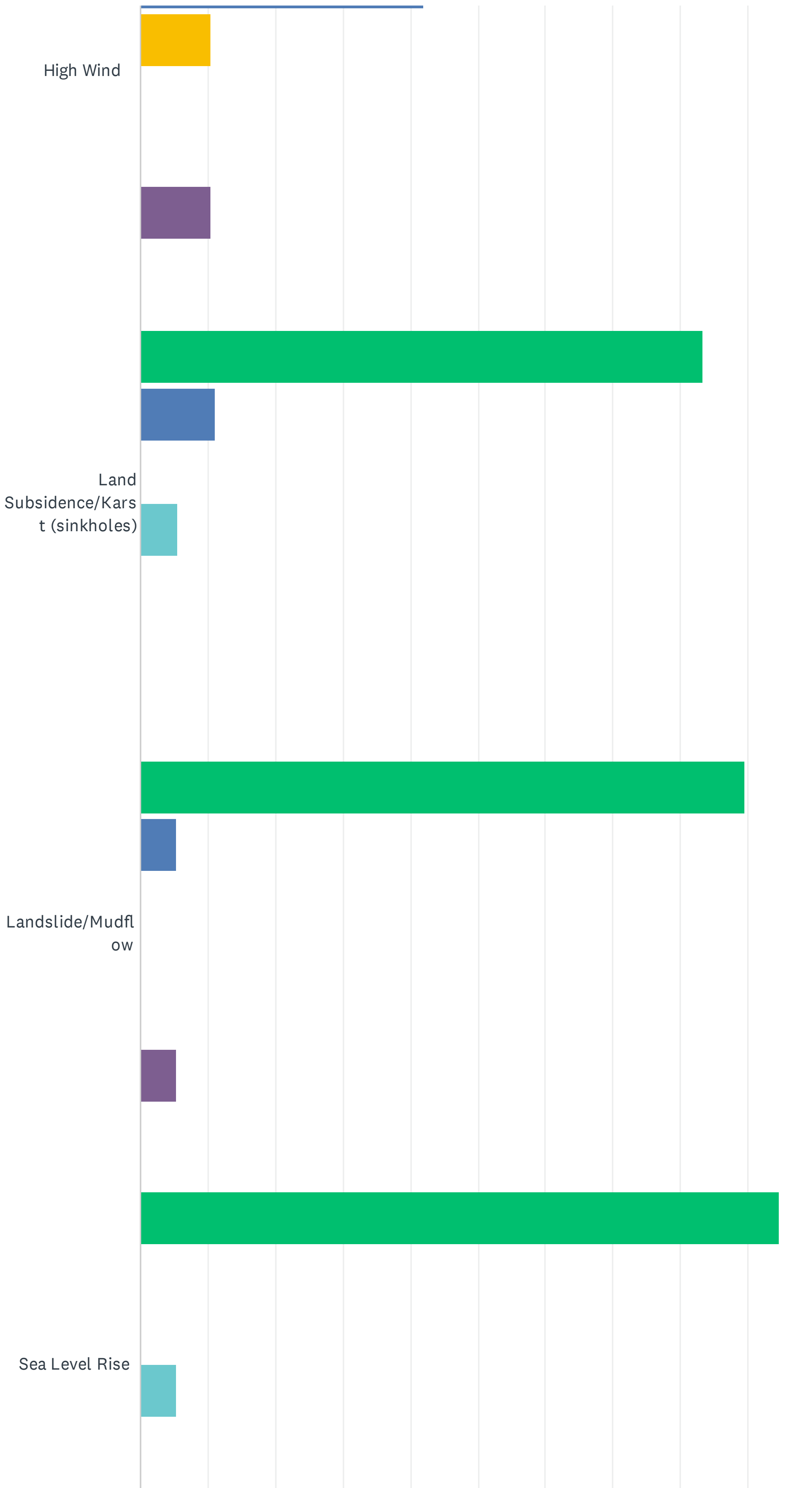
ANSWER CHOICES	RESPONSES	
Dam Failure	4.55%	1
Earthquake	95.45%	21
Extreme Heat	31.82%	7
Extreme Winter Weather (including Extreme Cold)	0.00%	0
Fire	22.73%	5
Flooding	50.00%	11
High Wind	4.55%	1
Land Subsidence/Karst (Sinkholes)	22.73%	5
Landslide/Mudflow	0.00%	0
Sea Level Rise	0.00%	0
Severe Storm/Thunderstorm	18.18%	4
Tornado	0.00%	0
Tsunami	0.00%	0
Water Shortage/Drought	36.36%	8
Total Respondents: 22		

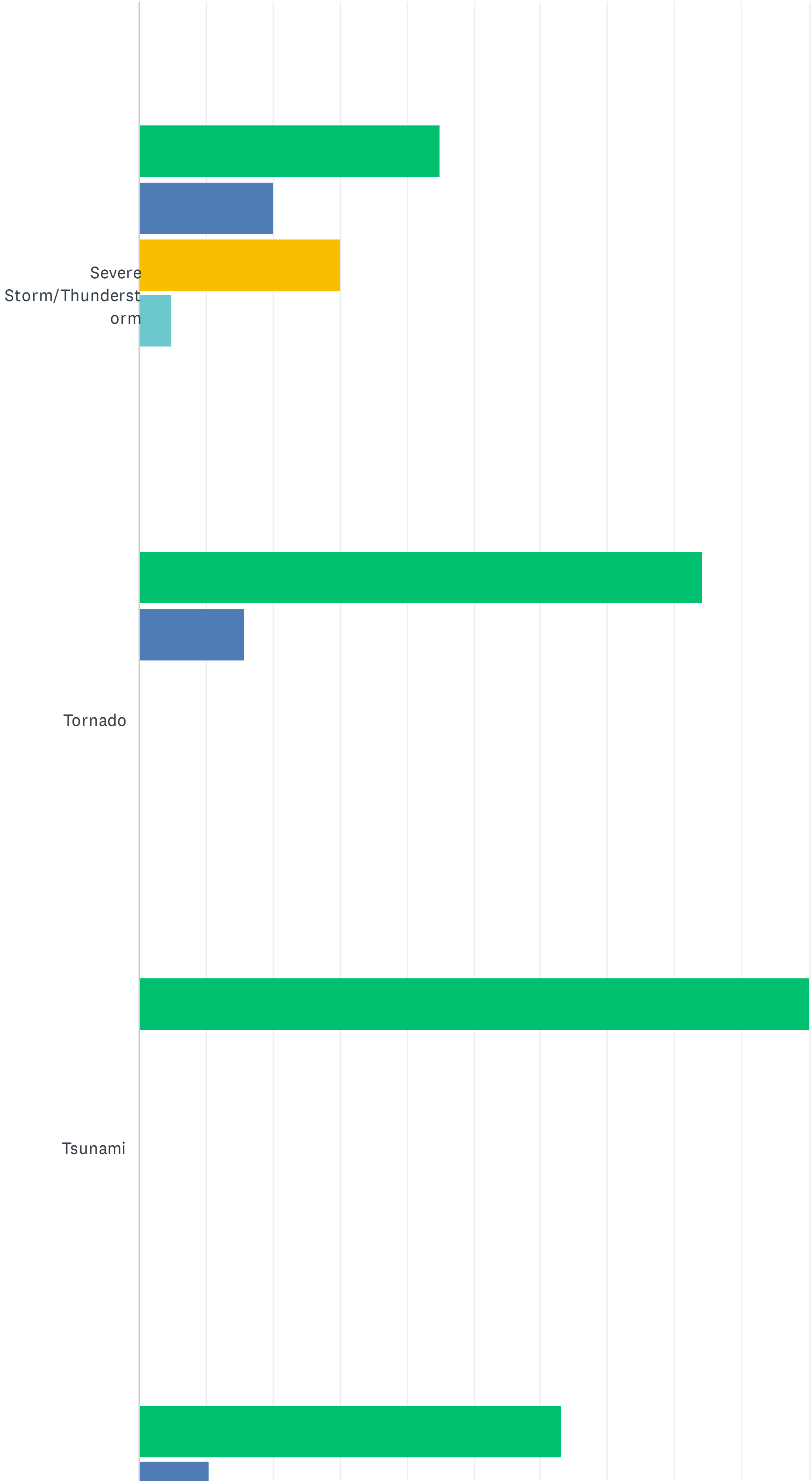
Q5 How many times within the city limits have the following hazards caused harm, endangered lives, or damaged property at your home or in your community?

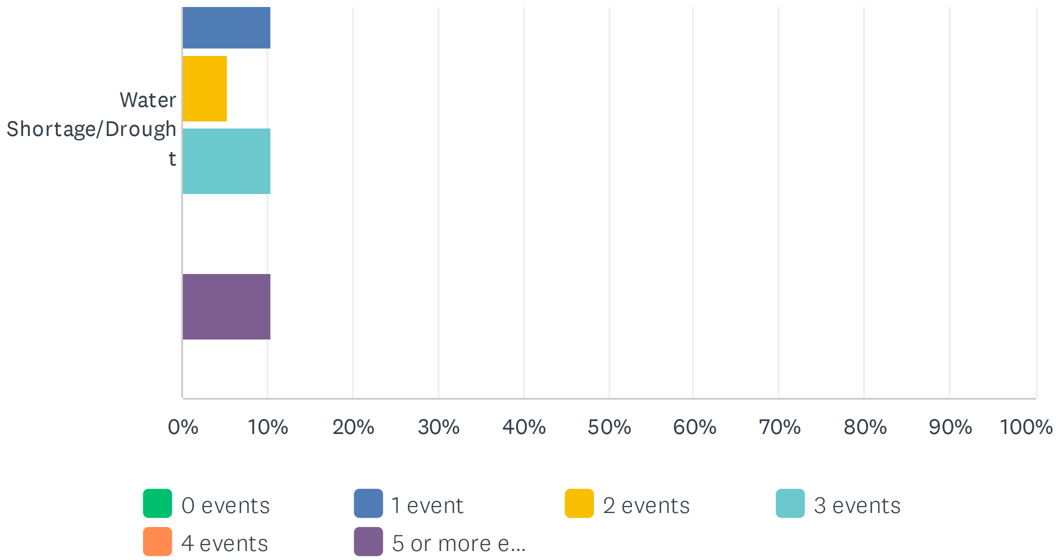
Answered: 21 Skipped: 2




Extreme Winter Weather (including...
Fire
Flooding


High Wind
Land Subsidence/Karst (sinkholes)
Landslide/Mudflow
Sea Level Rise

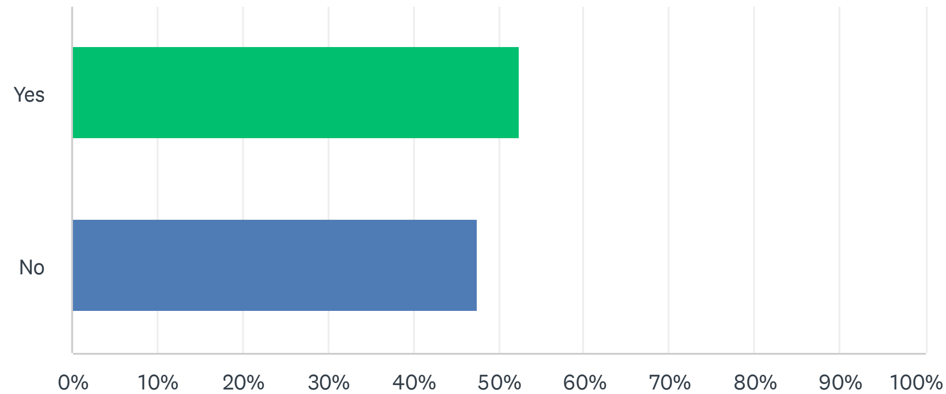

Severe Storm/Thunderstorm
Tornado
Tsunami



	0 EVENTS	1 EVENT	2 EVENTS	3 EVENTS	4 EVENTS	5 OR MORE EVENTS	TOTAL	WEIGHTED AVERAGE
Dam Failure	100.00% 18	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	18	1.00
Earthquake	35.00% 7	30.00% 6	5.00% 1	10.00% 2	10.00% 2	10.00% 2	20	2.60
Extreme Heat	57.89% 11	0.00% 0	15.79% 3	5.26% 1	5.26% 1	15.79% 3	19	2.47
Extreme Winter Weather (including cold)	84.21% 16	10.53% 2	5.26% 1	0.00% 0	0.00% 0	0.00% 0	19	1.21
Fire	68.42% 13	10.53% 2	15.79% 3	0.00% 0	0.00% 0	5.26% 1	19	1.68
Flooding	35.00% 7	30.00% 6	25.00% 5	0.00% 0	0.00% 0	10.00% 2	20	2.30
High Wind	36.84% 7	42.11% 8	10.53% 2	0.00% 0	0.00% 0	10.53% 2	19	2.16
Land Subsidence/Karst (sinkholes)	83.33% 15	11.11% 2	0.00% 0	5.56% 1	0.00% 0	0.00% 0	18	1.28
Landslide/Mudflow	89.47% 17	5.26% 1	0.00% 0	0.00% 0	0.00% 0	5.26% 1	19	1.32
Sea Level Rise	94.74% 18	0.00% 0	0.00% 0	5.26% 1	0.00% 0	0.00% 0	19	1.16
Severe Storm/Thunderstorm	45.00% 9	20.00% 4	30.00% 6	5.00% 1	0.00% 0	0.00% 0	20	1.95
Tornado	84.21% 16	15.79% 3	0.00% 0	0.00% 0	0.00% 0	0.00% 0	19	1.16
Tsunami	100.00% 19	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	19	1.00
Water Shortage/Drought	63.16% 12	10.53% 2	5.26% 1	10.53% 2	0.00% 0	10.53% 2	19	2.05

Q6 Have you taken any actions to make your home, business, or neighborhood more resilient to natural hazards?

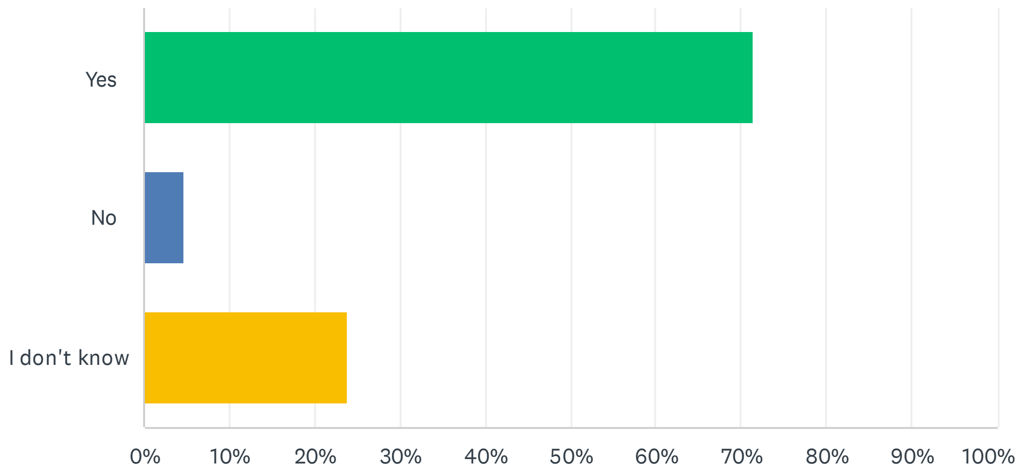
Answered: 21 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	52.38%	11
No	47.62%	10
TOTAL		21

Q7 Would incentives such as insurance discounts, property tax breaks, or low-interest loans motivate you to take additional steps to protect your home or business from natural disasters? (Example: flood-proofing your home)

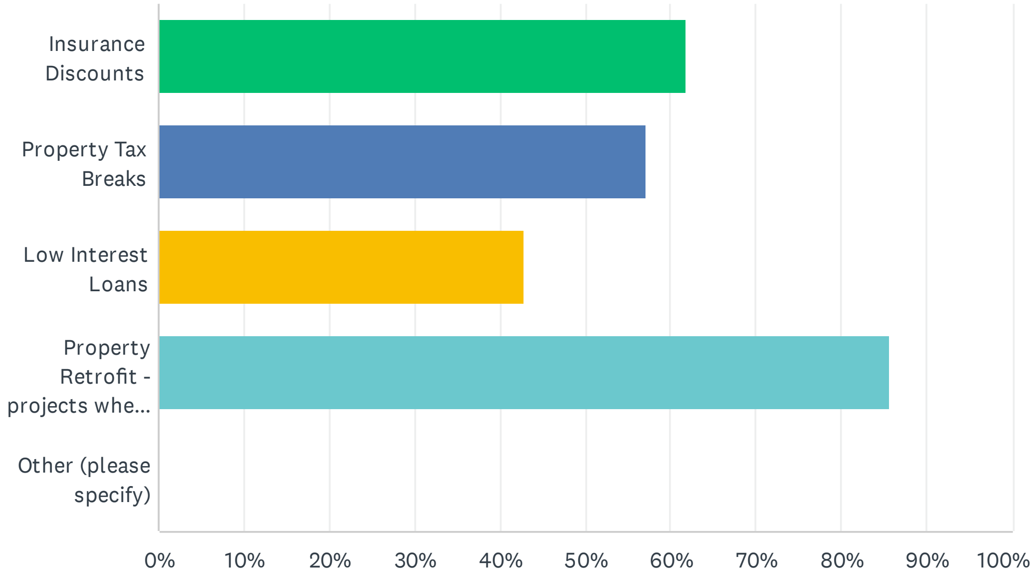
Answered: 21   Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	71.43%	15
No	4.76%	1
I don't know	23.81%	5
TOTAL		21

Q8 What kind of incentives would you like to see offered?

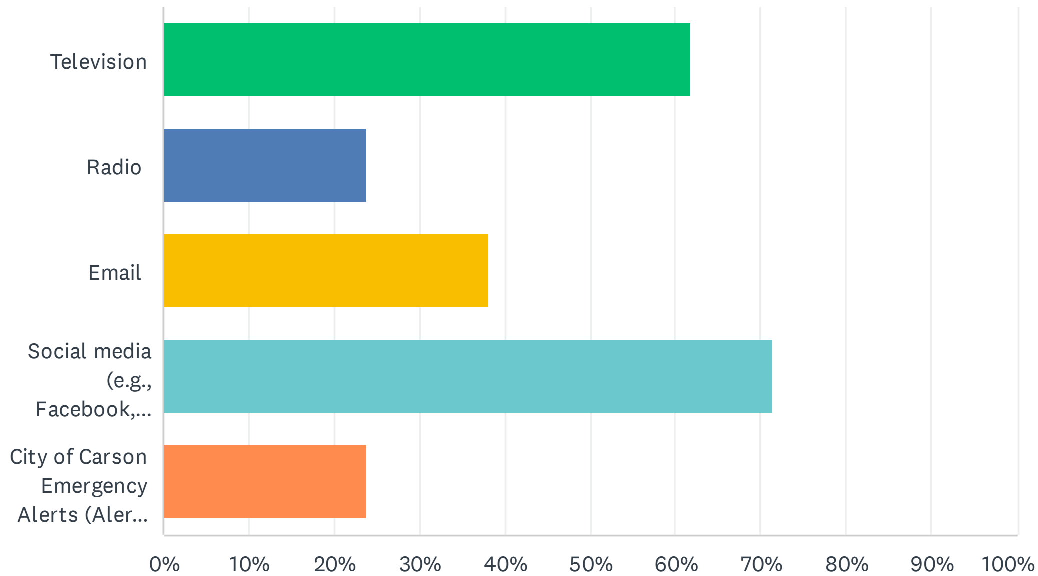
Answered: 21 Skipped: 2



ANSWER CHOICES	RESPONSES	
Insurance Discounts	61.90%	13
Property Tax Breaks	57.14%	12
Low Interest Loans	42.86%	9
Property Retrofit - projects where a portion of the cost is supplied by the city or grant funding.	85.71%	18
Other (please specify)	0.00%	0
Total Respondents: 21		

Q9 How do you receive warnings regarding severe weather events? Please check all that apply.

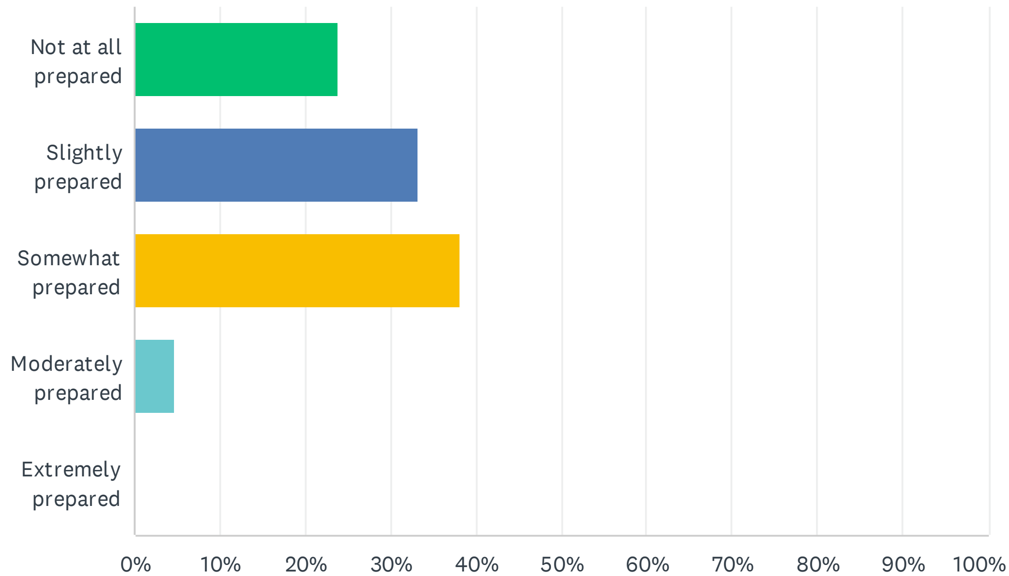
Answered: 21 Skipped: 2



ANSWER CHOICES	RESPONSES	
Television	61.90%	13
Radio	23.81%	5
Email	38.10%	8
Social media (e.g., Facebook, Twitter, etc.)	71.43%	15
City of Carson Emergency Alerts (Alert Southbay)	23.81%	5
Total Respondents: 21		

Q10 How well prepared do you think your community is for a natural disaster?

Answered: 21 Skipped: 2



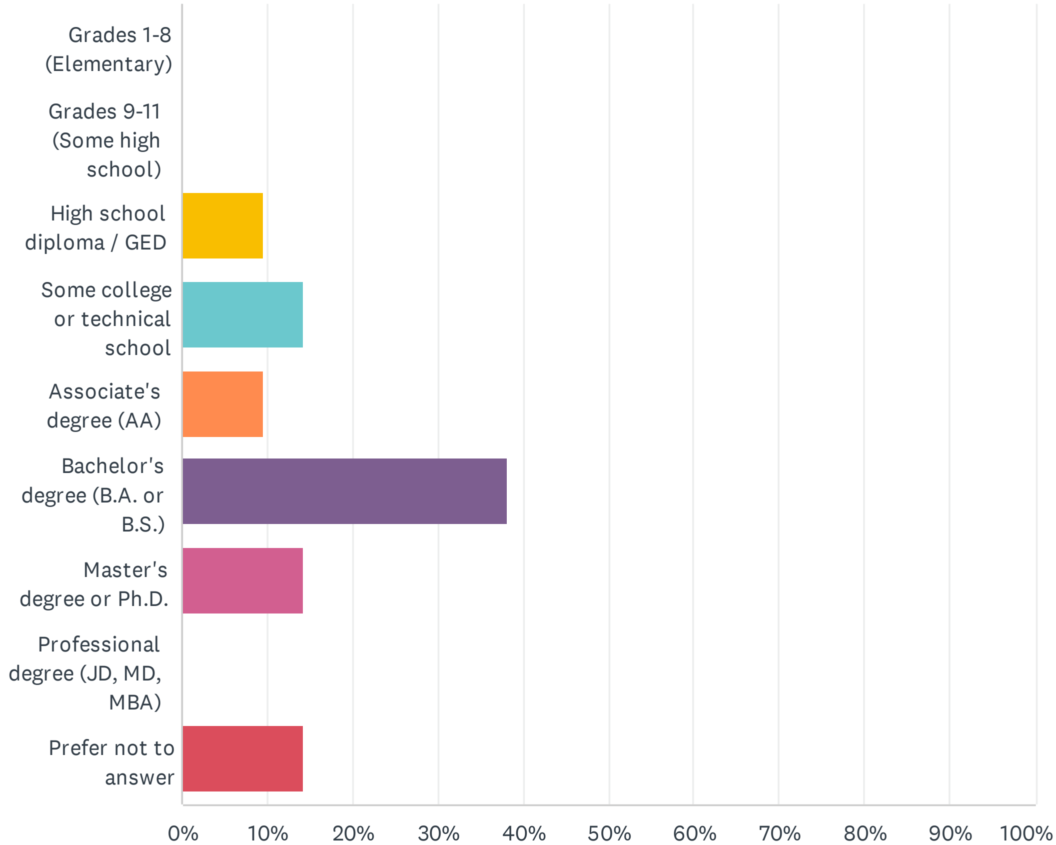
ANSWER CHOICES	RESPONSES	
Not at all prepared	23.81%	5
Slightly prepared	33.33%	7
Somewhat prepared	38.10%	8
Moderately prepared	4.76%	1
Extremely prepared	0.00%	0
TOTAL		21

Q11 Do you have any ideas or thoughts you would like to share about risk reduction, resiliency, or vulnerability to natural disasters? Please describe.

Answered: 9 Skipped: 14

Q12 What is the highest level of education you have attained?

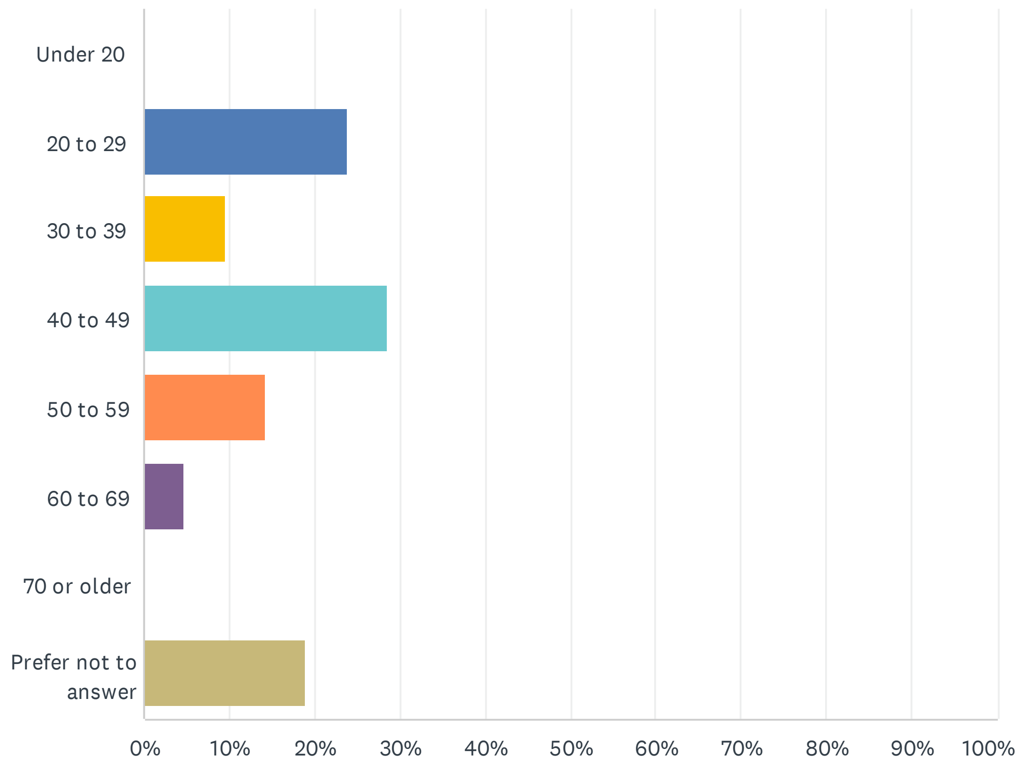
Answered: 21 Skipped: 2



ANSWER CHOICES	RESPONSES	
Grades 1-8 (Elementary)	0.00%	0
Grades 9-11 (Some high school)	0.00%	0
High school diploma / GED	9.52%	2
Some college or technical school	14.29%	3
Associate's degree (AA)	9.52%	2
Bachelor's degree (B.A. or B.S.)	38.10%	8
Master's degree or Ph.D.	14.29%	3
Professional degree (JD, MD, MBA)	0.00%	0
Prefer not to answer	14.29%	3
TOTAL		21

Q13 What is your age?

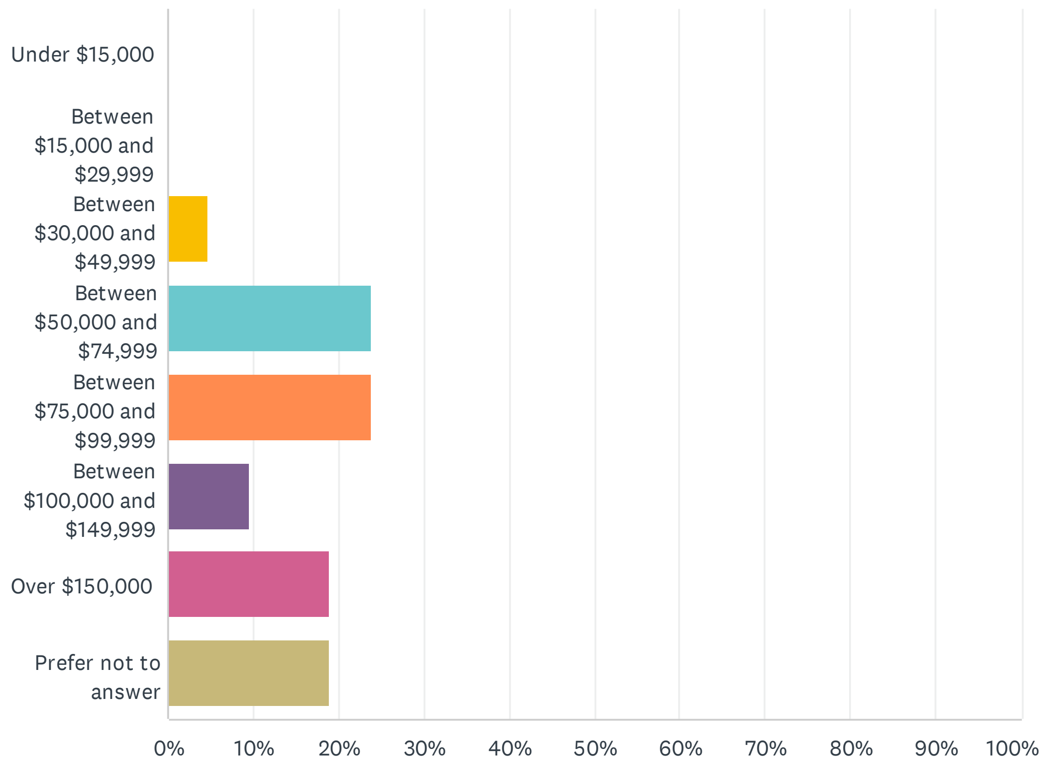
Answered: 21 Skipped: 2



ANSWER CHOICES	RESPONSES	
Under 20	0.00%	0
20 to 29	23.81%	5
30 to 39	9.52%	2
40 to 49	28.57%	6
50 to 59	14.29%	3
60 to 69	4.76%	1
70 or older	0.00%	0
Prefer not to answer	19.05%	4
TOTAL		21

Q14 What is your average annual household income? (Before taxes)

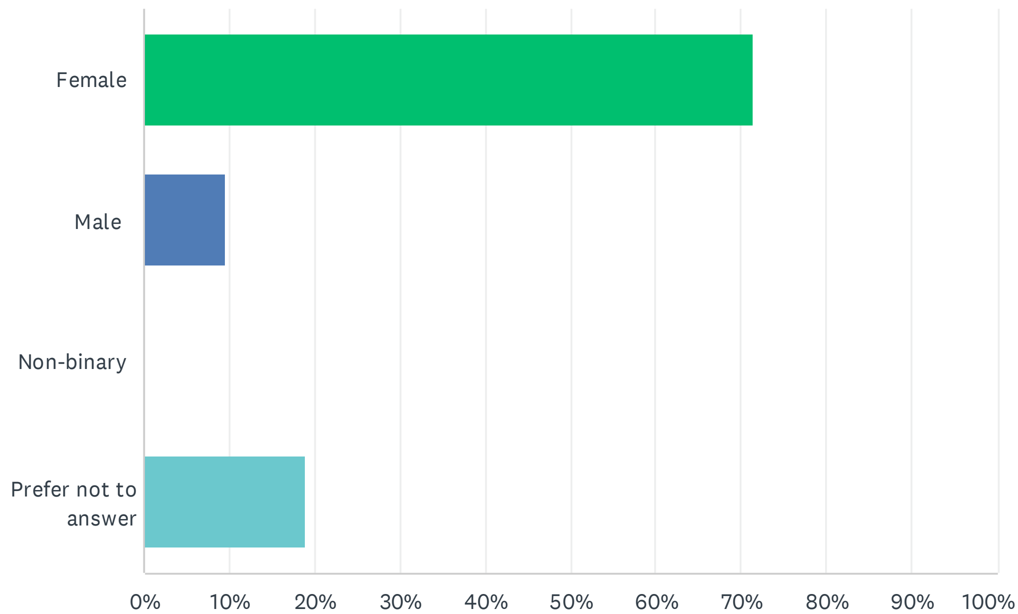
Answered: 21   Skipped: 2



ANSWER CHOICES	RESPONSES	
Under $15,000	0.00%	0
Between $15,000 and $29,999	0.00%	0
Between $30,000 and $49,999	4.76%	1
Between $50,000 and $74,999	23.81%	5
Between $75,000 and $99,999	23.81%	5
Between $100,000 and $149,999	9.52%	2
Over $150,000	19.05%	4
Prefer not to answer	19.05%	4
TOTAL		21

Q15 How would you describe your gender?

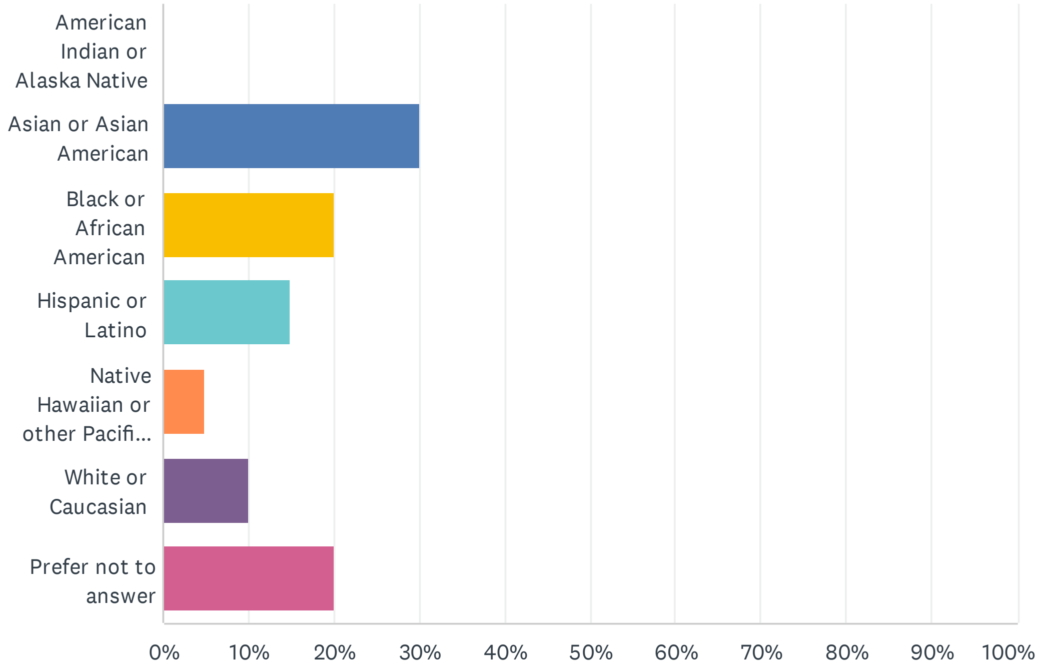
Answered: 21 Skipped: 2



ANSWER CHOICES	RESPONSES	
Female	71.43%	15
Male	9.52%	2
Non-binary	0.00%	0
Prefer not to answer	19.05%	4
TOTAL		21

Q16 How would you describe your race? You may select more than one.

Answered: 20 Skipped: 3



ANSWER CHOICES	RESPONSES	
American Indian or Alaska Native	0.00%	0
Asian or Asian American	30.00%	6
Black or African American	20.00%	4
Hispanic or Latino	15.00%	3
Native Hawaiian or other Pacific Islander	5.00%	1
White or Caucasian	10.00%	2
Prefer not to answer	20.00%	4
Total Respondents: 20		

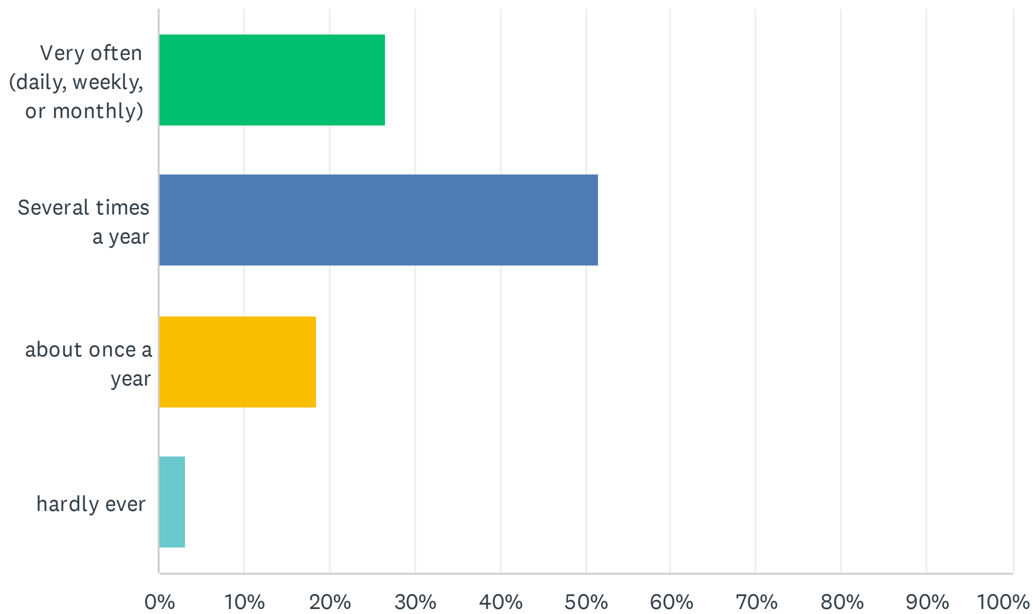
Q17 Thank you for completing the survey! As a token of our appreciation, we would like to enter your name into a lottery drawing to win a $50 Amazon gift card. If you would like to participate, please provide your full name, city or town, and valid email address below so we can contact you if you are the winner. Participation is completely optional.

Answered: 16 Skipped: 7

ANSWER CHOICES	RESPONSES	
Name	100.00%	16
Company	0.00%	0
Address	0.00%	0
Address 2	0.00%	0
City/Town	100.00%	16
State/Province	0.00%	0
ZIP/Postal Code	0.00%	0
Country	0.00%	0
Email Address	100.00%	16
Phone Number	0.00%	0

Q1 How often do you think or worry about natural disasters?

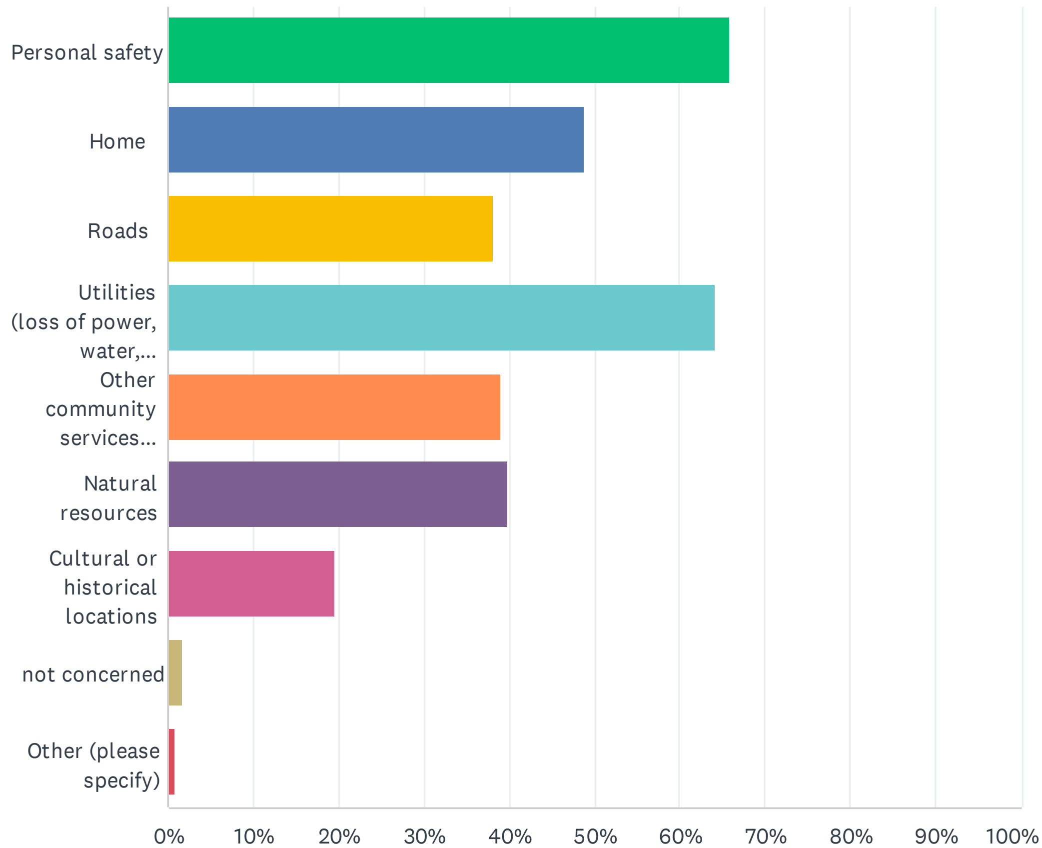
Answered: 124 Skipped: 3



ANSWER CHOICES	RESPONSES	
Very often (daily, weekly, or monthly)	26.61%	33
Several times a year	51.61%	64
about once a year	18.55%	23
hardly ever	3.23%	4
TOTAL		124

Q2 When considering drought/water shortage in your community, are you concerned about damage or impacts to your:

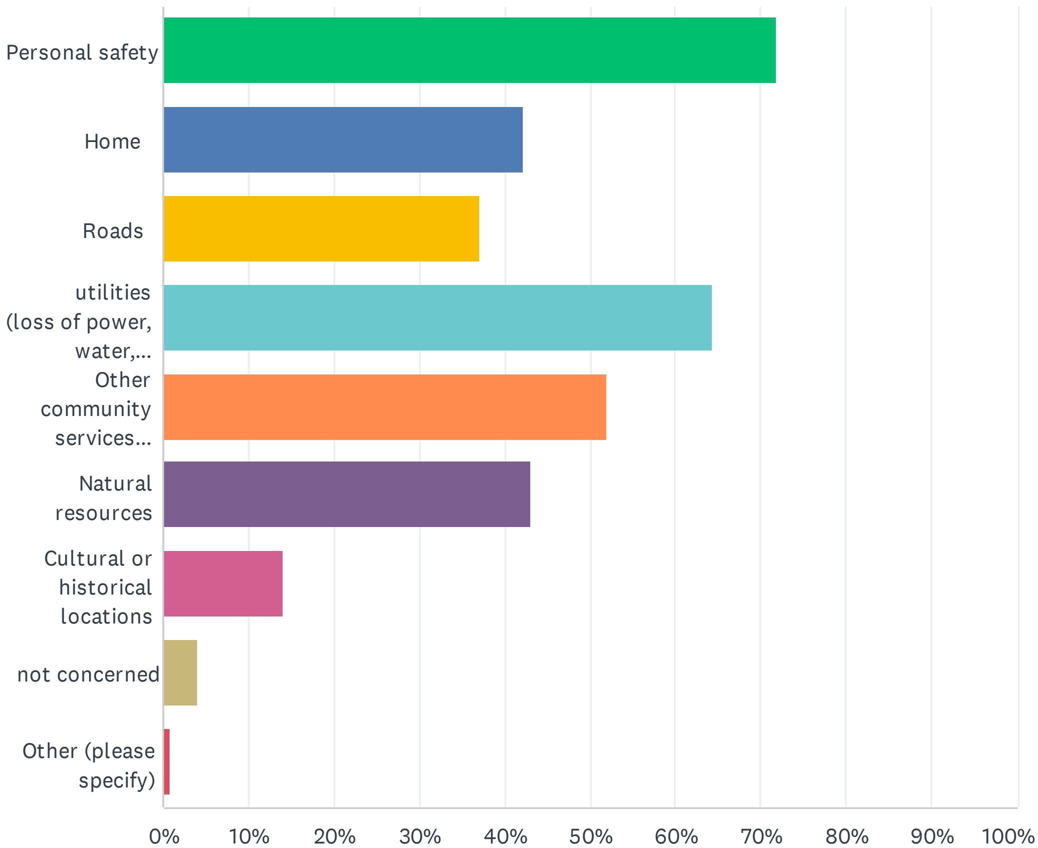
Answered: 123   Skipped: 4



ANSWER CHOICES	RESPONSES	
Personal safety	65.85%	81
Home	48.78%	60
Roads	38.21%	47
Utilities (loss of power, water, cable/internet, etc)	64.23%	79
Other community services (hospital functions, police, EMS, etc)	39.02%	48
Natural resources	39.84%	49
Cultural or historical locations	19.51%	24
not concerned	1.63%	2
Other (please specify)	0.81%	1
Total Respondents: 123		

Q3 When considering extreme heat, are you concerned about damages or impacts to your:

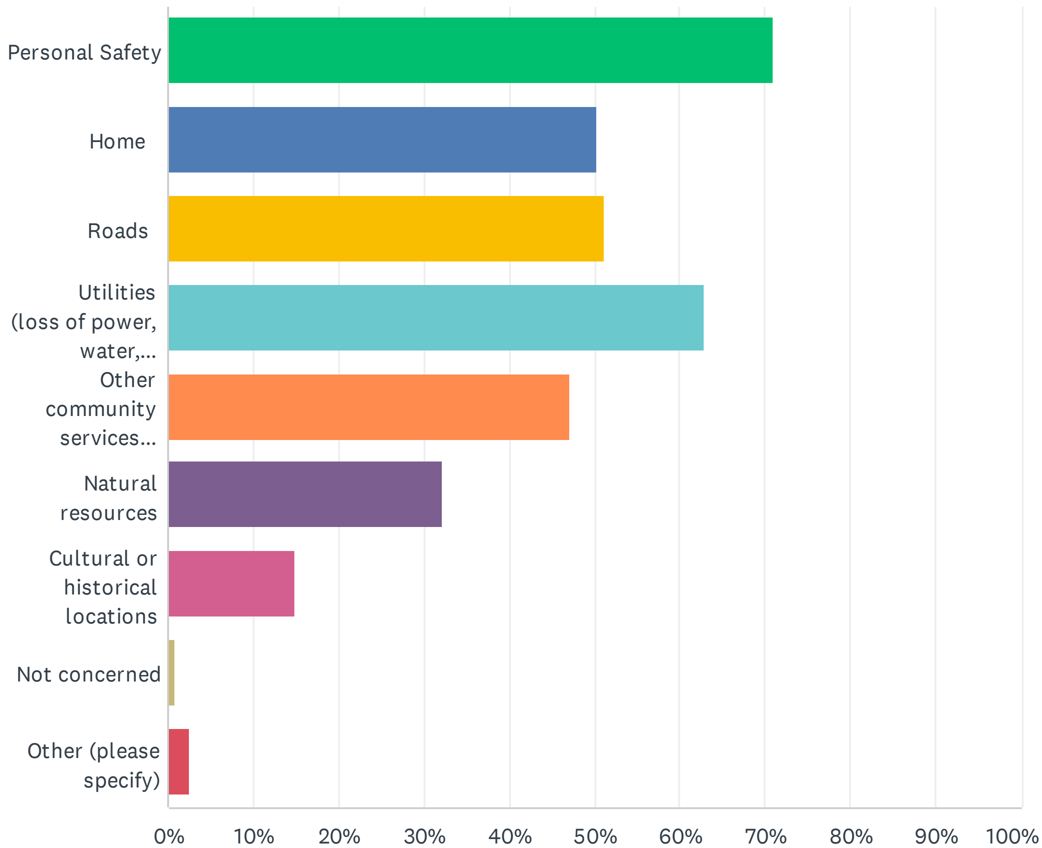
Answered: 121 Skipped: 6



ANSWER CHOICES	RESPONSES	
Personal safety	71.90%	87
Home	42.15%	51
Roads	37.19%	45
utilities (loss of power, water, cable/internet, etc.)	64.46%	78
Other community services (hospital functions, police, EMS, etc.)	52.07%	63
Natural resources	42.98%	52
Cultural or historical locations	14.05%	17
not concerned	4.13%	5
Other (please specify)	0.83%	1
Total Respondents: 121		

Q4 When considering extreme cold, are you concerned about damage or impacts to your:

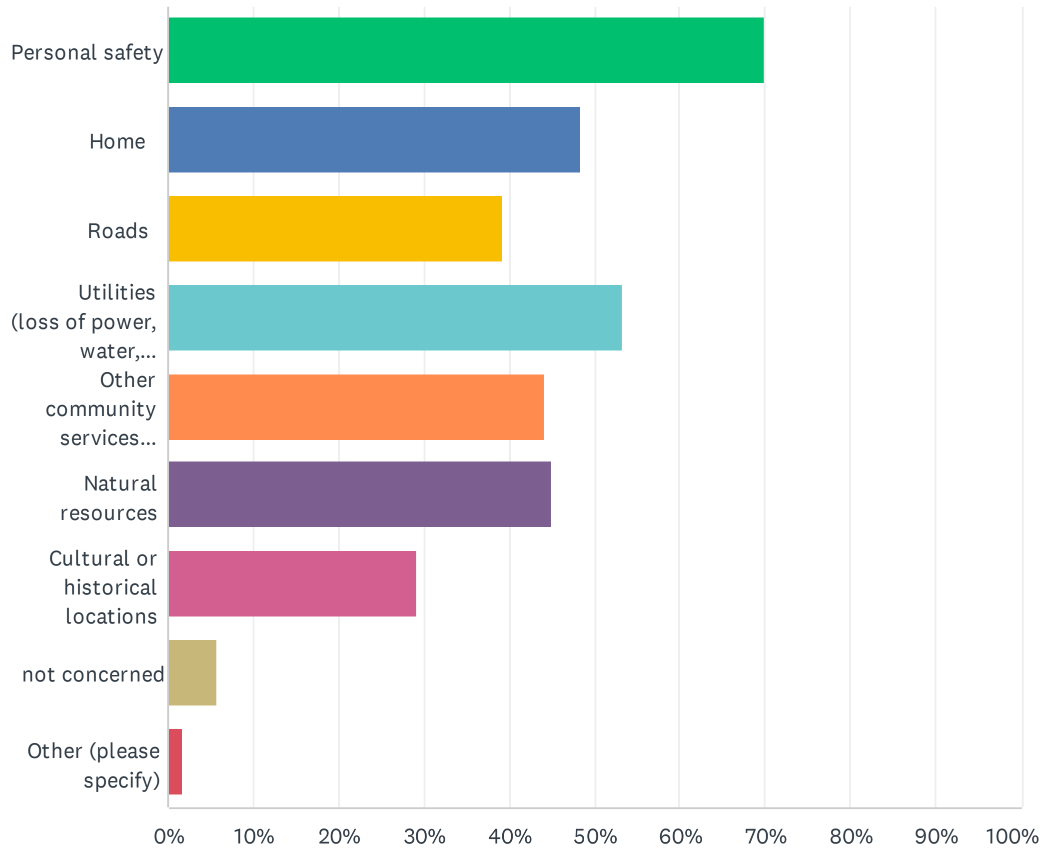
Answered: 121 Skipped: 6



ANSWER CHOICES	RESPONSES	
Personal Safety	71.07%	86
Home	50.41%	61
Roads	51.24%	62
Utilities (loss of power, water, cable/internet, etc)	62.81%	76
Other community services (hospital functions, police, EMS, etc.)	47.11%	57
Natural resources	32.23%	39
Cultural or historical locations	14.88%	18
Not concerned	0.83%	1
Other (please specify)	2.48%	3
Total Respondents: 121		

Q5 When considering wildfires, are you concerned about damage or impacts to your

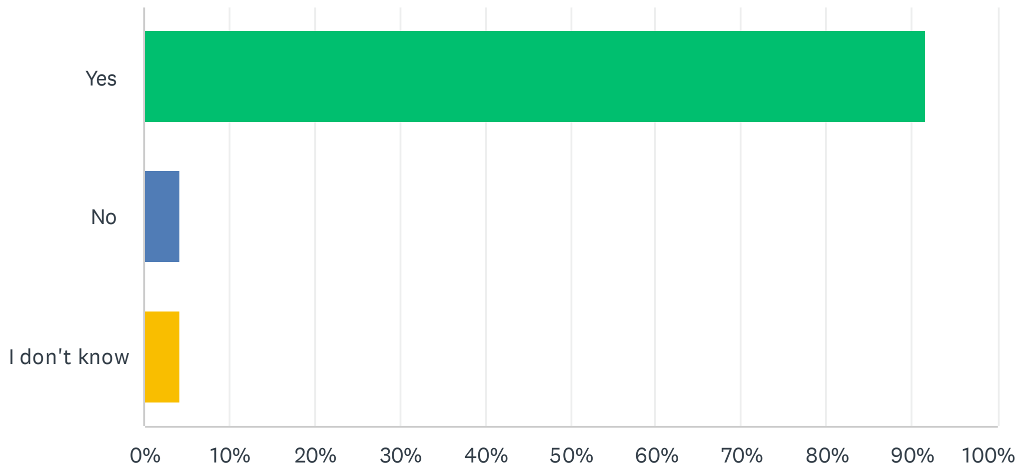
Answered: 120   Skipped: 7



ANSWER CHOICES	RESPONSES	
Personal safety	70.00%	84
Home	48.33%	58
Roads	39.17%	47
Utilities (loss of power, water, cable/internet, etc.)	53.33%	64
Other community services (hospital functions, police, EMS, etc.)	44.17%	53
Natural resources	45.00%	54
Cultural or historical locations	29.17%	35
not concerned	5.83%	7
Other (please specify)	1.67%	2
Total Respondents: 120		

Q6 Heat islands are urbanized areas that experience higher temperatures than outlying areas. Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies. Utilizing native vegetation, instead of foreign grasses, can also decrease water utilization and support pollinator populations. Would you support the integration of more native vegetation in your area to decrease heat island impacts?

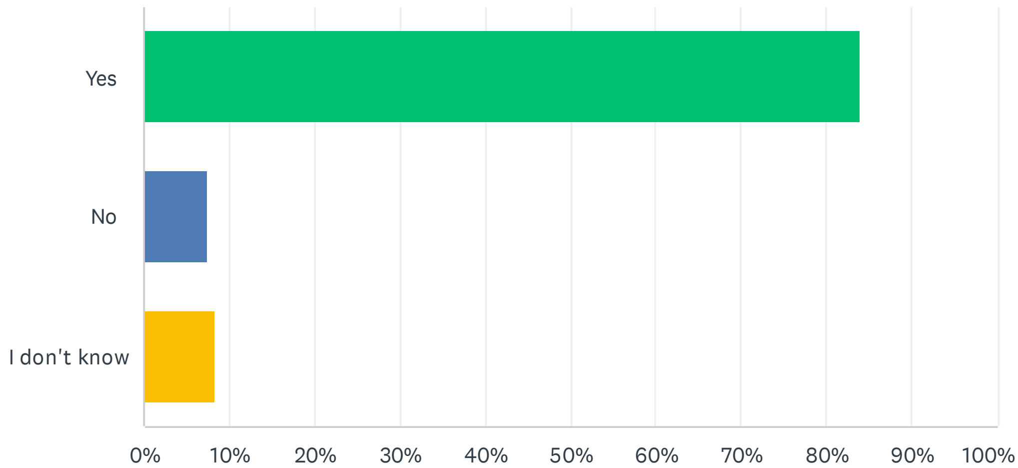
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	91.60%	109
No	4.20%	5
I don't know	4.20%	5
TOTAL		119

Q7 Would you be interested in information on native vegetation, rain gardens, or other methods you could implement at your home to decrease heat island impacts?

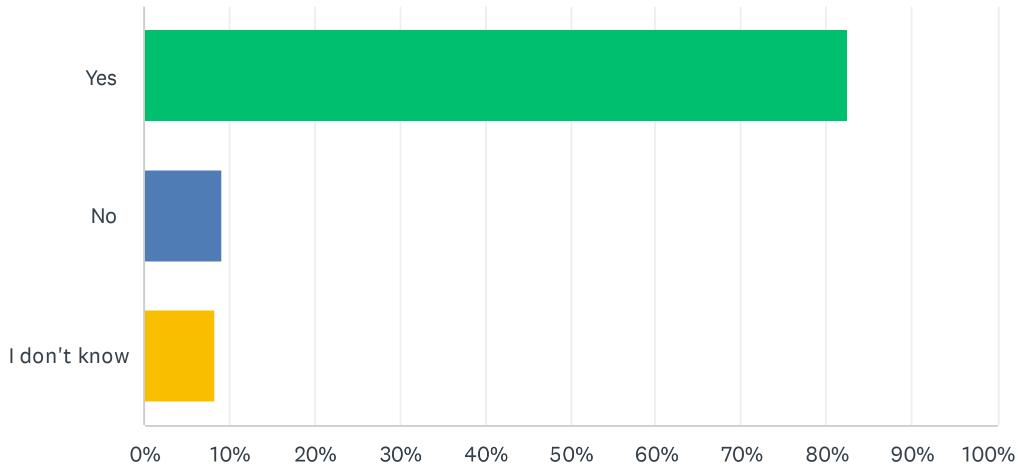
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	84.03%	100
No	7.56%	9
I don't know	8.40%	10
TOTAL		119

Q8 "Defensible Space" is a buffer between a building and the surrounding wildland area. It is designed to reduce the likelihood of direct contact between a wildfire and a home, or a structure fire and surrounding vegetation. Would you be interested in participating in a residential defensible space program?

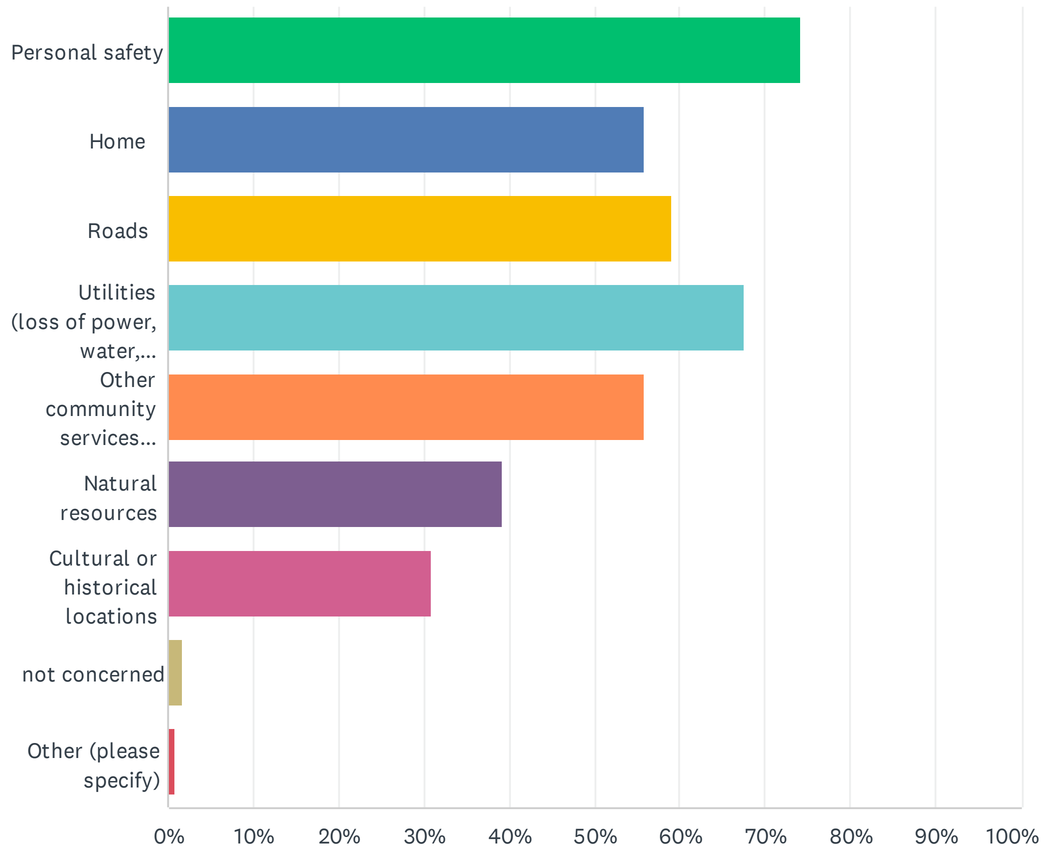
Answered: 120 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	82.50%	99
No	9.17%	11
I don't know	8.33%	10
TOTAL		120

Q9 When considering earthquakes, are you concerned about damage or impacts to your:

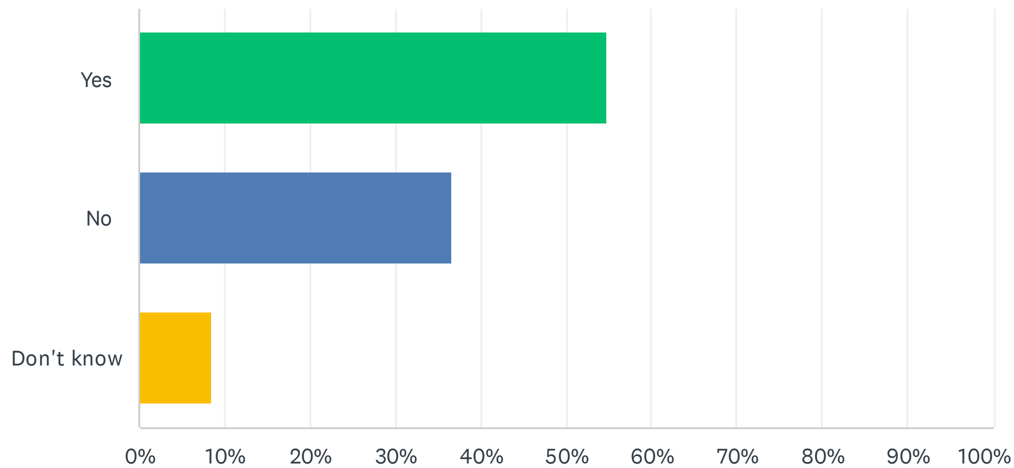
Answered: 120   Skipped: 7



ANSWER CHOICES	RESPONSES	
Personal safety	74.17%	89
Home	55.83%	67
Roads	59.17%	71
Utilities (loss of power, water, cable/internet, etc.)	67.50%	81
Other community services (hospital functions, police, EMS, etc.)	55.83%	67
Natural resources	39.17%	47
Cultural or historical locations	30.83%	37
not concerned	1.67%	2
Other (please specify)	0.83%	1
Total Respondents: 120		

Q10 Do you have earthquake insurance?

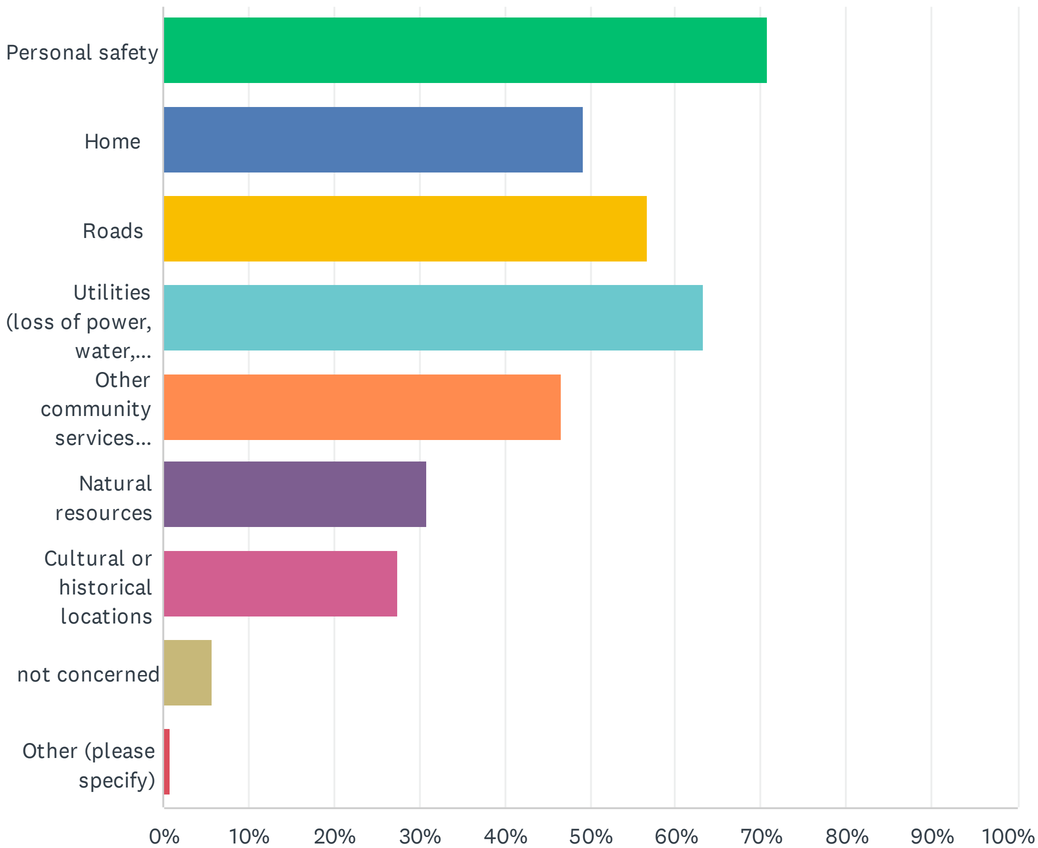
Answered: 117 Skipped: 10



ANSWER CHOICES	RESPONSES	
Yes	54.70%	64
No	36.75%	43
Don't know	8.55%	10
TOTAL		117

Q11 When considering landslides, are you concerned about damage or impacts to your:

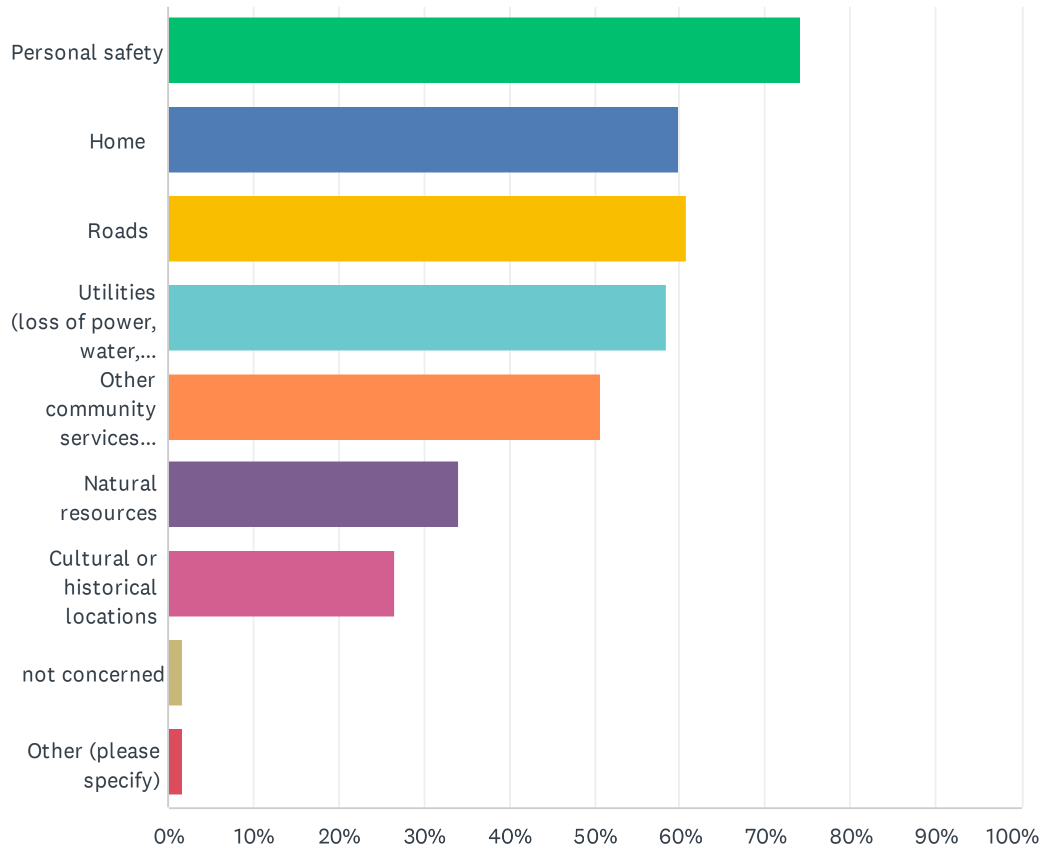
Answered: 120 Skipped: 7



ANSWER CHOICES	RESPONSES	
Personal safety	70.83%	85
Home	49.17%	59
Roads	56.67%	68
Utilities (loss of power, water, cable/internet, etc.)	63.33%	76
Other community services (hospital functions, police, EMS, etc.)	46.67%	56
Natural resources	30.83%	37
Cultural or historical locations	27.50%	33
not concerned	5.83%	7
Other (please specify)	0.83%	1
Total Respondents: 120		

Q12 When considering sinkholes/land subsidence, are you concerned about damage or impacts to your:

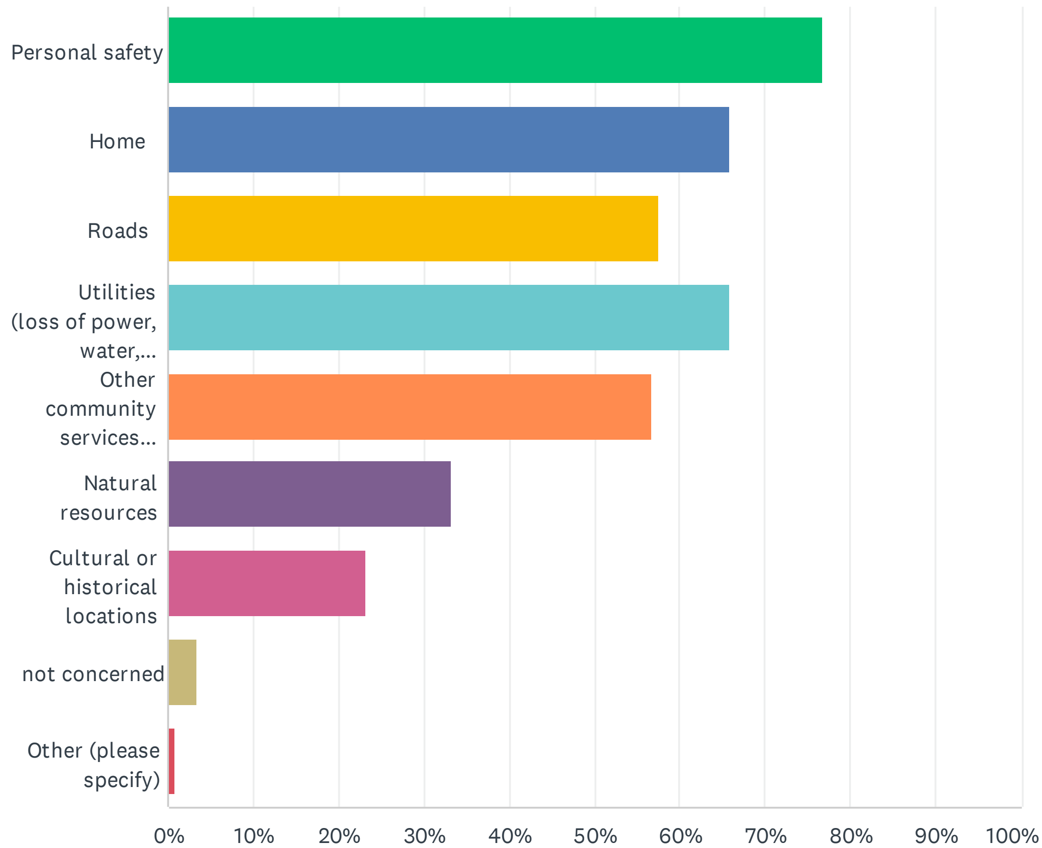
Answered: 120 Skipped: 7



ANSWER CHOICES	RESPONSES	
Personal safety	74.17%	89
Home	60.00%	72
Roads	60.83%	73
Utilities (loss of power, water, cable/internet, etc.)	58.33%	70
Other community services (hospital functions, police, EMS, etc.)	50.83%	61
Natural resources	34.17%	41
Cultural or historical locations	26.67%	32
not concerned	1.67%	2
Other (please specify)	1.67%	2
Total Respondents: 120		

Q13 When considering floods, are you concerned about damage or impacts to your:

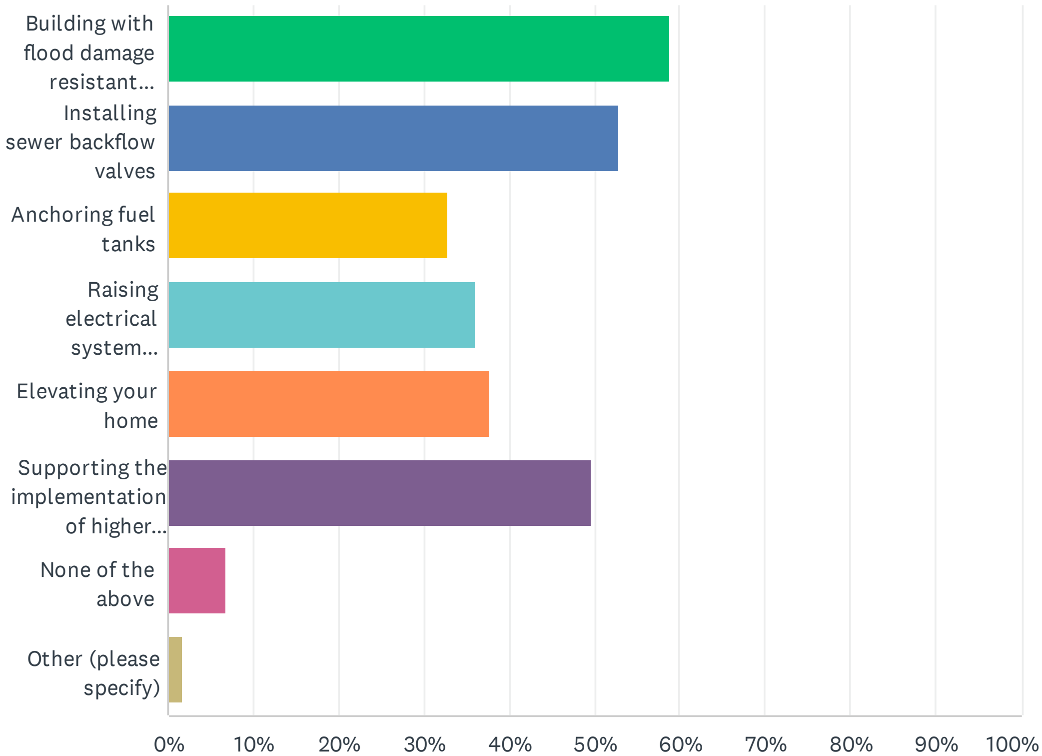
Answered: 120 Skipped: 7



ANSWER CHOICES	RESPONSES	
Personal safety	76.67%	92
Home	65.83%	79
Roads	57.50%	69
Utilities (loss of power, water, cable/internet, etc.)	65.83%	79
Other community services (hospital functions, police, EMS, etc.)	56.67%	68
Natural resources	33.33%	40
Cultural or historical locations	23.33%	28
not concerned	3.33%	4
Other (please specify)	0.83%	1
Total Respondents: 120		

Q14 If a program was offered, would you be interested in participating in any of the following flood mitigation activities? Activities could be funded through low interest loans or participation in a grant program:

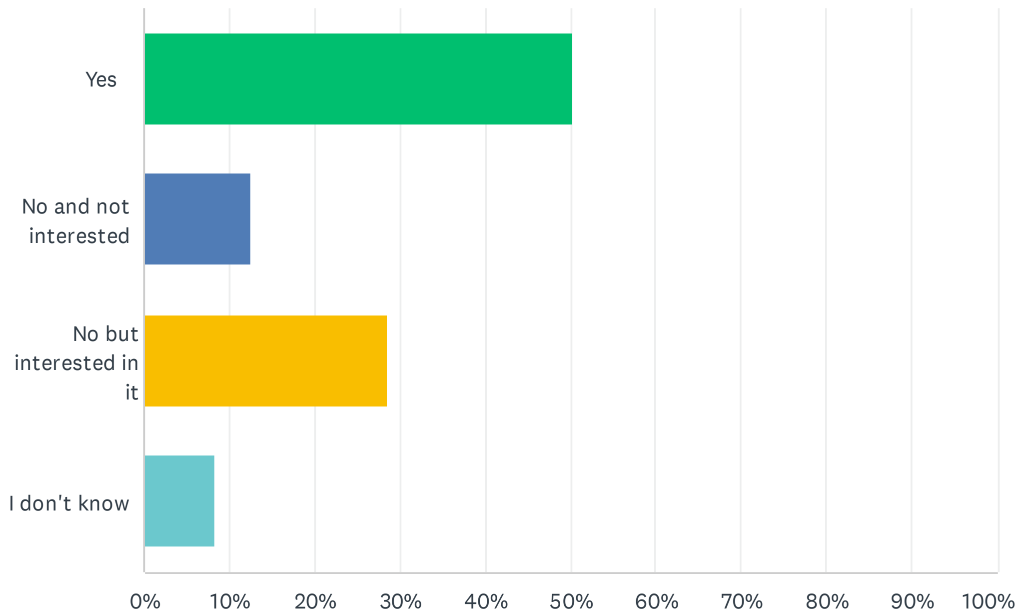
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Building with flood damage resistant materials	58.82%	70
Installing sewer backflow valves	52.94%	63
Anchoring fuel tanks	32.77%	39
Raising electrical system components	36.13%	43
Elevating your home	37.82%	45
Supporting the implementation of higher building code standards, particularly where they could lead to flood insurance discounts	49.58%	59
None of the above	6.72%	8
Other (please specify)	1.68%	2
Total Respondents: 119		

Q15 Flood insurance can be purchased by any homeowner, even if it is not required by your mortgage lender. Flood insurance rates for homeowners outside of the Special Flood Hazard area are typically cheaper than homes in the floodplain. Do you have flood insurance?

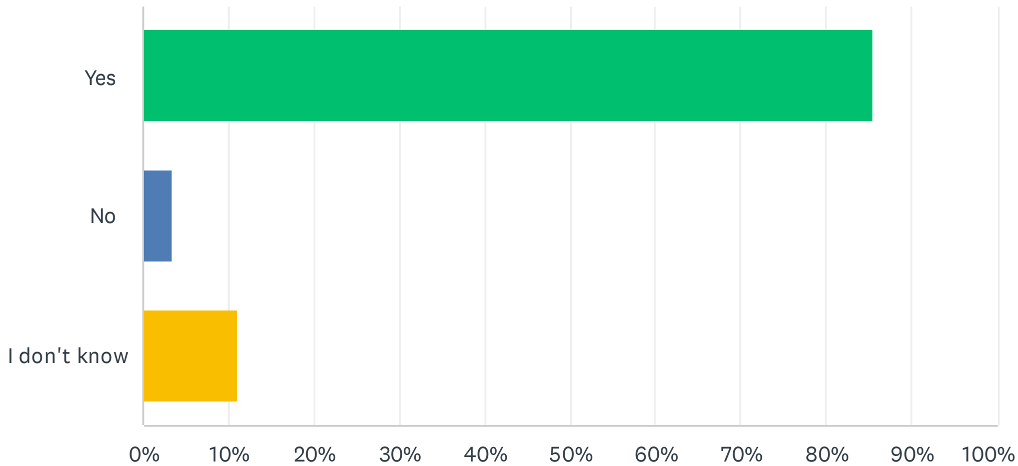
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	50.42%	60
No and not interested	12.61%	15
No but interested in it	28.57%	34
I don't know	8.40%	10
TOTAL		119

Q16 "Daylighting" is when a buried watercourse, typically flowing through culverts under concrete or roadways, is opened and restored to more natural conditions. The purpose of returning to riparian environment of a stream, wash, or river to a more natural state is to reduce runoff, create habitat for species, and/or improve an area's aesthetics. Is this a project you would support in your community?

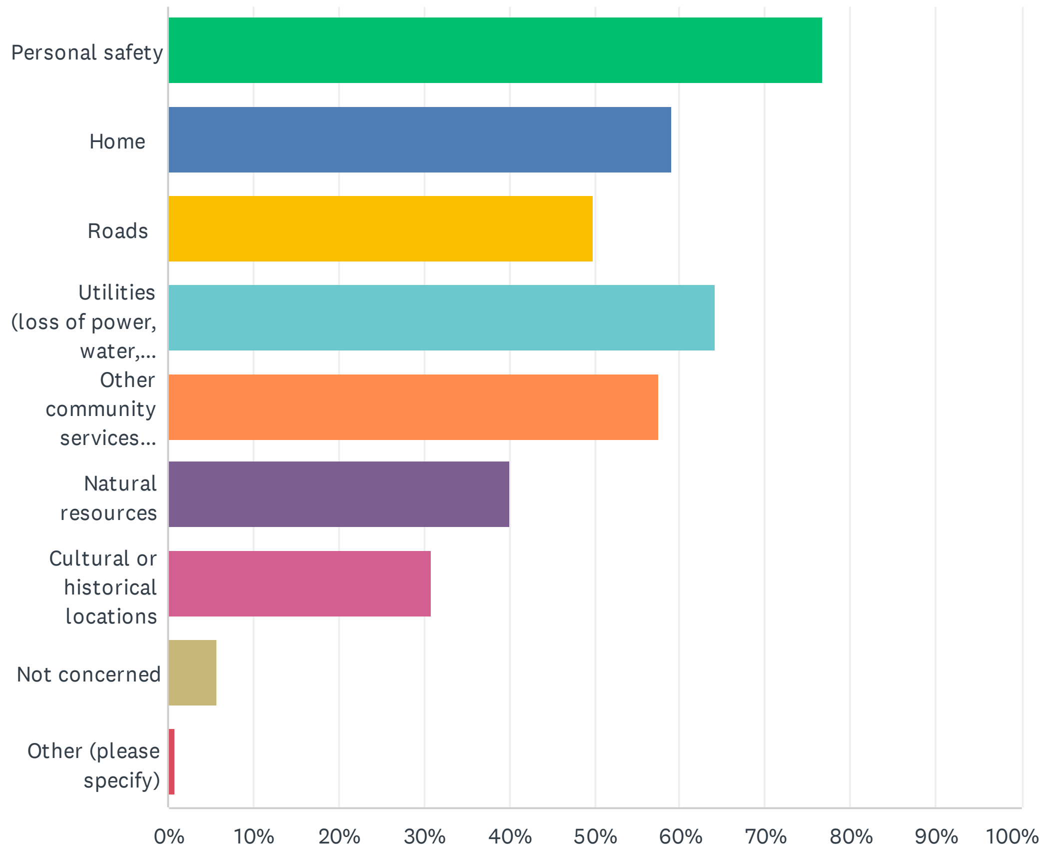
Answered: 118 Skipped: 9



ANSWER CHOICES	RESPONSES	
Yes	85.59%	101
No	3.39%	4
I don't know	11.02%	13
TOTAL		118

Q17 When considering tsunamis, are you concerned about damage or impacts to your:

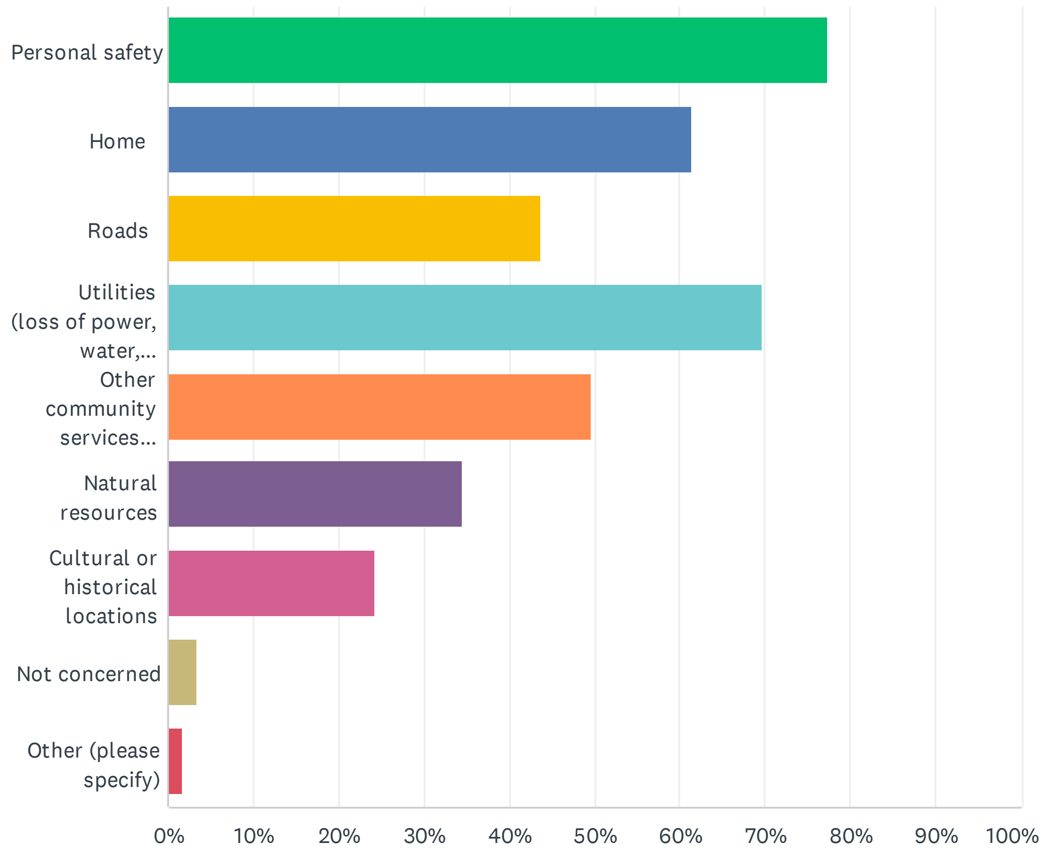
Answered: 120 Skipped: 7



ANSWER CHOICES	RESPONSES	
Personal safety	76.67%	92
Home	59.17%	71
Roads	50.00%	60
Utilities (loss of power, water, cable/internet, etc)	64.17%	77
Other community services (hospital functions, police, EMS, etc)	57.50%	69
Natural resources	40.00%	48
Cultural or historical locations	30.83%	37
Not concerned	5.83%	7
Other (please specify)	0.83%	1
Total Respondents: 120		

Q18 When considering severe storms/thunderstorms, are you concerned about damage or impacts to your:

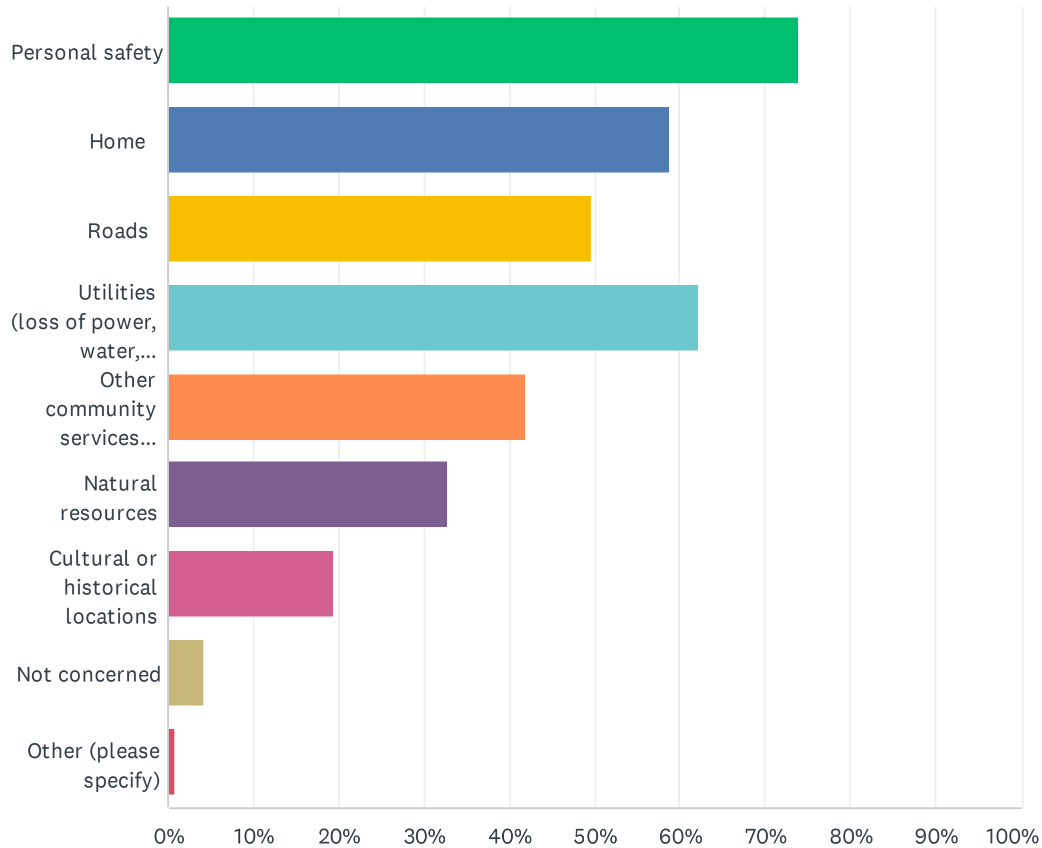
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Personal safety	77.31%	92
Home	61.34%	73
Roads	43.70%	52
Utilities (loss of power, water, cable/internet, etc)	69.75%	83
Other community services (hospital functions, police, EMS, etc)	49.58%	59
Natural resources	34.45%	41
Cultural or historical locations	24.37%	29
Not concerned	3.36%	4
Other (please specify)	1.68%	2
Total Respondents: 119		

Q19 When considering hail, are you concerned about damage or impacts to your:

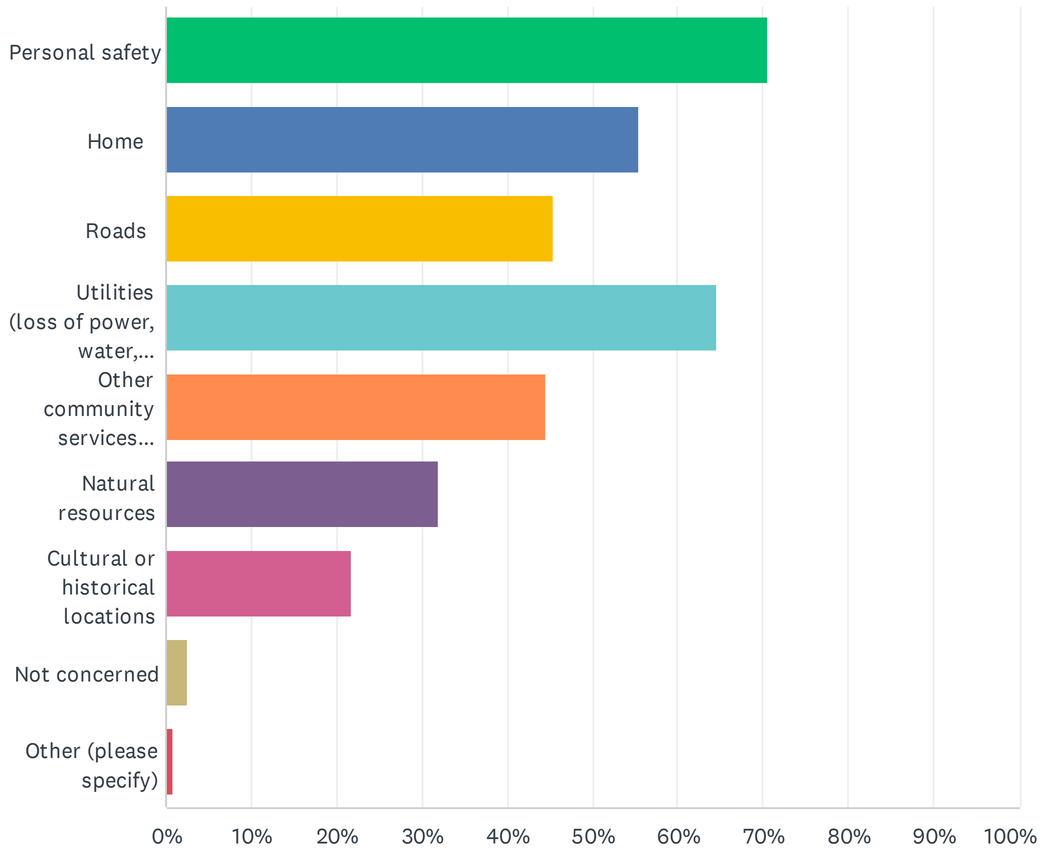
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Personal safety	73.95%	88
Home	58.82%	70
Roads	49.58%	59
Utilities (loss of power, water, cable/internet, etc)	62.18%	74
Other community services (hospital functions, police, EMS, etc)	42.02%	50
Natural resources	32.77%	39
Cultural or historical locations	19.33%	23
Not concerned	4.20%	5
Other (please specify)	0.84%	1
Total Respondents: 119		

Q20 When considering high wind, are you concerned about damage or impacts to your:

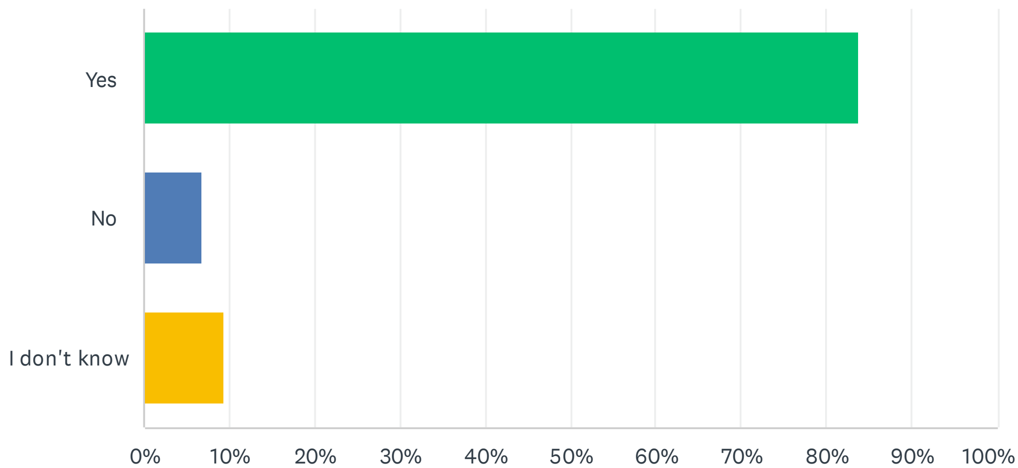
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Personal safety	70.59%	84
Home	55.46%	66
Roads	45.38%	54
Utilities (loss of power, water, cable/internet, etc)	64.71%	77
Other community services (hospital functions, police, EMS, etc)	44.54%	53
Natural resources	31.93%	38
Cultural or historical locations	21.85%	26
Not concerned	2.52%	3
Other (please specify)	0.84%	1
Total Respondents: 119		

Q21 A hurricane strap is a connector, usually made of galvanized or stainless steel, that is used to strengthen wood framed roofs and homes. They create a load path between the roof and the foundation, allowing the force of strong winds to be shared throughout the structure rather than only the roof during weather events like tropical storms, tornadoes, high wind, and winter storms. Each strap costs less than $2.00 and would need to be installed according to code at regular intervals through the home's frame.If property tax breaks were offered, would you be interested in this type of home retrofit?

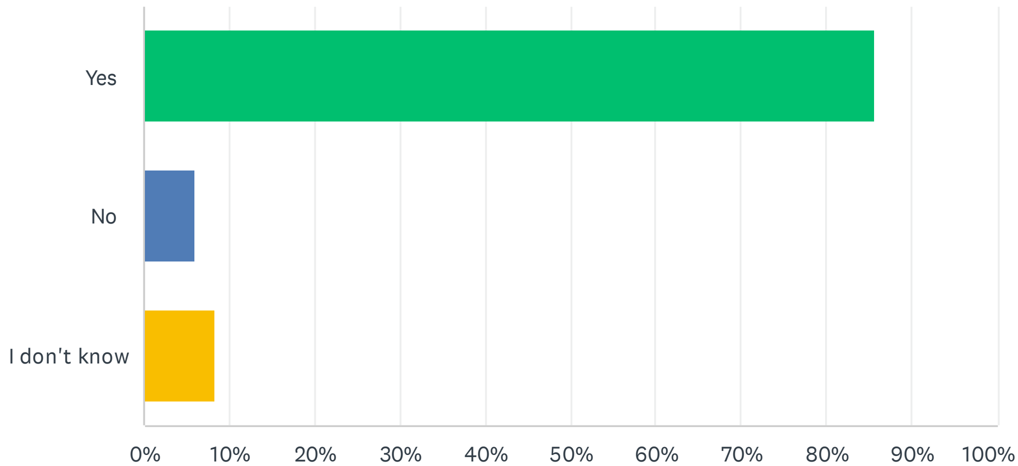
Answered: 118 Skipped: 9



ANSWER CHOICES	RESPONSES	
Yes	83.90%	99
No	6.78%	8
I don't know	9.32%	11
TOTAL		118

Q22 Would you support the implementation of higher local building codes to require hurricanes straps in new construction or permitted retrofits?

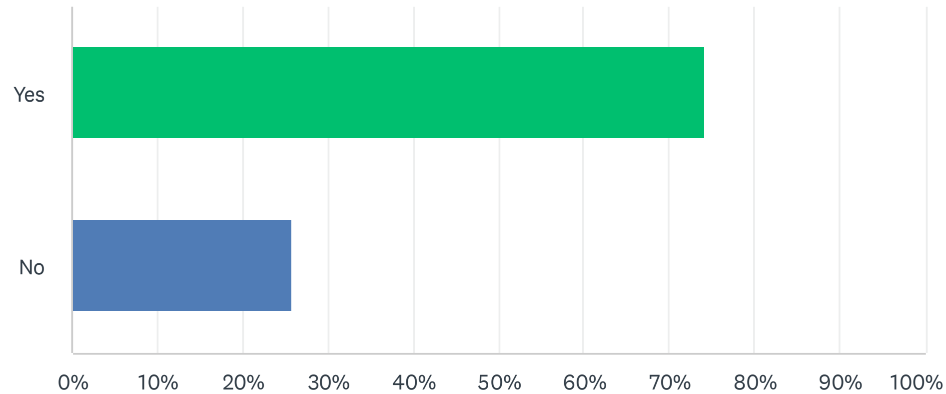
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	85.71%	102
No	5.88%	7
I don't know	8.40%	10
TOTAL		119

Q23 If an emergency evacuation notice was issued for your area, would you know where to go?

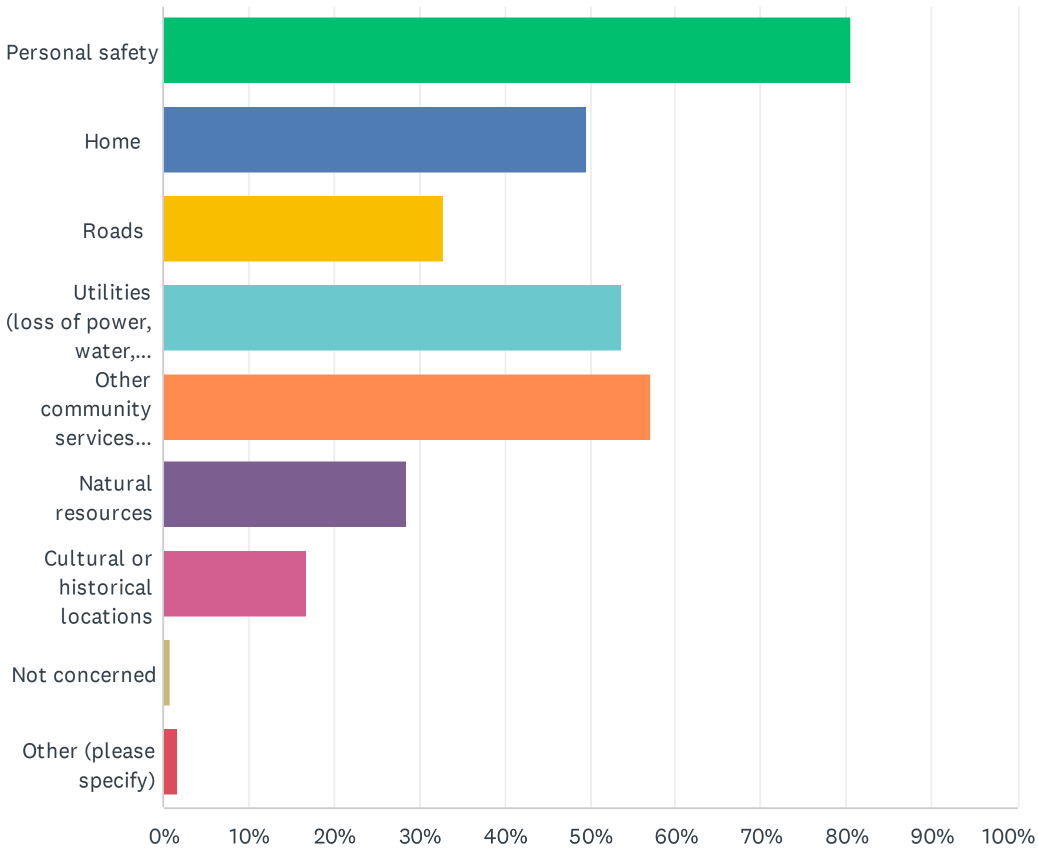
Answered: 116 Skipped: 11



ANSWER CHOICES	RESPONSES	
Yes	74.14%	86
No	25.86%	30
TOTAL		116

Q24 When considering pandemics, are you concerned about damage or impacts to your:

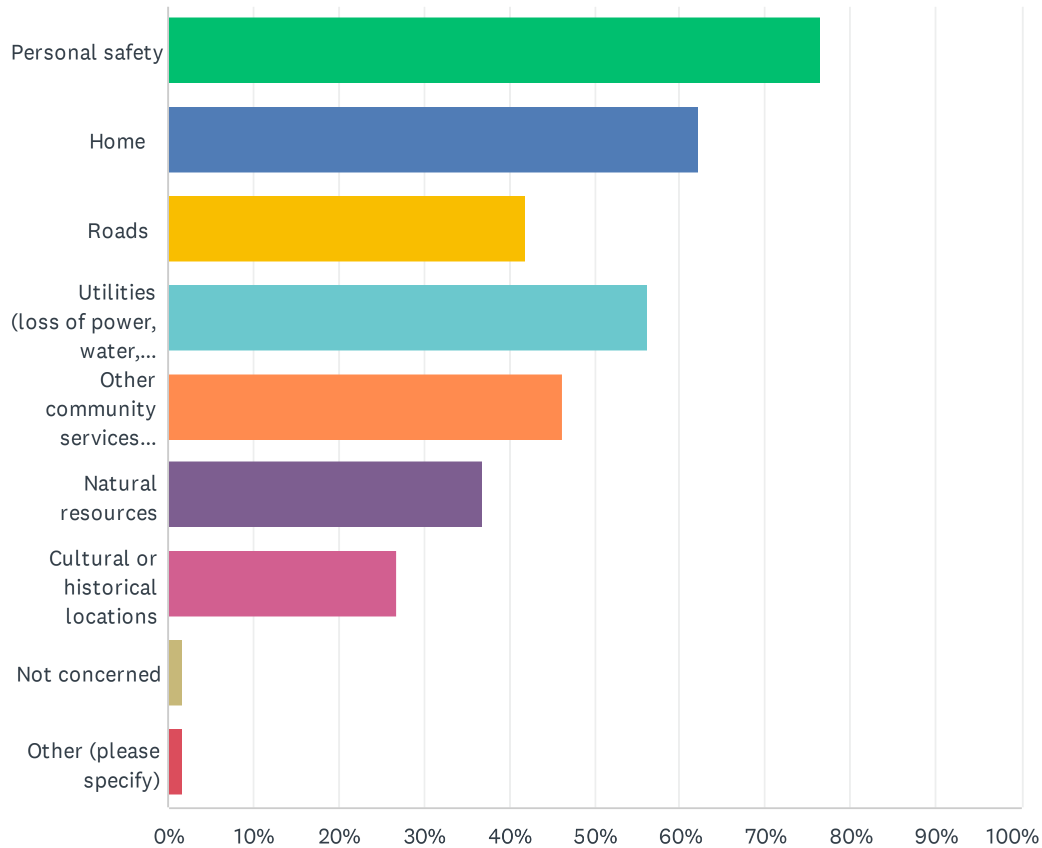
Answered: 119 Skipped: 8



ANSWER CHOICES	RESPONSES	
Personal safety	80.67%	96
Home	49.58%	59
Roads	32.77%	39
Utilities (loss of power, water, cable/internet, etc)	53.78%	64
Other community services (hospital functions, police, EMS, etc)	57.14%	68
Natural resources	28.57%	34
Cultural or historical locations	16.81%	20
Not concerned	0.84%	1
Other (please specify)	1.68%	2
Total Respondents: 119		

Q25 When considering urban fire, are you concerned about damage or impacts to your:

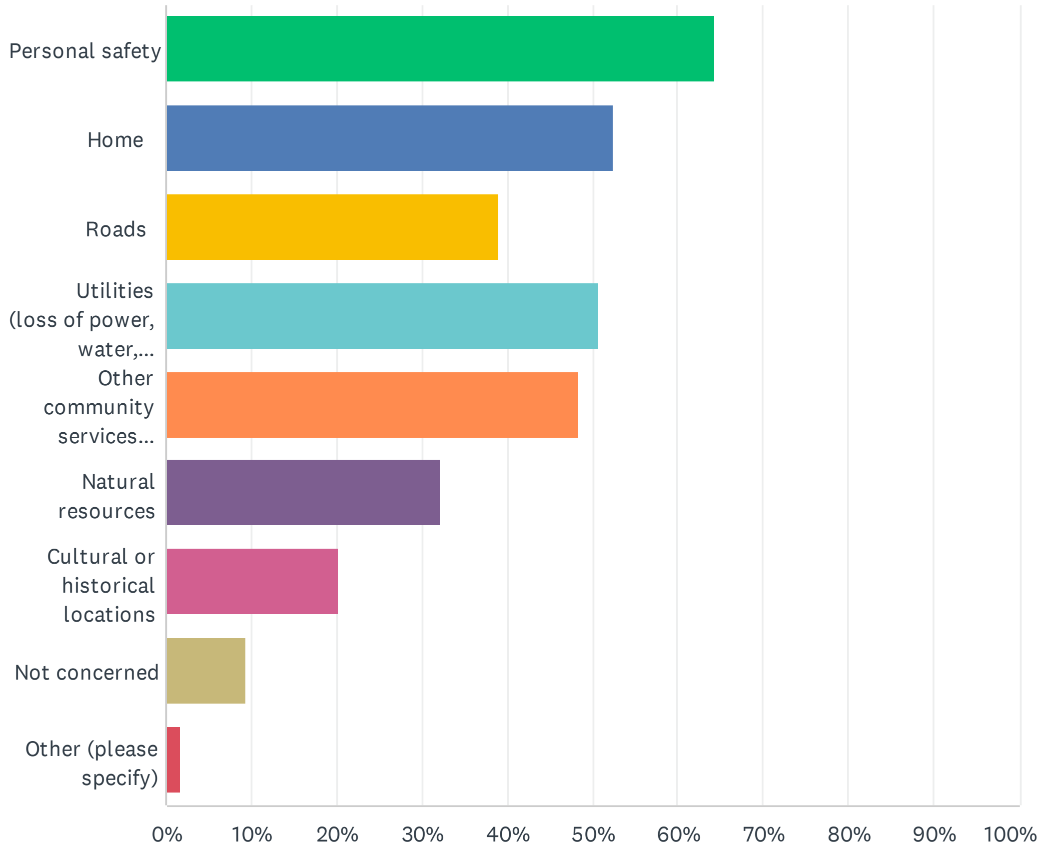
Answered: 119   Skipped: 8



ANSWER CHOICES	RESPONSES	
Personal safety	76.47%	91
Home	62.18%	74
Roads	42.02%	50
Utilities (loss of power, water, cable/internet, etc)	56.30%	67
Other community services (hospital functions, police, EMS, etc)	46.22%	55
Natural resources	36.97%	44
Cultural or historical locations	26.89%	32
Not concerned	1.68%	2
Other (please specify)	1.68%	2
Total Respondents: 119		

Q26 When considering environmental hazards (mining, hazardous materials, conventional and unconventional wells, etc) are you concerned about damage or impacts to your:

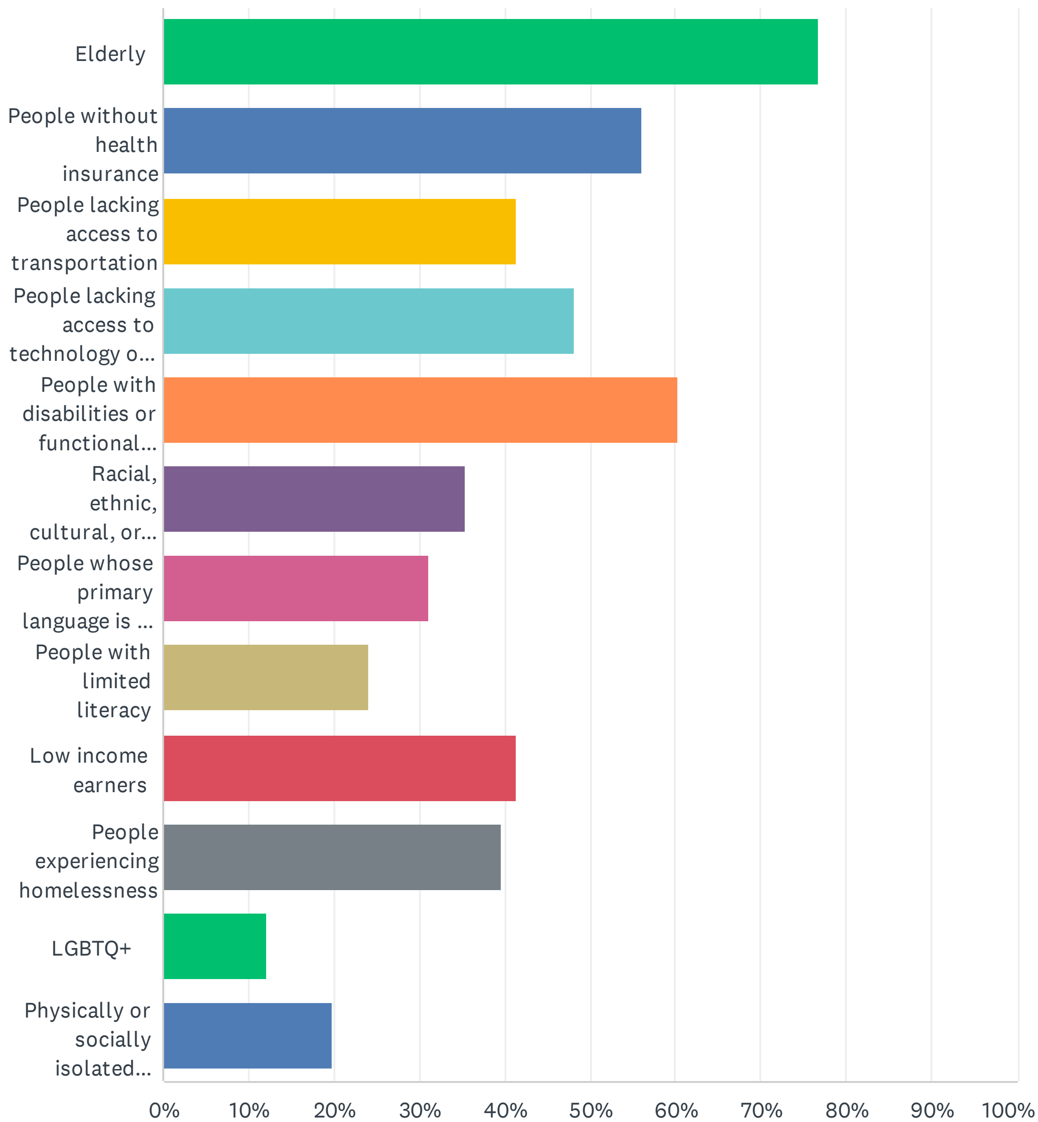
Answered: 118 Skipped: 9



ANSWER CHOICES	RESPONSES	
Personal safety	64.41%	76
Home	52.54%	62
Roads	38.98%	46
Utilities (loss of power, water, cable/internet, etc)	50.85%	60
Other community services (hospital functions, police, EMS, etc)	48.31%	57
Natural resources	32.20%	38
Cultural or historical locations	20.34%	24
Not concerned	9.32%	11
Other (please specify)	1.69%	2
Total Respondents: 118		

Q27 The term "vulnerable population" can refer to a variety of different populations, and these can vary between communities. Are there any populations that would be at increased risk to any of the hazards mentioned so far?

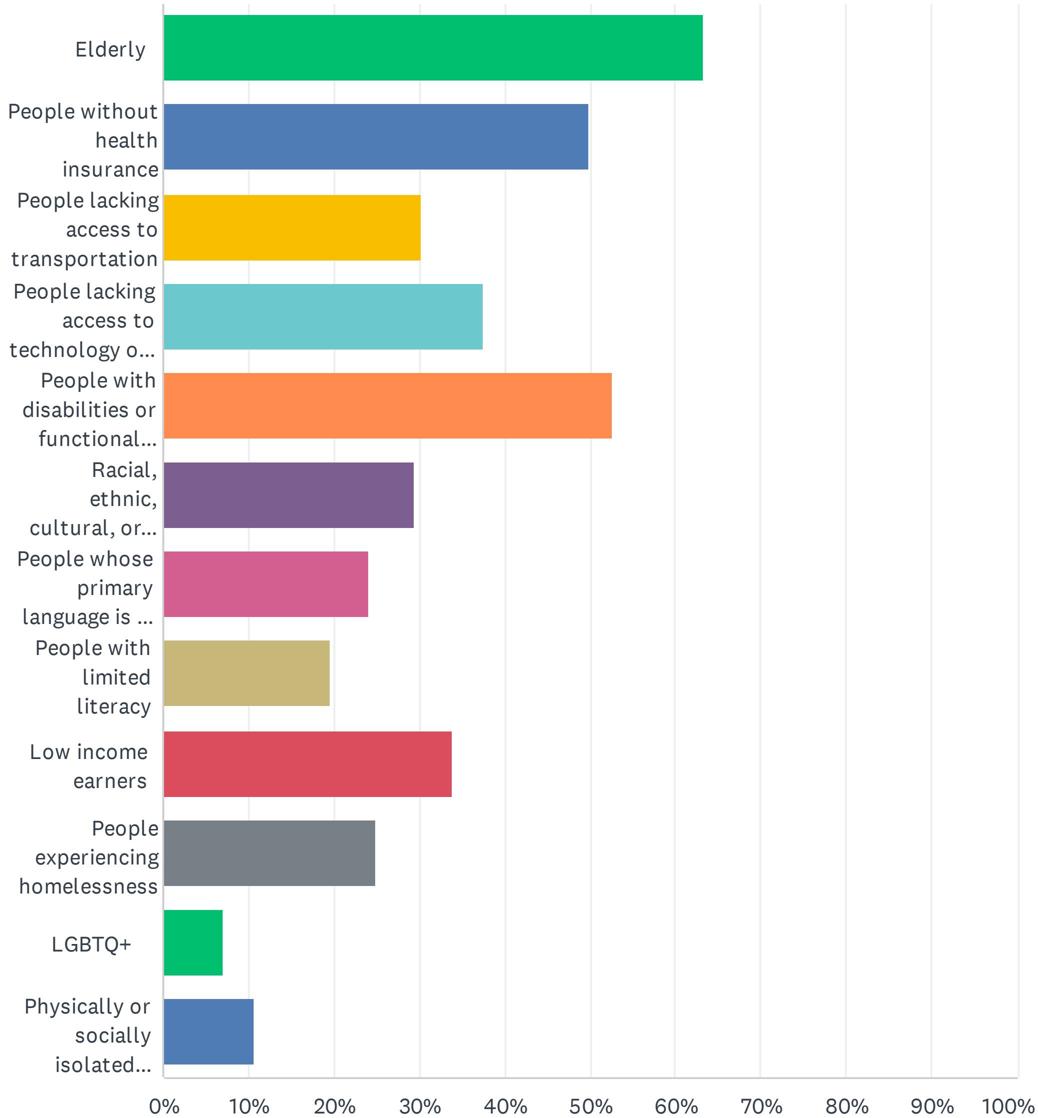
Answered: 116 Skipped: 11



ANSWER CHOICES	RESPONSES	
Elderly	76.72%	89
People without health insurance	56.03%	65
People lacking access to transportation	41.38%	48
People lacking access to technology or with limited technological proficiency	48.28%	56
People with disabilities or functional needs	60.34%	70
Racial, ethnic, cultural, or religious minorities	35.34%	41
People whose primary language is not English	31.03%	36
People with limited literacy	24.14%	28
Low income earners	41.38%	48
People experiencing homelessness	39.66%	46
LGBTQ+	12.07%	14
Physically or socially isolated individuals	19.83%	23
Total Respondents: 116		

Q28 Do you identify with any of the following vulnerable populations?

Answered: 112 Skipped: 15



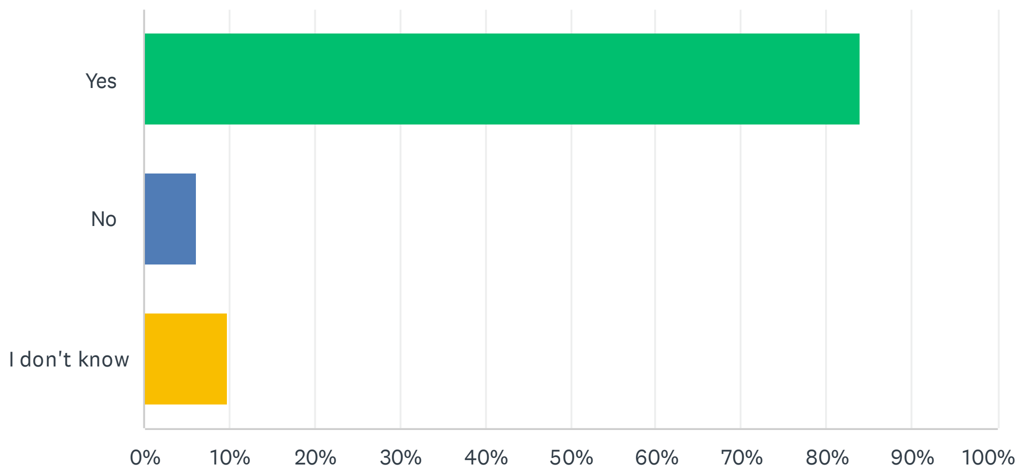
ANSWER CHOICES	RESPONSES	
Elderly	63.39%	71
People without health insurance	50.00%	56
People lacking access to transportation	30.36%	34
People lacking access to technology or with limited technological proficiency	37.50%	42
People with disabilities or functional needs	52.68%	59
Racial, ethnic, cultural, or religious minorities	29.46%	33
People whose primary language is not English	24.11%	27
People with limited literacy	19.64%	22
Low income earners	33.93%	38
People experiencing homelessness	25.00%	28
LGBTQ+	7.14%	8
Physically or socially isolated individuals	10.71%	12
Total Respondents: 112		

Q29 Could the City of Carson provide additional support for vulnerable populations to be better prepared for hazards?

Answered: 85 Skipped: 42

Q30 If a program was offered, would you be interested in joining a community group that fosters emergency preparedness, community support, and discuss future mitigation opportunities?

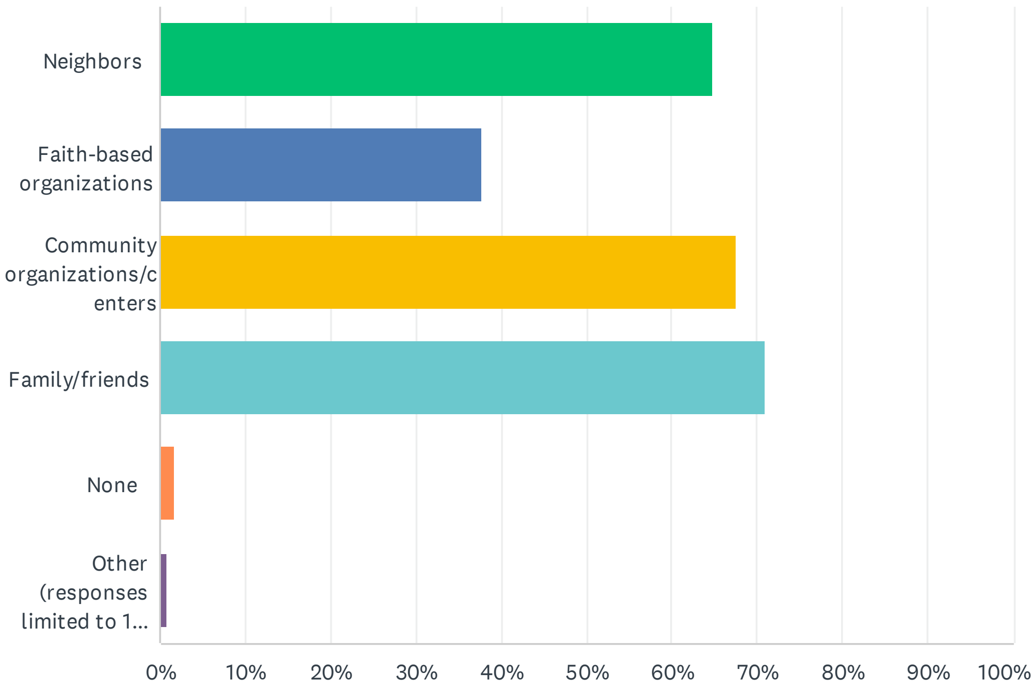
Answered: 113 Skipped: 14



ANSWER CHOICES	RESPONSES	
Yes	84.07%	95
No	6.19%	7
I don't know	9.73%	11
TOTAL		113

Q31 In the event of an emergency, would you feel supported by any of the following?

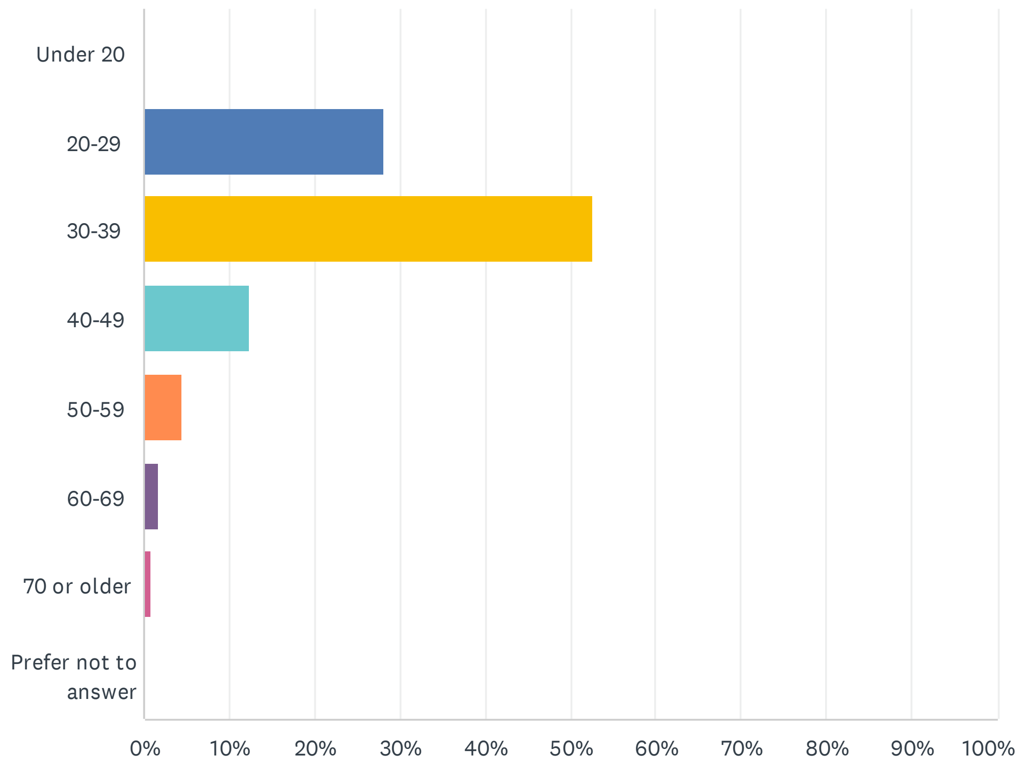
Answered: 114   Skipped: 13



ANSWER CHOICES	RESPONSES	
Neighbors	64.91%	74
Faith-based organizations	37.72%	43
Community organizations/centers	67.54%	77
Family/friends	71.05%	81
None	1.75%	2
Other (responses limited to 100 characters)	0.88%	1
Total Respondents: 114		

Q32 What is your age?

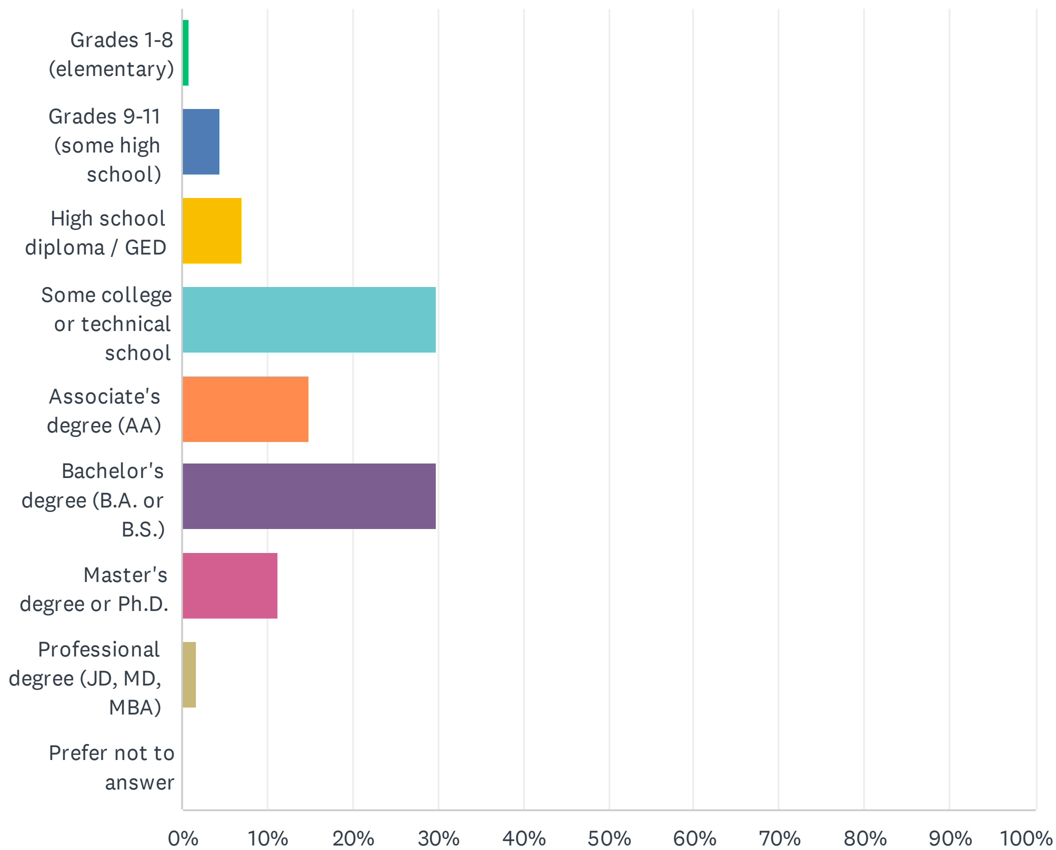
Answered: 114 Skipped: 13



ANSWER CHOICES	RESPONSES	
Under 20	0.00%	0
20-29	28.07%	32
30-39	52.63%	60
40-49	12.28%	14
50-59	4.39%	5
60-69	1.75%	2
70 or older	0.88%	1
Prefer not to answer	0.00%	0
TOTAL		114

Q33 What is the highest level of education you have attained?

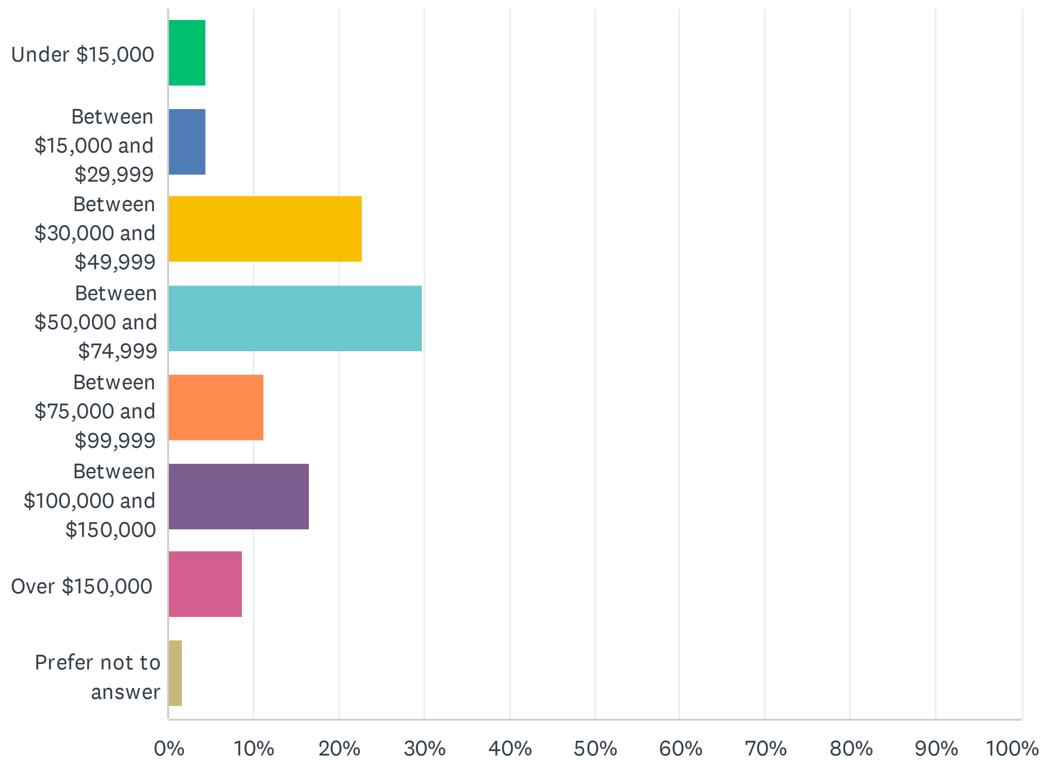
Answered: 114   Skipped: 13



ANSWER CHOICES	RESPONSES	
Grades 1-8 (elementary)	0.88%	1
Grades 9-11 (some high school)	4.39%	5
High school diploma / GED	7.02%	8
Some college or technical school	29.82%	34
Associate's degree (AA)	14.91%	17
Bachelor's degree (B.A. or B.S.)	29.82%	34
Master's degree or Ph.D.	11.40%	13
Professional degree (JD, MD, MBA)	1.75%	2
Prefer not to answer	0.00%	0
TOTAL		114

Q34 What is your average annual household income? (before taxes)

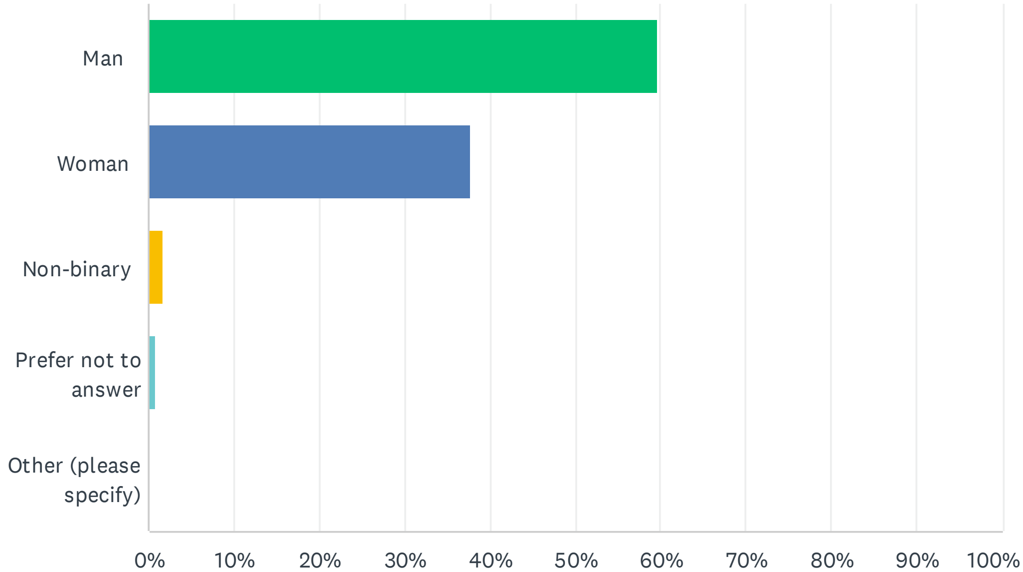
Answered: 114 Skipped: 13



ANSWER CHOICES	RESPONSES	
Under $15,000	4.39%	5
Between $15,000 and $29,999	4.39%	5
Between $30,000 and $49,999	22.81%	26
Between $50,000 and $74,999	29.82%	34
Between $75,000 and $99,999	11.40%	13
Between $100,000 and $150,000	16.67%	19
Over $150,000	8.77%	10
Prefer not to answer	1.75%	2
TOTAL		114

Q35 How would you describe your gender?

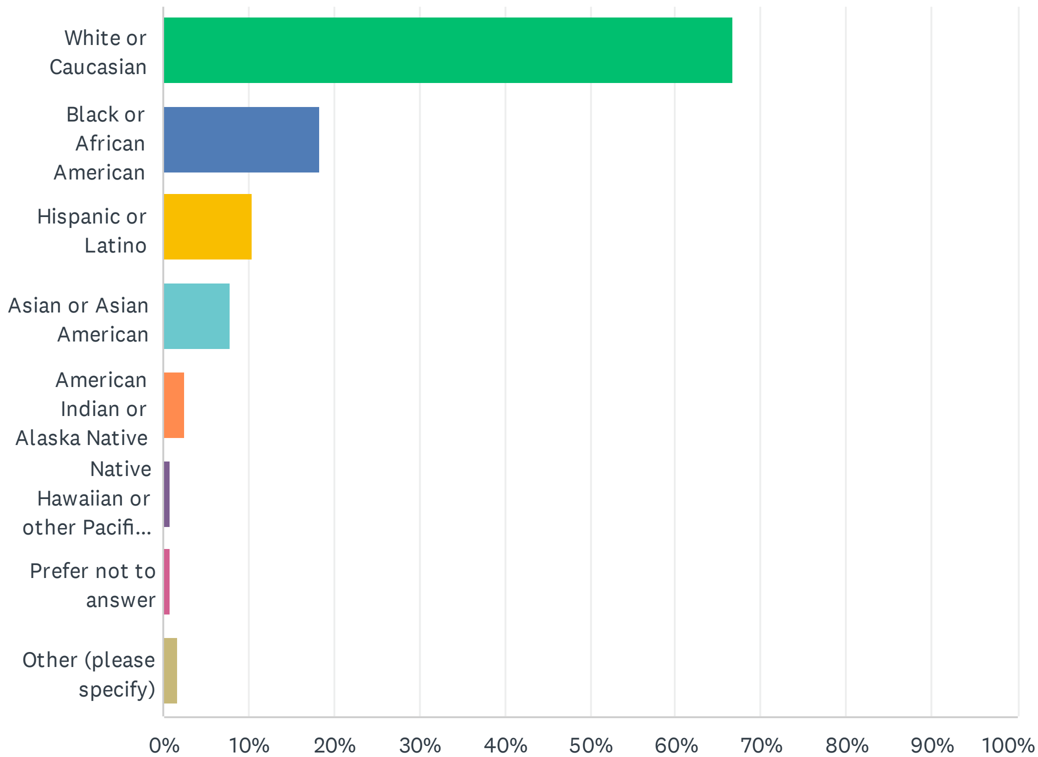
Answered: 114 Skipped: 13



ANSWER CHOICES	RESPONSES	
Man	59.65%	68
Woman	37.72%	43
Non-binary	1.75%	2
Prefer not to answer	0.88%	1
Other (please specify)	0.00%	0
TOTAL		114

Q36 How would you describe your race/ethnicity? You may select more than one.

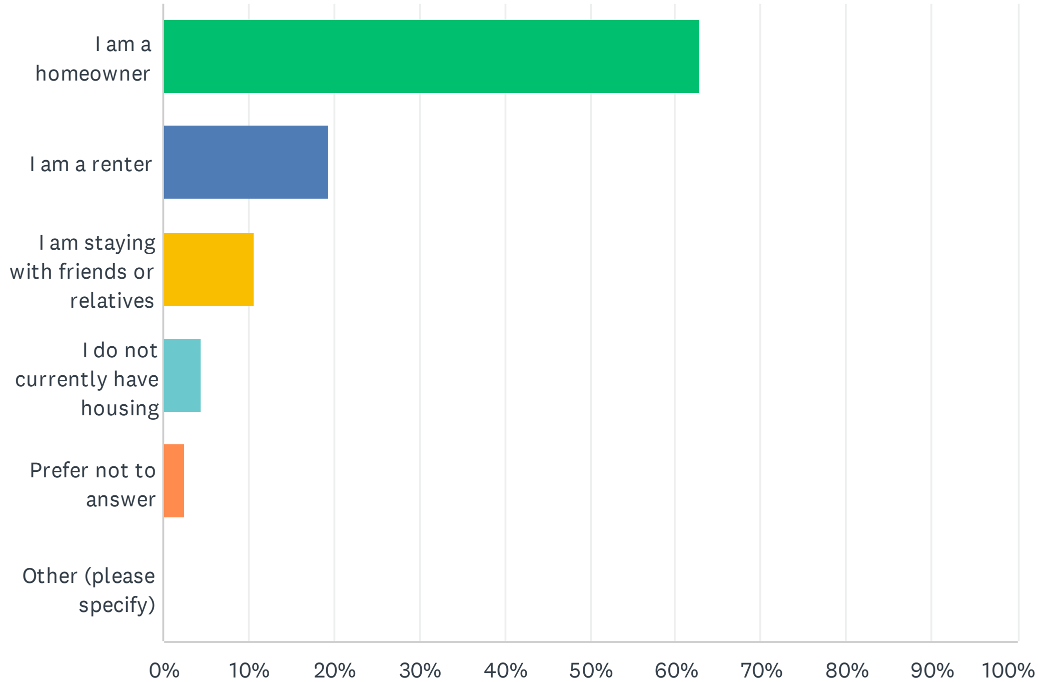
Answered: 114 Skipped: 13



ANSWER CHOICES	RESPONSES	
White or Caucasian	66.67%	76
Black or African American	18.42%	21
Hispanic or Latino	10.53%	12
Asian or Asian American	7.89%	9
American Indian or Alaska Native	2.63%	3
Native Hawaiian or other Pacific Islander	0.88%	1
Prefer not to answer	0.88%	1
Other (please specify)	1.75%	2
Total Respondents: 114		

Q37 Which of the following best describes your current housing situation?

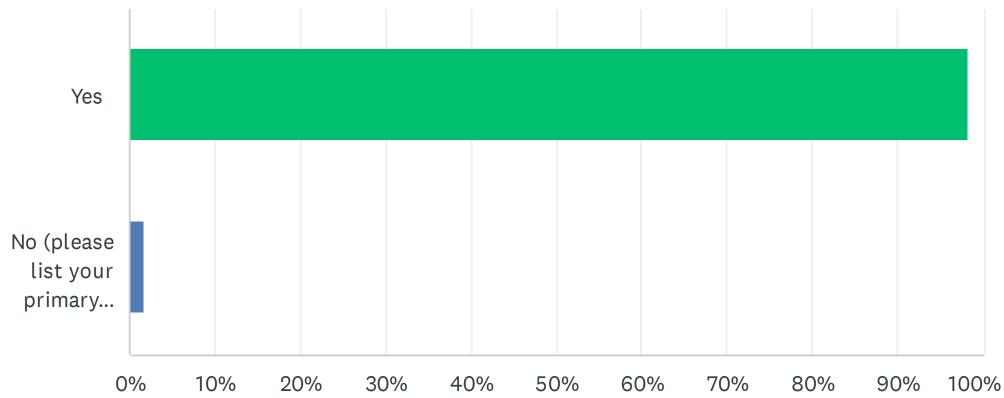
Answered: 113 Skipped: 14



ANSWER CHOICES	RESPONSES	
I am a homeowner	62.83%	71
I am a renter	19.47%	22
I am staying with friends or relatives	10.62%	12
I do not currently have housing	4.42%	5
Prefer not to answer	2.65%	3
Other (please specify)	0.00%	0
TOTAL		113

Q38 Is English your primary language?

Answered: 116 Skipped: 11



ANSWER CHOICES	RESPONSES	
Yes	98.28%	114
No (please list your primary language)	1.72%	2
TOTAL		116

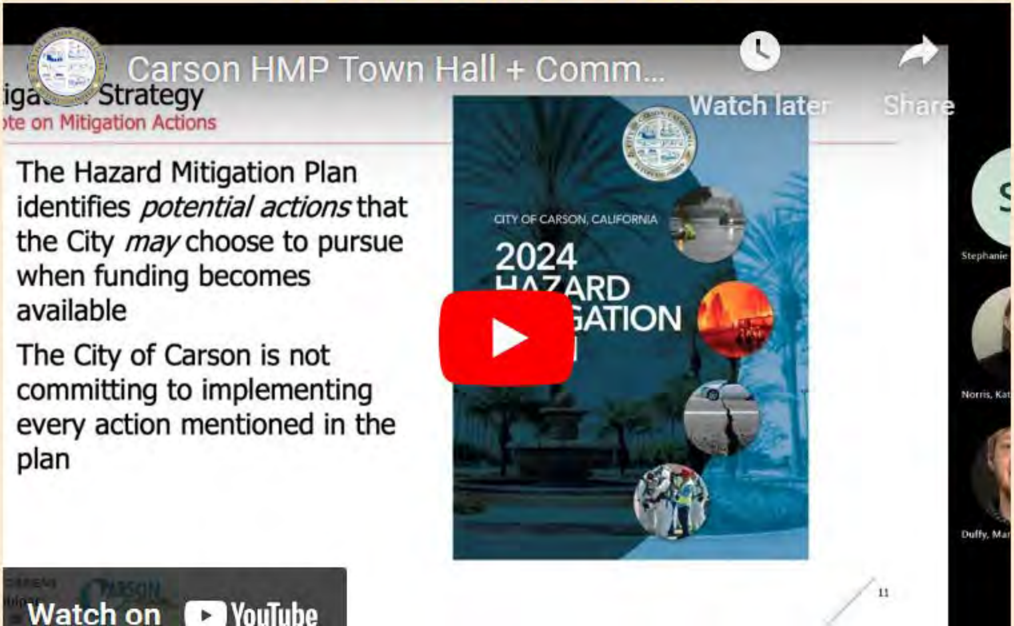
Public Safety Services

The Department of Public Safety Services develops and administers programs designed to enhance public safety, crime prevention and emergency preparedness. Community Safety Services provides oversight of the City's law enforcement program and directs the City's Code Enforcement Detail, Parking Enforcement Detail, Crossing Guard program, Block Captains program, Neighborhood Watch program, Community Emergency Response Team (C.E.R.T.) program and the City's Emergency Operations Center.

Hazard Mitigation Public Plan Meeting

Thursday, 6/27/2024, 6:00 PM - 6:30 PM, Carson Community Center of via Teams

Click here for more information.



WE WANT TO HEAR FROM YOU

HAZARD MITIGATION

PUBLIC PLAN MEETING

SAVE THE DATE

PLEASE JOIN US FOR THE PUBLIC REVIEW MEETING OF OUR HAZARD MITIGATION PLAN DRAFT. YOUR FEEDBACK ON OUR DRAFT PLAN IS INVALUABLE!

DATE: JUNE 27TH
TIME: 6:00 PM - 6:30 PM
LOCATION: CARSON COMMUNITY CENTER OR ONLINE VIA TEAMS

MEETING ID: 274 333 759 820
PASSCODE: RYZGT4

WE LOOK FORWARD TO YOUR PARTICIPATION.
TO REVIEW THE FULL DRAFT, PLEASE VISIT OUR WEBSITE

FOR MORE INFORMATION PLEASE EMAIL: PUBLICSAFETYDEPARTMENT@CARSONCA.GOV

cityofcarsonca ...

cityofcarsonca We want to hear from you! Join our Hazard Mitigation Public Plan Meeting on June 27th from 6 p.m. - 9 p.m. at the Carson Community Center or via Teams.

Take a look at the draft plan on carsonca.gov.
For more information, please email Publicsafetydepartment@carsonca.gov.

18w

2 likes
June 24

Add a comment...

cityofcarsonca

cityofcarsonca Recent disasters, such as flooding and earthquakes, remind us the importance of being prepared. How prepared are you and your loved ones?

To assess how prepared you are, please complete the Hazard Mitigation survey. The information from the survey will help you gage your awareness and preparedness and inform the city how we can better serve you.

Survey link:
https://www.surveymonkey.com/r/RRBNGNP

Participants will be automatically entered to win a $50 Amazon gift card.

To access the disaster resources available to you, visit:
https://ci.carson.ca.us/CityManager/EmergencyServices.aspx

27w

3 likes

April 21

Add a comment...