



COUNTY OF
SAN DIEGO

County of San Diego Vulnerability Assessment and Adaptation Report

June 2021



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County of San Diego Vulnerability Assessment and Adaptation Report

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June 2021

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APPROVAL

I hereby certify that the **County of San Diego Vulnerability Assessment and Adaptation Report** was considered by the Director of Planning & Development Services on the 14th day of July, 2021.


KATHLEEN FLANNERY
Acting Director of Planning & Development Services

I hereby certify the **County of San Diego Vulnerability Assessment and Adaptation Report** and has hereby been approved by the Deputy Chief Administrative Officer of the Land Use and Environment Group on the 14th day of July, 2021. The Director of Planning & Development Services is authorized to approve and periodically update this County of San Diego Vulnerability Assessment and Adaptation Report pursuant to Board of Supervisors Resolution No. 21-125.

Approved: July 14, 2021


SARAH AGHASSI
Deputy Chief Administrative Officer

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List of Abbreviations

°F	degrees Fahrenheit
APG 2.0	California Adaptation Planning Guide
BAU	business-as-usual
CalEnviroScreen 3.0	California Environmental Health Screening Tool
CalEPA	California Environmental Protection Agency's
CalOES	California Office of Emergency Services
Caltrans	California Department of Transportation
CAP	Climate Action Plan
CEC	California Energy Commission
Climate Assessment	California's Fourth Climate Assessment
CNRA	California Natural Resources Agency
County	County of San Diego
EIR	Environmental Impact Report
EJ	Environmental Justice
EJC	Environmental Justice Communities
FEMA	Federal Emergency Management Association
FHSZ	Fire Hazard Severity Zones
GHG	greenhouse gas
GIS	geographic information system
IRWM	Integrated Regional Water Management
km	kilometers
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MSCP	Multiple Species Conservation Program
MTS	Metropolitan Transit System
MWD	Metropolitan Water District of Southern California
NCTD	North County Transit District
OES	Office of Emergency Services
OPR	Governor's Office of Planning and Research
RCP	Representative Concentration Pathways
report	Vulnerability Assessment and Adaptation Report
SANDAG	San Diego Association of Governments
SB	Senate Bill
SDCWA	San Diego County Water Authority
SDG&E	San Diego Gas and Electric
SDRCC	San Diego Regional Climate Collaborative
SGMA	Sustainable Groundwater Management Act
UHIE	Urban Heat Island Effect
WUI	wildland-urban interface

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Executive Summary

Global climate change is expected to intensify the impacts of existing environmental hazards within unincorporated San Diego county, including human health hazards, poor air quality, extreme heat events, landslides, flooding, and wildfires. The frequency and severity of these hazards will increase as a result of climate change. The purpose of climate adaptation planning is to seek strategies to reduce vulnerability to projected climate change effects, increase the local capacity to adapt, and build resilience. The two core components of a climate change adaptation plan are a vulnerability assessment and adaptation strategies, which are included as part of this Vulnerability Assessment and Adaptation Report (report). The report focuses on understanding the vulnerability of, and developing adaptation strategies for, populations and assets in the unincorporated areas of the County of San Diego (County). The term “countywide” is used when referring to both unincorporated and incorporated jurisdictions in San Diego County.

Vulnerability Assessment

Section 2, “Vulnerability Assessment,” identifies the unincorporated county’s exposure to effects of climate change, the sensitivity of population groups and community assets to climate change effects, potential climate change impacts, and the County’s existing adaptive capacity to address those impacts. Potential impacts are ranked through a method known as “vulnerability scoring,” which is the recommended method identified in the 2020 update of the California Adaptation Planning Guide (APG 2.0).

The unincorporated county is expected to experience a warming trend, along with variable precipitation patterns over the next several decades. These changes are because of a global increase in greenhouse gas (GHG) emissions which cause infrared radiation to be trapped in the atmosphere and result in a warming effect. The average maximum temperatures in the unincorporated county are expected to increase by approximately 5.9 to 8.7 degrees Fahrenheit (°F) by the end of the 21st century, depending on a medium or high emissions scenario (CEC 2020a)¹. This is significant because even a slight change in the Earth’s atmospheric systems will cause cascading effects to other dependent systems. In addition to increasing temperatures, climate models predict that precipitation volatility will intensify in future years in San Diego. In the coming decades dry years are likely to become even drier, while wet years will become even wetter. These factors will lead to several secondary climate impacts, including human health hazards, drought, extreme heat events, extreme precipitation and flooding, landslides, wildfires, and sea-level rise.

As these climate change-related hazards become more frequent and intense over time, threats to population groups and physical assets will increase. Key populations and assets identified in the unincorporated county are organized into the following overarching categories: populations, transportation, energy, water, biodiversity and habitat, and emergency services. Population groups include the County’s Environmental Justice Communities (EJCs) (pending presentation to and approval from the Board of Supervisors), low-income persons, communities of color, linguistically isolated persons, senior citizens, persons with disabilities, and persons experiencing homelessness.

Populations and assets that are most vulnerable to climate change effects were determined by evaluating current adaptation efforts in place and through community outreach. The vulnerability scoring method allows the County

¹ Projected increase in temperature for the unincorporated county is shown here. Please see section 2.1.1, “Climate Change Effects” for greater detail on historical and projected temperatures.

to understand which populations and assets will potentially face the greatest threats and where there are gaps in current planning efforts. The County followed the qualitative scoring process recommended by APG 2.0 to rate potential impact and adaptive capacity, in order to determine an overall vulnerability score. The vulnerability scores for all unincorporated county climate vulnerabilities are summarized in Table VA-1 below.

Table VA-1. Vulnerability Scoring Summary			
Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Impacts to Populations			
Increased human health risk (i.e., poor air quality, infectious diseases, mental health concerns, limited access to potable water, heat-related illnesses)	High	Medium	4
Reduced available water supply from extended drought periods	High	High	3
Increased exposure to flood risk from extreme precipitation and sea-level rise	Medium	High	2
Increased exposure of people to landslides	Medium	High	2
Increased exposure of people to wildfires	High	Medium	4
Lack of electricity during Public Safety Power Shutoffs implemented during times of high wildfire risk	High	Medium	4
Limited ability to prepare for climate events and to respond and evacuate	Medium	High	2
Impacts to Transportation			
Increased risk of damage to roadways from extreme heat events	Medium	Medium	3
Increased risk of damage to roadways from flooding or sea-level rise	Low	Medium	2
Increased risk of damage to roadways from landslides	Medium	Medium	3
Increased risk of damage to roadways from wildfires	Medium	Medium	3
Increased impacts to evacuation routes and emergency access during hazard events	High	High	3
Increased risk of damage to transit facilities	Low	Medium	2
Increased risk of damage to railways	Low	Medium	2
Increased risk of damage to bicycle paths and trails	Medium	Medium	3
Impacts to Energy Resources			
Increased system stress during droughts and extreme heat events	High	High	3
Increased system stress and physical damage from flooding, sea-level rise, and landslides	Low	Low	3
Risk of physical damage from wildfires	Medium	High	2
Increased demand for electricity generation during extreme heat events	High	Low	5
Reduced effectiveness of hydro-electric electricity generation facilities during drought and extreme precipitation events	Low	Low	3
Reduced effectiveness of solar electricity generation facilities due to increased smoke from wildfires	Low	Low	3
Impacts to Water			
Increased risk of physical damage to flood control and water conveyance facilities	Medium	High	2
Increased demand for flood control and water conveyance facilities	Medium	High	2
Increase in water demand	Medium	Medium	3

Table VA-1. Vulnerability Scoring Summary

Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Reduction in available water supply	High	Medium	4
Increased risk of contamination of potable water supply from sea-level rise	Low	Low	3
Impacts to Biodiversity and Habitat			
Increased risk of damage to hillside habitat and flood control habitat	Medium	Medium	3
Reduced access to and increased risk of damage to recreation areas	Low	Medium	2
Loss of vegetation and habitat	High	Medium	4
Land subsidence from increased saturation	Low	Low	3
Decrease in species health and population	Medium	Medium	3
Impacts to Emergency Services			
Increased exposure of emergency responders to heat-related sickness, smoke inhalation, and infectious disease	High	Medium	4
Increased demand for emergency response services	Medium	Medium	3
Increased demand for emergency facilities (e.g., hospitals, cooling centers, telecommunication systems, and evacuation centers)	High	High	3
Increased risk of damage to emergency facilities (e.g., hospitals, cooling centers, telecommunication systems, and evacuation centers)	Medium	Medium	3

APG 2.0 does not specify a threshold for prioritizing vulnerability scores. Thus, the County elected to prioritize climate vulnerabilities that received an overall score of four or higher. These are climate vulnerabilities where impacts to populations and assets would be severe and where few or insufficient existing policies and programs are in place to address the vulnerability. Seven climate vulnerabilities received a score of four or five. Although all climate vulnerabilities are addressed to some extent in the goals and policies proposed in this report, by focusing on the highest scoring climate vulnerabilities, the County can better prioritize where adaptation efforts should be made. The highest scoring climate vulnerabilities are:

- Increased human health risk (i.e., poor air quality, infectious diseases, mental health concerns, limited access to potable water, heat-related illnesses).
- Increased exposure of people to wildfires.
- Lack of electricity during Public Safety Power Shutoffs implemented during times of high wildfire risk.
- Increased demand for electricity generation during extreme heat events.
- Reduction in available water supply.
- Loss of vegetation and habitat.
- Increased exposure of emergency responders to heat-related sickness, smoke inhalation, and infectious disease.

Adaptation Goals and Policies

Section 3, “Adaptation Framework,” lays out the adaptation component of the report and includes a set of adaptation goals and policies to address the impacts of climate change, protect people and infrastructure that are the most vulnerable to its effects, and increase resilience to climate change. Adaptation goals and policies were developed to address the County’s priority climate impacts and are organized by the six population and asset categories. The preliminary goals are:

- **Goal 1:** Increase community resilience to climate change and protection of vulnerable populations.
- **Goal 2:** Increase the resilience of transportation systems and protection of critical transportation infrastructure from climate change.
- **Goal 3:** Increase the resilience of energy resources and protection of critical energy infrastructure and systems from climate change.
- **Goal 4:** Protect water resources vulnerable to climate change and ensure a safe and reliable supply of water.
- **Goal 5:** Protect biodiversity and habitat vulnerable to climate change.
- **Goal 6:** Ensure that emergency services have adequate capacity to address increased needs due to climate change-related impacts.

Each goal will be implemented through detailed policies that outline specific actions the County will take, the responsible department(s) and partner agencies, timeframe for implementation, and additional co-benefits that result from the policy. Subject to consideration and approval by the Board of Supervisors in 2021, these goals and policies will be integrated into the County’s General Plan Safety Element and/or General Plan Implementation Plan, in compliance with Senate Bill (SB) 379. Implementation of these goals and policies will help the County protect vulnerable populations and assets and build resilience to climate change.

1. Introduction

The effects of climate change are already occurring at global and regional scales and will continue to worsen existing hazards in unincorporated San Diego county over time. The primary effects of climate change include increased temperatures and changes in precipitation patterns. These factors, either individually or in combination, could contribute to an increase in the frequency and intensity of secondary climate effects such as human health hazards, drought, extreme heat events, extreme precipitation and flooding, landslides, wildfires, and sea-level rise. The level of impact from these climate change-related events will vary across the unincorporated county due to physical, social, and economic characteristics.

Addressing climate change requires an integrated approach that targets both the sources of climate change and the effects. GHG emissions are responsible for causing climate change. The largest source of GHG emissions from human activities is from burning fossil fuels for electricity, heat, and transportation. Efforts that focus on reducing the sources of climate change are termed climate change mitigation, GHG mitigation, or climate action. Efforts to reduce harm from the effects of a changing climate, the focus of this report, are referred to as climate adaptation and resilience. Figure VA-1 illustrates the relationship between these two approaches. State law requires communities to address climate change mitigation in local planning and environmental review processes and climate adaptation in local long-range planning processes, such as general plans (CalOES 2020; Gov. Code 65302(g)(4)).

Figure VA-1 Relationship between Climate Mitigation and Adaptation



Source: CalOES 2020; adapted by Ascent Environmental in 2020.

1.1 Existing County Climate Change Mitigation and Adaptation Efforts

The County's existing climate change mitigation efforts are laid out in the County of San Diego Climate Action Plan (CAP). On February 14, 2018, the County of San Diego Board of Supervisors adopted the County's CAP. The CAP included an inventory of the County's 2014 baseline GHG emissions, future emission projections, and GHG reduction targets in line with the State's GHG reduction mandates. The CAP identified strategies and measures to reduce the County's contribution of GHG emissions to the atmosphere to meet 2020 and 2030 GHG emissions targets, and to demonstrate progress towards the State's 2050 GHG reduction goal. Some CAP strategies and measures may include co-benefits for adaptation. For example, Measure W-1.2 aims to reduce outdoor water use for landscaping in new and existing development. Climate change-related impacts such as drought will require the County and its residents to adapt to less reliable or reduced water supply; thus, Measure W-1.2 would yield adaptation benefits as well as GHG reductions. Measure A-2.2 is to implement a tree planting program to increase carbon sequestration. This would result in the adaptation co-benefit of increasing resilience to the climate change impacts of increased extreme heat events and the urban heat island effect (UHIE), a phenomenon where urbanized areas may experience higher temperatures than outlying areas due to limited greenery and more paved surfaces that absorb and re-emit heat. Additionally, Chapter 4 of the CAP, "Climate Change Vulnerability, Resiliency, and Adaptation," includes a preliminary vulnerability assessment and adaptation measures, which are referenced and further developed in this report. However, the primary focus of the CAP is climate mitigation (County of San Diego 2018a).

In response to June 12, 2020, Court of Appeal ruling, the County has rescinded and will be revising its 2018 CAP and related Supplemental Environmental Impact Report (EIR). The court ruling struck down the CAP's EIR and required rescission of the CAP, but did not find fault with its 26 GHG reduction measures. Thus, the County has continued to implement GHG reduction measures. To address the court ruling, the CAP and EIR will be revised in partnership with residents, and business and environmental groups.

Lastly, the San Diego County Office of Emergency Services (OES) is responsible for developing and updating the Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). This plan describes natural and human-caused hazards within the unincorporated county and identifies ways to minimize risks. The 2017 MJHMP includes an assessment of vulnerability associated with emerging climate change risks such as extreme heat, coastal storms/erosion, wildfire, flooding, and drought/water supply.

1.2 Purpose of This Report

This report builds upon the County's prior climate change efforts and focuses on climate change adaptation and resilience. The geographic scope of this report is the unincorporated county because these are the areas where the County has land use jurisdiction and the ability to implement goals and policies. At times, regional climate change projection and countywide trends (inclusive of incorporated cities) are referenced because the effects and impacts of climate change cross jurisdictional boundaries.

The report includes a comprehensive vulnerability assessment and adaptation goals and policies, which will be incorporated into the County's General Plan Safety Element, in compliance with SB 379, Government Code section 65302(g)(4). SB 379 was enacted to integrate climate change adaptation into California's general plan process. The bill requires all cities and counties to revise their safety elements to include climate change adaptation and resilience strategies upon the general plan's next update. Under Government Code Section 65040.2, the

Governor’s Office of Planning and Research (OPR) is charged with periodically updating and adopting the State General Plan Guidelines to guide the preparation of general plans for all cities and counties in California. The 2017 update to the General Plan Guidelines Safety Element chapter includes an additional focus on preparing communities for long-term climate change impacts (OPR 2017). This report was prepared following SB 379 and OPR’s General Plan Guidelines.

The purpose of climate adaptation planning is to seek strategies to reduce vulnerability to projected climate change effects, increase the local capacity to adapt, and build resilience. Climate resilience is the ability of an individual, community, organization, or natural system to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience (CalOES 2020). A climate resilient county is one that is prepared for the effects of climate change, continues to provide essential services, protects the most vulnerable during hazardous events, and continually learns and adjusts in the face of change and disruption.

The two basic components of climate adaptation planning are vulnerability assessment and adaptation strategies. The report includes a comprehensive vulnerability assessment to identify how climate change will impact the unincorporated county. The vulnerability assessment identifies projected climate change exposures for the unincorporated county at mid- to late-century timescales. In addition to identifying the unincorporated county’s exposure to the effects of climate change, the assessment evaluates the sensitivity of key population groups and community assets to climate change effects, potential impacts, and the County’s existing adaptive capacity to reduce impacts.

As these climate change-related hazards become more frequent and intense over time, threats to population groups, and physical assets will increase. Key populations and assets identified in the unincorporated county are organized into the following overarching categories: populations, transportation, energy, water, biodiversity and habitat, and emergency services. This assessment identifies the unincorporated county’s populations and assets that are most vulnerable to climate change effects and the level of severity at which they may be impacted through a method known as “vulnerability scoring.” This scoring helps the County understand which effects pose the greatest threats and should be prioritized in adaptation planning efforts.

The report also includes a set of proposed adaptation goals and policies to address the impacts of climate change, protect people and infrastructure that are the most vulnerable to its effects, and increase resilience to climate change. Goals and policies were developed to address climate change effects that are projected to be most severe, build the County’s and partner agencies’ capacity to deal with future impacts and to protect communities and physical assets that are most at risk from climate change-related hazards. Subject to consideration and approval by the Board of Supervisors in 2021, these goals and policies will be integrated into the County’s General Plan Safety Element, in compliance with SB 379.

1.3 Climate Change Background Context

The global average temperature is expected to increase by 0.54 to 8.6 °F by the end of the 21st century, depending on future worldwide GHG emission scenarios (IPCC 2014). According to California’s Fourth Climate Change Assessment, depending on levels of future GHG emissions, average annual maximum daily temperatures in California are projected to increase by 4.4 to 5.8 °F by 2050 and by 5.6 to 8.8 °F by 2100 (Bedsworth et al. 2018).

While there is consensus that global climate change is worsened by human activity, there is less certainty as to the potential consequences of climate change, particularly at the regional and local levels. However, regional and local efforts are critical in building resilience and can lead to a greater understanding of climate risks and strategies to reduce their impacts.

Impacts from climate change will adversely affect people and the physical and natural environment through increases in average global temperatures, unpredictability in precipitation patterns, and rising sea levels. Precipitation patterns would be changed in a variety of ways as a result of climate change, including increased frequency of extreme storm events and reduced precipitation falling as snow in high elevation areas. These changes in precipitation patterns, along with increased average temperatures, will result in changes to water supply, threats to biological resources, and threats to human health and safety. Rising sea levels will result in coastal erosion, flooding, infrastructure damage, or saltwater intrusion in groundwater. The state and the unincorporated county have already seen signs of extreme weather effects, the frequency, and intensity of which have been worsened by climate change (CNRA, OPR, & CEC 2018; 2019). Extreme weather effects such as volatility in precipitation, increased average temperatures, and increased frequency of extreme heat events have led to increases in the frequency and intensity of hazards to human health and safety such as wildfires, droughts, and changes in the available water supply.

Unstable water supply and changing temperatures affect the prevalence of pests, diseases, and species, which will directly impact crop development and forest health. Other environmental concerns include a decline in water quality, reduced availability and overdrawing of groundwater supply, and declining soil health. Vulnerabilities of water resources also include risks related to the degradation of watersheds, alteration of ecosystems, and loss of habitat.

Climate change is also causing impacts on energy, water, and transportation infrastructure throughout the state (CNRA, OPR, & CEC 2018). Changes in temperature, precipitation patterns, extreme weather events, and sea-level rise have the potential to affect and decrease the efficiency of power plants and generation facilities, increase electricity demand, and threaten built infrastructure from increased risks of flooding and wildfire. Climate change impacts such as sea-level rise, storm surge, and flooding are imminent threats to roadways, bridges, airports, transit, and rail systems. Additionally, temperature extremes and increased precipitation can increase the risk of road/pavement and railroad track failure, resulting in loss of access or ability to evacuate, decreased transportation safety, and increased maintenance costs. Finally, the increased frequency of extreme storm events would increase the likelihood of landslides, which could result in damage to residences, roadways, and utility and flood control infrastructure. The frequency of landslides would be further worsened by increased wildfires that could remove soil supporting vegetation and biological resources.

There are many plans, policies, and programs in place already that address existing hazards. In some cases, these may be sufficient to address the potential for climate change to worsen existing hazards, and in other cases, gaps emerge and new policies are needed. This report intends to identify and address those gaps.

1.4 Regulatory Setting

1.4.1 SENATE BILL 379

According to SB 379, general plan safety elements must address climate change vulnerability, adaptation strategies, and emergency response strategies. SB 379 states:

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

As specified in Government Code section 65302(g)(4)(A) vulnerability assessments must identify the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts, utilizing federal, state, regional, and local climate vulnerability documentation such as APG 2.0 and the Cal-Adapt climate tool created by the California Energy Commission (CEC) and University of California, Berkeley Geospatial Innovation Facility. Other sources of information include data from local agencies regarding their adaptive capacity and historical data on natural events and hazards. Per Government Code section 65302(g)(4)(B), adaptation policies, goals, and objectives are to be developed based on findings from the vulnerability assessment. Additionally, Government Code section 65302(g)(4)(C) requires jurisdictions to create a set of feasible implementation measures to reduce climate change impacts on new or proposed land uses.

1.5 Guiding Documents

1.5.1 CALIFORNIA ADAPTATION PLANNING GUIDE

The California Office of Emergency Services (CalOES) and the California Natural Resources Agency (CNRA) prepared APG in 2012 to provide vulnerability assessment and adaptation planning guidance for communities. CalOES released APG 2.0 (dated June 2020), which includes updated guidance, an increased focus on equity and outreach, and best practices. APG 2.0 provides a framework for communities to identify potential climate change effects and important physical, social, and natural assets, create adaptation strategies to address climate change impacts, and develop a monitoring and implementation framework for climate change adaptation (CalOES 2020). This report was prepared according to the guidance provided in APG 2.0.

1.5.2 CALIFORNIA'S FOURTH CLIMATE ASSESSMENT

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

1.5.3 SAFEGUARDING CALIFORNIA PLAN

Alongside the update to the Climate Assessment, CNRA released the Safeguarding California Plan in 2018 which provides a roadmap for State government action to build climate resilience. The Safeguarding California Plan identifies actions the State government will take to protect communities, infrastructure, services, and the natural environment from climate change impacts and includes strategies for use as local examples for climate adaptation. The Safeguarding California Plan is referenced in this report to provide guidance on assessing the County's vulnerability to climate change and the development of adaptation strategies.

1.5.4 SAN DIEGO COUNTY AND REGIONAL PLANNING EFFORTS

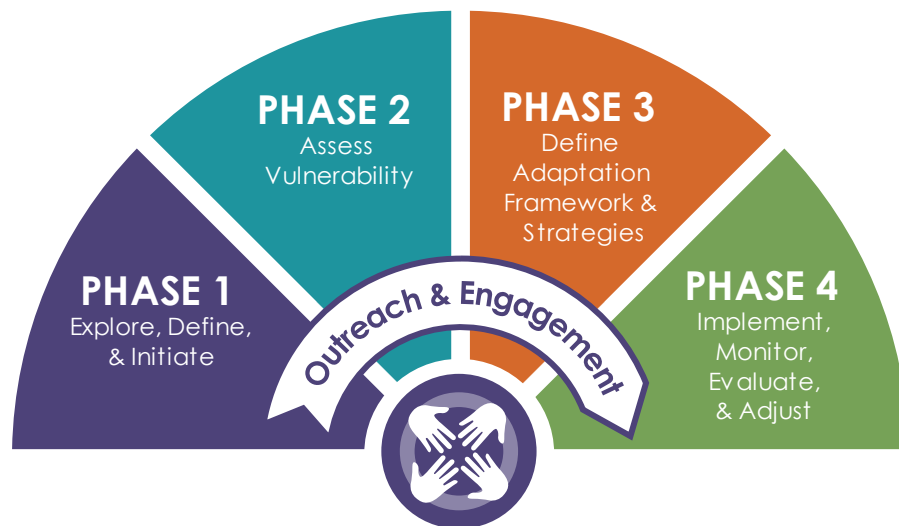
In addition to State adaptation efforts, the County and supporting agencies have developed planning documents focused on local and regional adaptation to climate change hazards. These planning documents analyze existing hazards and include strategies or guidelines to mitigate their severity. The County's MJHMP, General Plan, 2018 CAP, and Emergency Operation Plan were considered in the development of this vulnerability assessment. Other agency documents reviewed include California's Fourth Climate Change Assessment, San Diego Summary Report;

the California Department of Transportation (Caltrans) Climate Change Vulnerability Assessment 2019 District 11 Technical Report; the San Diego Association of Governments (SANDAG) San Diego Forward: The Regional Plan; the San Diego Regional Climate Collaborative (SDRCC) Regional Adaptation Needs Assessment; the San Diego County Water Authority's (SDCWA) Water Shortage Contingency Plan, 2015 Urban Water Management Plan, and the Regional Water Supply Portfolio Diversification; and the San Diego Integrated Regional Water Management (IRWM) Program's IRWM Plan.

1.6 Adaptation Planning Process

The State's APG 2.0 helps communities throughout the state plan for and adapt to the impacts of climate change. The guide includes a four-phase process, illustrated in Figure VA-2 which allows communities to assess their specific climate vulnerabilities and provides a menu of strategies for communities to reduce climate change-related risks and prepare for current and future impacts of climate change.

Figure VA-2 Adaptation Planning Process



Source: CalOES 2020; adapted by Ascent Environmental in 2020.

- **Phase 1, “Explore, Define, and Initiate,”** includes scoping and defining the adaptation planning effort. Phase 1 also involves identifying key roles and stakeholders in the local government and throughout the community to contribute to the planning process. Potential climate change effects and important physical, social, and natural assets in the community are identified for further analysis. Phase 1 is discussed in Section 1, “Introduction,” of this report.
- **Phase 2, “Assess Vulnerability,”** includes an analysis of potential climate change impacts and adaptive capacity to determine the vulnerability of populations, natural resources, and community assets. The vulnerability assessment is composed of four steps: exposure, sensitivity and potential impacts, adaptive capacity, and vulnerability scoring. Phase 2 also integrates stakeholder and public input to provide a comprehensive assessment of the community's sensitivity to climate change and its ability to adapt. Phase 2 is addressed in Section 2, “Vulnerability Assessment” of this report.
- **Phase 3, “Define Adaptation Framework and Strategies,”** focuses on creating an adaptation framework and developing adaptation strategies based on the results of the vulnerability assessment. Adaptation strategies identify how the community will address the potential for harm based on the community's

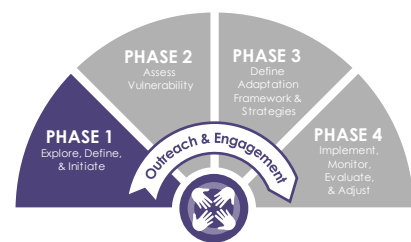
resources, goals, values, needs, and regional context. Community input is needed to prioritize adaptation strategies, identify co-benefits of strategies, and determine implementation steps. Phase 3 is discussed in Section 3, “Adaptation Framework,” of this report.

- In **Phase 4, “Implement, Monitor, Evaluate, and Adjust,”** the adaptation framework is implemented, consistently monitored and evaluated, and adjusted based on continual learning, feedback, or triggers. The adaptation planning process is intended to be cyclical in nature. Phase 4 is not included within this report, as it is not required for compliance with SB 379 and because the County already has processes in place to monitor and evaluate its planning efforts. Furthermore, the adaptation goals and strategies in this report will be included in the County’s General Plan Safety Element Update, which contains an Implementation Plan. The Implementation Plan will guide the implementation, monitoring, and evaluation of all policies in the Safety Element, including the adaptation policies.

The ultimate goal of adaptation planning is to improve community resilience in the face of a changing climate. A resilient community is one that is prepared for current and future hazardous conditions and experiences less harm when a disaster happens. Resilient communities can recover from hazards more quickly and rebuild in a manner that accounts for continuing climate change. Ongoing learning and monitoring allow for adjustments to be made in response to new information and opportunities, which is important for building resilience.

1.7 Public Outreach and Stakeholder Engagement

The County is concurrently updating its General Plan Housing Element and Safety Element and developing a new Environmental Justice (EJ) Element for adoption in 2021. Public outreach regarding climate change adaptation was conducted alongside the outreach for the County’s General Plan updates. Six public workshops were held in November 2020: two workshops each for the three General Plan Elements under review. Each workshop provided a broad overview of the specific General Plan element before communicating a detailed description of the overarching goals of the element. As a result of the COVID-19 pandemic and to comply with State and local public health guidelines, all six workshops were held virtually through the Zoom Webinar platform. All webinars provided an interactive forum using poll questions and a question-and-answer chat box for members of the public to ask questions and provide feedback on the General Plan elements. Opportunities were also provided for the public to submit additional comments by email or phone.



Source: CalOES 2020; adapted by Ascent Environmental in 2020.

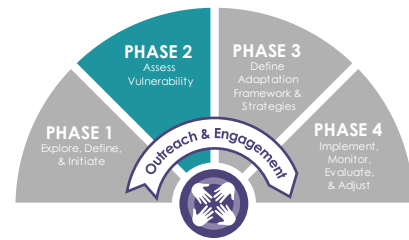
The General Plan Safety Element and EJ Element workshops included discussion of topics relevant to climate change vulnerability and adaptation. Public input from these workshops informed the development of this report. During the Safety Element workshops, participants were asked to rate how concerned they were about various physical hazards. Climate change concerns scored the highest: workshop participants indicated they personally or their community experienced personal injury, loss of life, property damage, and environmental damage from climate change. Participants also reviewed and rated high-level strategies for public safety. The highest scoring strategies to reduce impacts from hazards included vegetative brush clearing to prevent damage from wildfires, floodplain development restrictions and stormwater management, decentralized energy grids, and energy and water conservation home retrofits. During the EJ Element workshops, participants were asked about climate change hazards. The highest scoring areas of concern related to climate change were unhealthy air quality, need for public infrastructure improvements, affordable housing, chronic disease and health, access to public transit, stakeholder engagement, and access to internet and communication technology.

Additionally, County department staff engaged in the development of this report through peer review. Adaptation goals and policies will require coordinated efforts from various County departments to implement. For example, adaptation policies related to extreme heat may require collaboration with the County's Health and Human Services Department, and adaptation policies related to wildfire risk will require coordination with the County Fire Protection District. Staff review focused on vetting the accuracy of the adaptive capacity and vulnerability scoring sections of the report to confirm the existing County programs that address climate change vulnerability and provide further insight on the vulnerability scoring.

Public and stakeholder input was critical in ground-truthing the technical analysis and supporting identification of the top climate change-related concerns for the County. This input informed the development and prioritization of the adaptation goals and policies, leading to a focused set of policies to address priority concerns. The public outreach and stakeholder engagement played a key role in determining the County's approach to climate change adaptation and resilience.

2. Vulnerability Assessment

This section provides a comprehensive assessment of the unincorporated county's vulnerabilities to climate change. It identifies and characterizes the climate hazards and other climate effects that are anticipated to affect the unincorporated county. The vulnerability assessment follows the process outlined in Phase 2 of APG 2.0 and is composed of the following four steps:



Source: CalOES 2020; adapted by Ascent Environmental in 2020.

- **Exposure:** The purpose of this step is to understand existing hazards within the unincorporated county, and how these hazards will change. Existing hazards that can be worsened by the effects of climate change are identified and described, based on historical data from sources such as the MJHMP. Climate projection data are used to develop projections for how existing hazards are expected to change by mid- and late-century.
- **Sensitivity and Potential Impacts:** This step compiles a list of population groups and community assets that are sensitive to localized climate change effects. Future climate impacts have the potential to be more severe than historical ones and may also generate new impacts that communities have not yet experienced. Using historical data, research from regional and state reports on climate impacts, and input from stakeholders, this step seeks to understand how sensitive populations and assets may be affected by climate change.
- **Adaptive Capacity:** The County, partner agencies, and countywide organizations have already taken steps to build resilience and protect sensitive populations and assets from hazards. Thus, the purpose of this step is to characterize the unincorporated county's current ability to cope with climate impacts. The ability of the County to adapt to each of the identified climate impacts is determined through a review of existing plans, policies, and programs, and through stakeholder engagement.
- **Vulnerability Scoring:** Lastly, this step determines the County's priority climate vulnerabilities through a vulnerability scoring process. Vulnerability scores are based on several factors including how severe projected climate exposures will be, how sensitive population groups and assets are to the anticipated climate effects, and whether sufficient adaptive capacity exists to manage the potential impact.

The vulnerability assessment helps the County understand which climate vulnerabilities are most urgent and should be prioritized during the adaptation strategy development phase outlined in Section 3, "Adaptation Framework."

2.1 Exposure

The unincorporated county consists of approximately 34 Community Planning and Sub-regional Areas which span a variety of geographical terrain including rural, suburban, and urban areas. Due to the wide variety of land types, the unincorporated county is exposed to many types of natural hazards. When the unincorporated county's semi-arid coastal plain and foothills are covered with dry, overgrown vegetation and are combined with weather patterns of high temperatures and high winds, the threat of wildfires is heightened. The presence of creeks and streams in urbanized areas makes them susceptible to flood events during intense rainstorms. Climate change is anticipated to worsen the threat and potential impact of these existing hazards. Increased temperatures and prolonged drought conditions can increase dry fuel in the plain and highland areas, intensifying wildfires and reducing available water supply. Greater frequency and intensity of extreme precipitation events may increase rainwater runoff during

storms and increase the likelihood of flooding. This section summarizes existing hazards in the unincorporated county and describes the projected climate change effects that are anticipated to worsen these hazards.

2.1.1 EXISTING HAZARDS

The MJHMP provides a comprehensive understanding of several hazards, including those worsened by climate change. It evaluates emerging climate risks, sea-level rise, coastal storms, erosion, floods, landslides, wildfires, extreme heat, and drought/water supply hazards. Three major existing hazards that are anticipated to become more frequent or severe because of climate change are wildfires, landslides, and flooding.

WILDFIRES

The unincorporated county and incorporated cities have a long history of wildfires that have caused 27 declarations of emergencies since 1953. In October 2007, the unincorporated county experienced its worst wildfire that caused multiple fatalities and injuries to civilians and firefighters, while also destroying 369,000 acres, 2,670 structures, 239 vehicles, and two commercial properties (County of San Diego OES 2017). The California Department of Forestry and Fire Protection's Fire and Resource Assessment Program assesses the condition of California's forests and rangelands, and maps fire hazard within State Responsibility Areas, based on factors such as vegetative fuels, terrain, and weather. The maps categorize lands into moderate, high, and very high Fire Hazard Severity Zones (FHSZ). FHSZ maps consider the likelihood that an area will be burned over a 30- to 50-year period and do not consider modifications from fuel reduction efforts. As shown in Figure VA-3, many areas within the unincorporated county are within a very high FHSZ. Wildfires also result in secondary impacts: a major consequence of wildfires is post-fire flooding and debris flow. The risk of floods and debris flows after fires increases due to vegetation loss and soil exposure. These flows are a risk to life because they can occur with little warning and can exert great force on objects in their path.

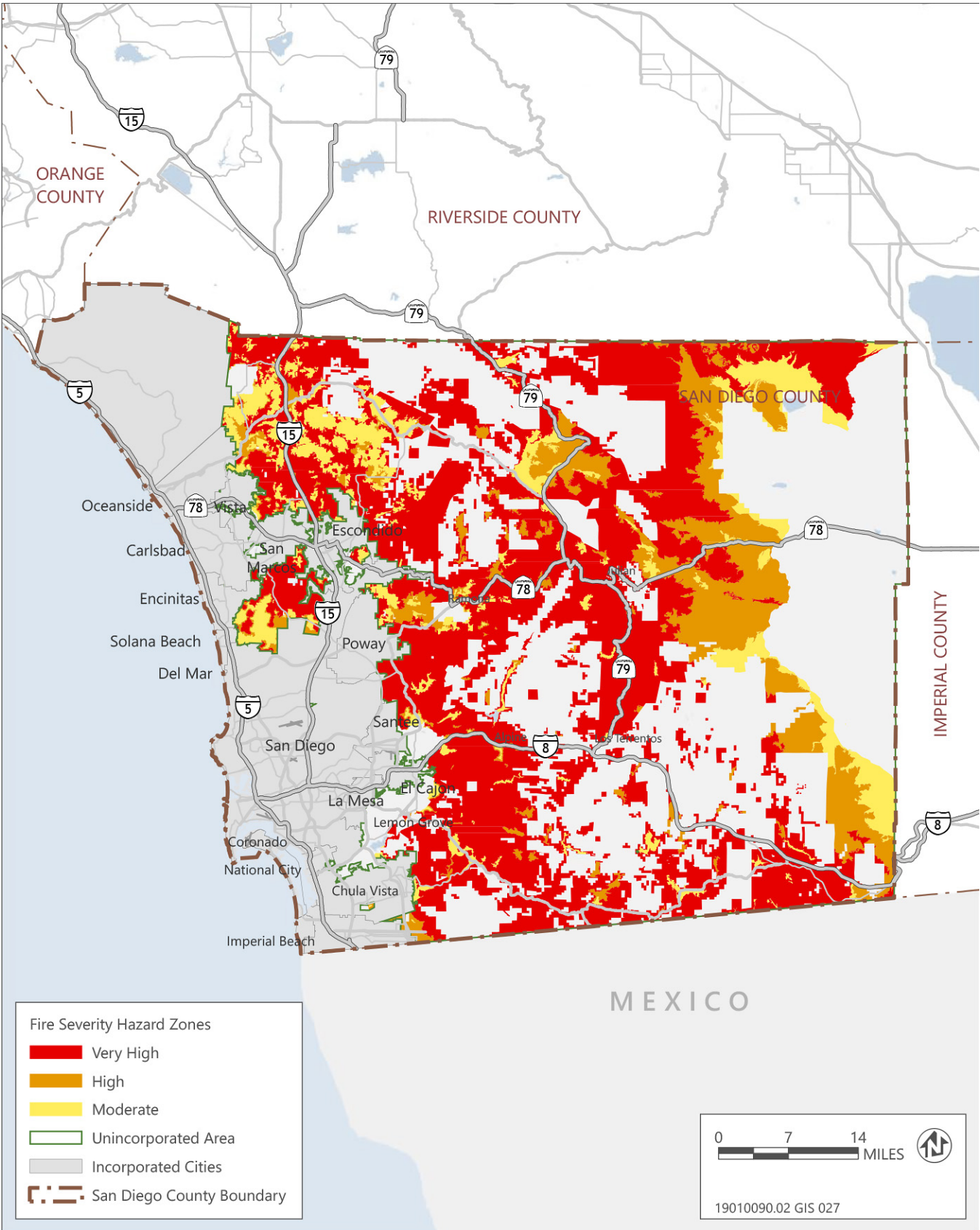
LANDSLIDES

In addition to wildfires, elevated rainfall and groundwater levels can trigger landslides. Elevated rainfall and groundwater levels are most often the cause of landslides in Southern California (Yates et al. 2009, Young 2015). Landslides are events where a mass of earth or rock moves down a slope, which can be triggered by both geologic (e.g., earthquake) and climatologic factors. As shown in Figure VA-4 areas of greater landslide susceptibility within the unincorporated county are located in the northern and eastern areas, primarily along steep mountain ranges.

FLOODING

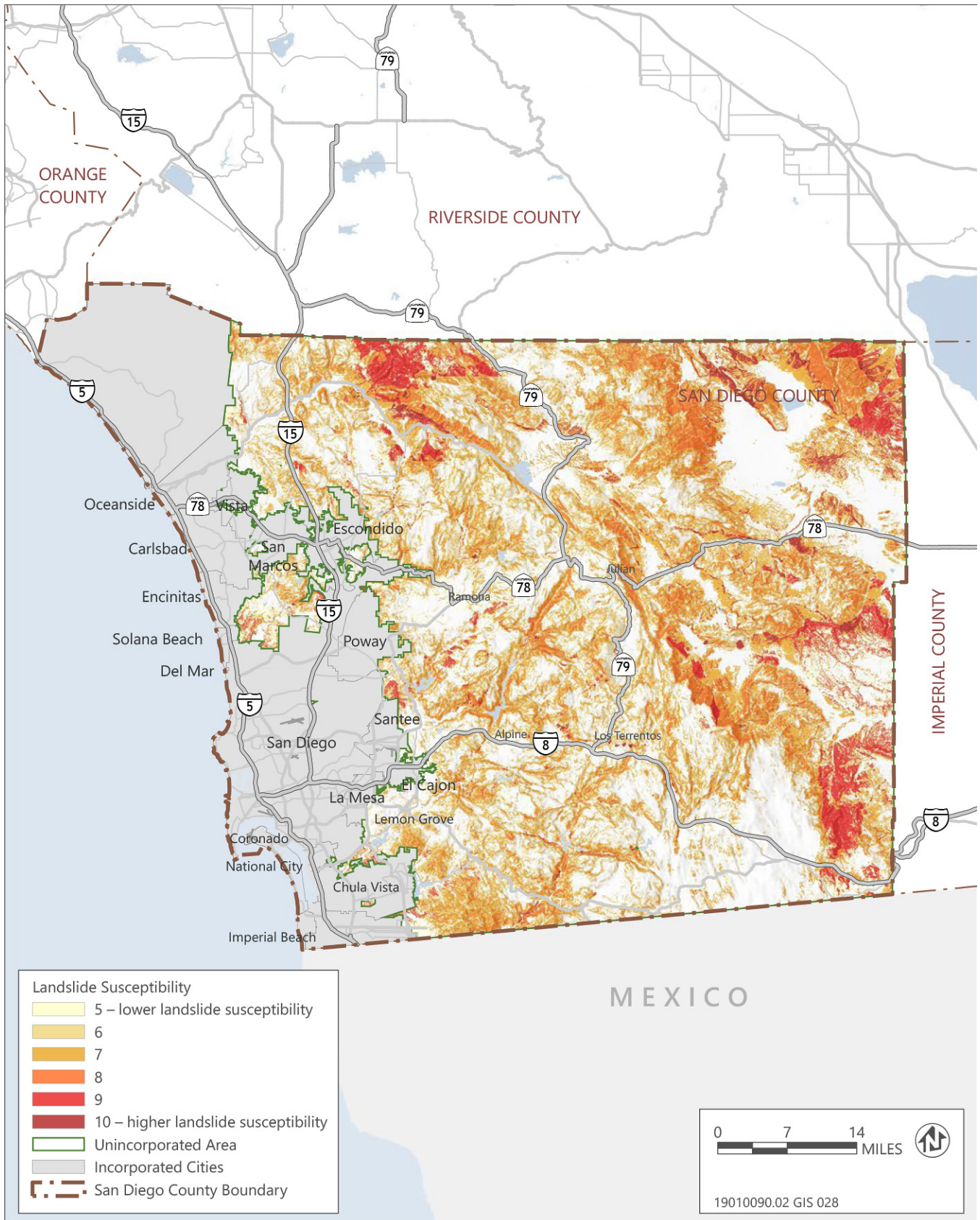
The eastern portion of the unincorporated county is most susceptible to flash floods due to its mountain canyons, dry creek beds, and high desert terrain. The National Weather Service's definition of a flash flood is a flood occurring in a watershed where the time of travel of the peak of flow from one end of the watershed to the other is less than six hours. There are no watersheds in the unincorporated county that have a longer response time than six hours. The unincorporated county has experienced flash floods in the form of both large rushes of water and gradually rising streams (County of San Diego OES 2017). Since 1950, the County has proclaimed 10 states of emergencies due to flooding, which have caused millions of dollars in damage and have resulted in two historical instances of dam failure (County of San Diego OES 2017). Figure VA-5 shows 100-year floodplains and floodways within the unincorporated county. Areas at greatest risk of riverine flooding are located along waterways in the western portions of the unincorporated county that feed into the incorporated areas to the west. The unincorporated county is also susceptible to 100-year floodplain events, primarily in the central and northeastern areas including Lake Henshaw and Borrego Springs.

Figure VA-3 Unincorporated County of San Diego Fire Hazard Severity Zones



Source: CALFIRE 2007

Figure VA-4 Unincorporated County of San Diego Landslide Susceptibility



Source: Department of Conservation, California Geological Survey 2018

Figure VA-5 Unincorporated County of San Diego Floodplains and Floodways



Source: SANDAG/SanGIS 2020

2.1.2 CLIMATE CHANGE EFFECTS

In Phase 1 of the adaptive planning process, climate change effects are described and projected at various time scales. Climate change effects are categorized as primary (direct) and secondary (indirect). Primary effects are those that are caused by the initial impacts of increased GHG emissions, while secondary effects are the result of the primary effects. The primary climate change effects analyzed for the unincorporated county include changes in average temperature and annual precipitation amounts. The secondary effects, which can occur because of individual changes or a combination of changes in the primary effects, include human health hazards, drought, extreme heat events, extreme precipitation and flooding, landslides, wildfires, and sea-level rise.

Though the precise extent of future climate change effects is uncertain, historical climate data and forecasted GHG emissions can be used to project climate change effects through mid-century (2035-2064) and late-century (2070-2099). To assess potential effects from climate change, APG 2.0 recommends using Cal-Adapt, a tool developed by the CEC and the University of California Berkeley Geospatial Innovation Facility that uses global climate simulation model data to provide a view of how climate change might affect California. Cal-Adapt addresses the uncertainty in future GHG emissions with the use of Representative Concentration Pathways (RCPs), which depict two different future emissions scenarios: RCP 4.5 represents a medium emissions scenario where communities attempt to reduce GHG emissions. This scenario predicts that GHG emissions will continue to rise until plateauing in the middle of the 21st century and would decrease to below 1990 levels by the end of the 21st century. RCP 8.5 represents a high emissions scenario, or business-as-usual (BAU) scenario, where GHG emissions continue to increase through the end of the 21st century. Because the efficacy of GHG reduction strategies is not known, a discussion of both emissions scenarios, and their associated impacts, is included in this vulnerability assessment (Bedsworth et al. 2018).

Cal-Adapt also includes 10 global climate models, downscaled to local and regional resolution using the Localized Constructed Analogs statistical technique. Four of these models have been selected by California's Climate Action Team Research Working Group as priority models for research contributing to California's Fourth Climate Change Assessment². Projected future climate from these four models can be described as producing:

- A warm/dry simulation (HadGEM2-ES),
- A cooler/wetter simulation (CNRM-CM5),
- An average simulation (CanESM2), and
- The model simulation that is most unlike the first three for the best coverage of different possibilities (MIROC5).

To analyze climate projections for the unincorporated county, the average global climate model (CanESM2) was chosen, as it represents an average scenario. Most of the data presented in Cal-Adapt have been downscaled to grid cells that are 6 kilometers (km) by 6 km in size. Generally, the geographic study area for climate change effects includes all grid cells that are composed of at least 75 percent of unincorporated county lands. For late century drought conditions, extreme heat, and extreme precipitation secondary climate effects, aggregated grid cell data was unavailable, so the study area is instead comprised of four census tracts in the unincorporated county. As shown in Figure VA-6, these four census tracts cover much of the unincorporated county and account for 49 percent of the geographic area of the unincorporated county. For the late century drought scenario, countywide data was used as aggregated grid cell data was unavailable. Additionally, both the causes and impacts of drought are far-reaching and cross-jurisdictional boundaries, affecting the region as a whole, and are analyzed at this scale.

² California's Fourth Climate Change Assessment contributes to the scientific understanding of climate change-related vulnerabilities at the State and local level. The Fourth Assessment is a series of technical reports that include climate projections and impacts.

Figure VA-6 Extreme Heat and Extreme Precipitation Study Area



Sources: Data downloaded from U.S. [Census](#) Bureau in 2020; adapted by Ascent Environmental in 2020.

PRIMARY CLIMATE CHANGE EFFECTS

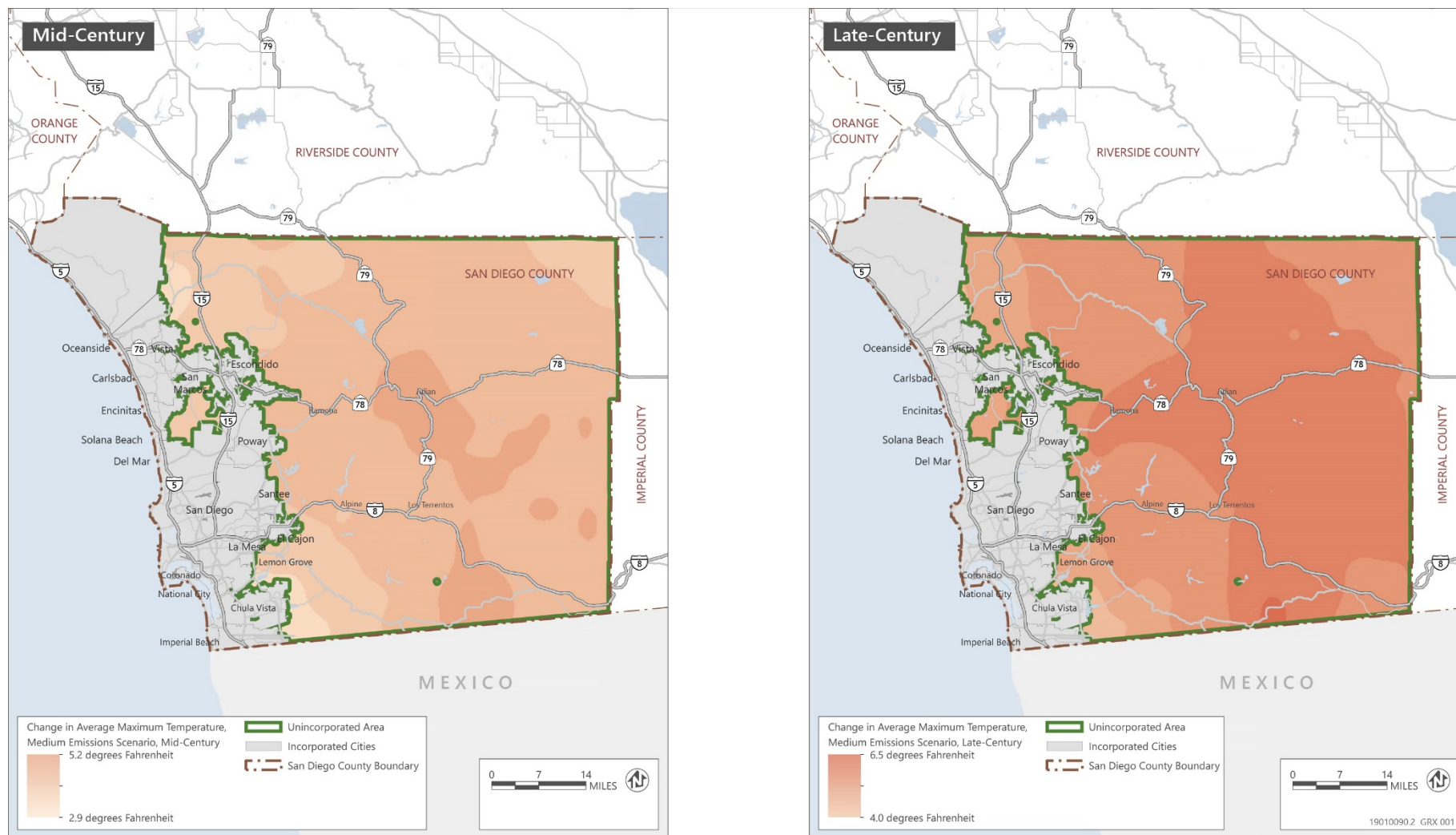
Increased Temperature

As discussed in the Executive Summary, according to Cal-Adapt, the historic (1961-1990) annual average maximum temperature for the study area was 75.3 °F, and the historic annual average minimum temperature was 46.2 °F. As shown in Table VA-2, both are projected to increase by mid-century and further increase by the end of the century. The annual average maximum temperatures in the unincorporated county are projected to be 80.5 °F by mid-century and 81.2 °F by the end of the century under the medium emissions scenario. Under the high emissions scenario, the annual average maximum temperature in the study area is projected to be 81.4 °F by mid-century and 84.0 °F by the end of the century (CEC 2020a). This equates to an increase in temperatures of approximately 5.9 to 8.7 °F by the end of the 21st century, depending on a medium or high emissions scenario (CEC 2020a).

Increased temperature in the unincorporated county will influence secondary climate effects including human health hazards, drought, extreme heat events, wildfires, and sea-level rise. Figures VA-7.1 and VA-7.2 show the projected change in average annual maximum temperature in the unincorporated county under the medium and high emissions scenarios in the mid-century and late-century. As shown in the figures, while there is some variation across specific locations within the unincorporated county, the unincorporated county as a whole will experience increased temperatures.

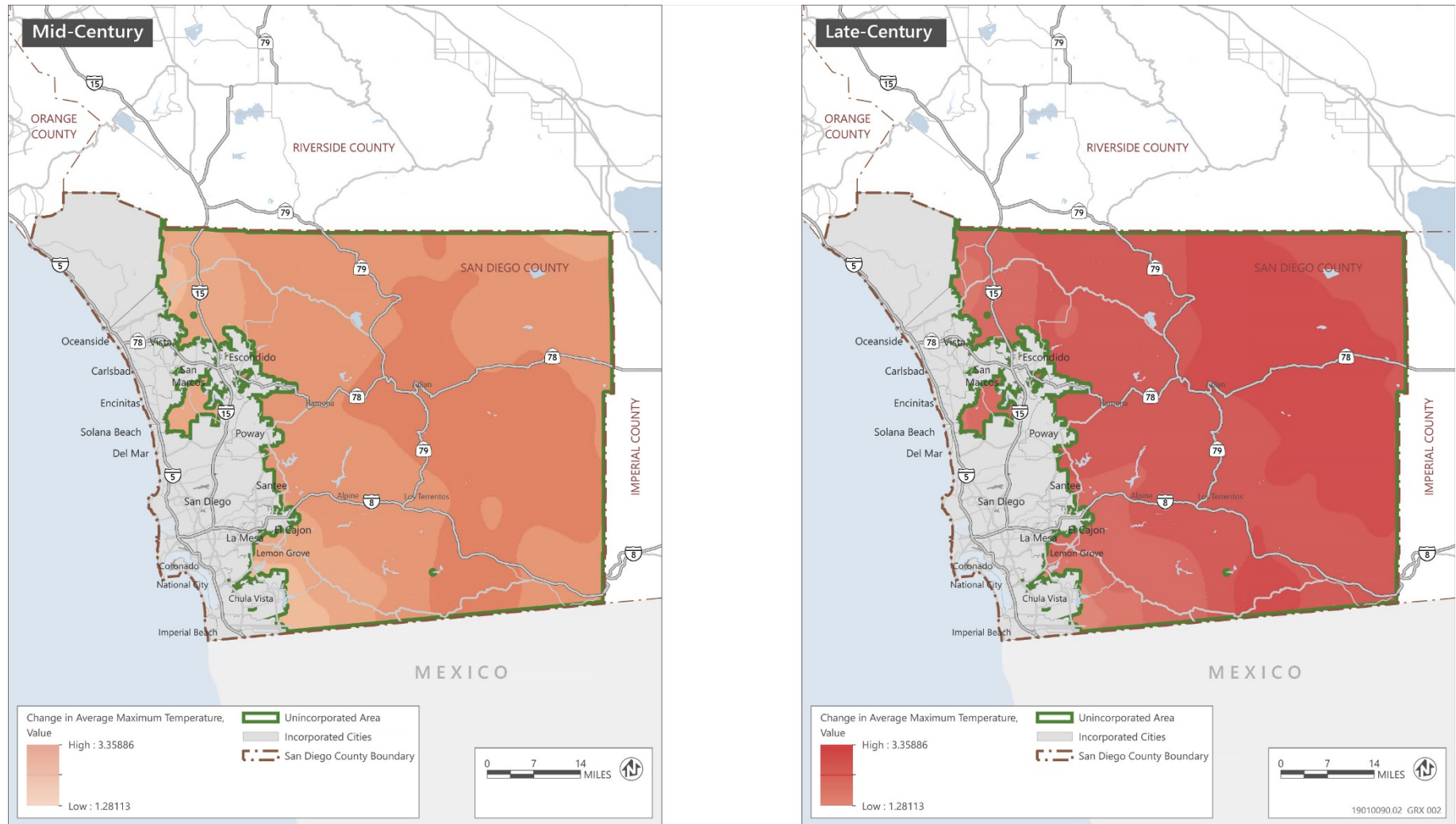
Table VA-2. Changes in Annual Average Temperature in the Unincorporated County of San Diego					
Annual Average Temperature (°F)	Historic Annual Average Temperature (1961-1990)	Medium Emissions Scenario (RCP 4.5)		High Emissions Scenario (RCP 8.5)	
		Mid-Century	Late Century	Mid-Century	Late Century
Maximum Temperature	75.3	80.5	81.2	81.4	84.0
Minimum Temperature	46.2	51.7	52.4	52.8	56.8
Notes: °F = degrees Fahrenheit, RCP = Representative Concentration Pathway					
Source: CEC 2020a					

Figure VA-7.1 Change in Average Annual Maximum Temperature, Medium Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Figure VA-7.2 Change in Average Annual Maximum Temperature, High Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Changes in Precipitation Patterns

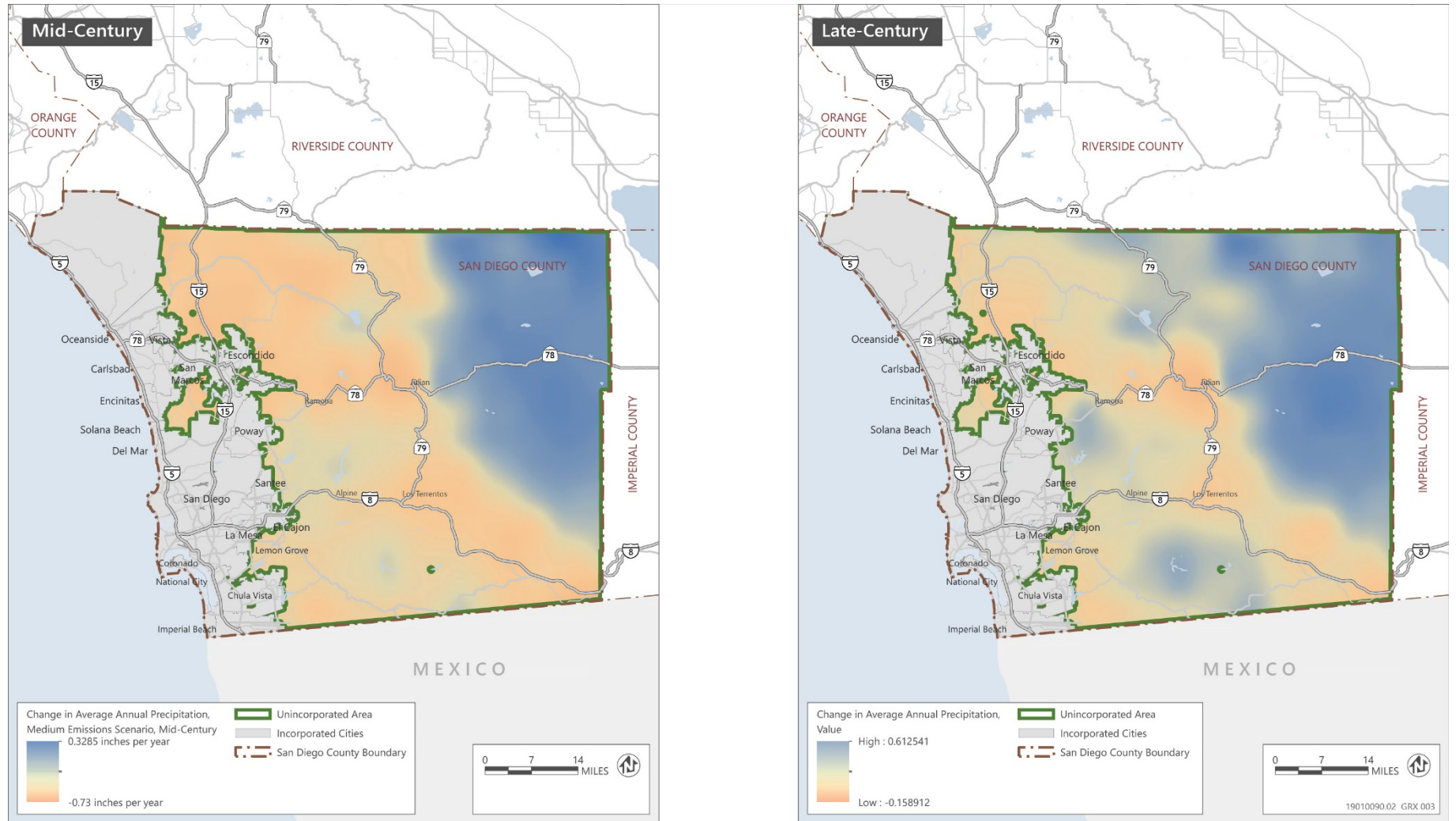
According to California’s Fourth Climate Change Assessment San Diego Region report (2019), precipitation patterns in California oscillate between extremely dry and wet periods. Climate models predict that precipitation volatility will intensify in future years in San Diego. Dry years are likely to become even drier, while wet years will become even wetter in the next several decades. Most critically, future wet seasons will have more precipitation as rain than snow due to higher temperatures, disrupting the normal timing of groundwater and surface water recharge. The State Water Project, which exports water from the Northern Sierras, is currently one of the primary sources of water countywide and accounts for 45 percent of the region’s supply. It is estimated that this source will see a 10 percent decrease in volume by mid-century (Wang et al. 2018).

According to Cal-Adapt, the historic annual average precipitation in the unincorporated county has been 16.1 inches. As shown in Table VA-3, the total annual precipitation in the watershed is projected to be 14.6 inches by midcentury and 24.3 inches by the end of the century under the medium emissions scenario. Under the high emissions scenario, the annual average precipitation in the unincorporated county is projected to be 17.2 inches by mid-century and 19.8 inches by the end of the century (CEC 2020a). While these changes in precipitation patterns do not reveal any clear upward or downward trends, precipitation patterns may become more volatile. Changes in precipitation patterns will lead to secondary climate effects including human health hazards, drought, extreme precipitation and flooding, landslides, and wildfires.

Table VA-3. Changes in Annual Average Precipitation in the Unincorporated County of San Diego					
Annual Average Precipitation	Historic Annual Average Precipitation (1961-1990)	Medium Emissions Scenario (RCP 4.5)		High Emissions Scenario (RCP 8.5)	
		Mid-Century	Late Century	Mid-Century	Late Century
Annual Average Precipitation (in)	16.1	14.6	24.3	17.2	19.8
Notes: in = inches, RCP = Representative Concentration Pathway Source: CEC 2020a					

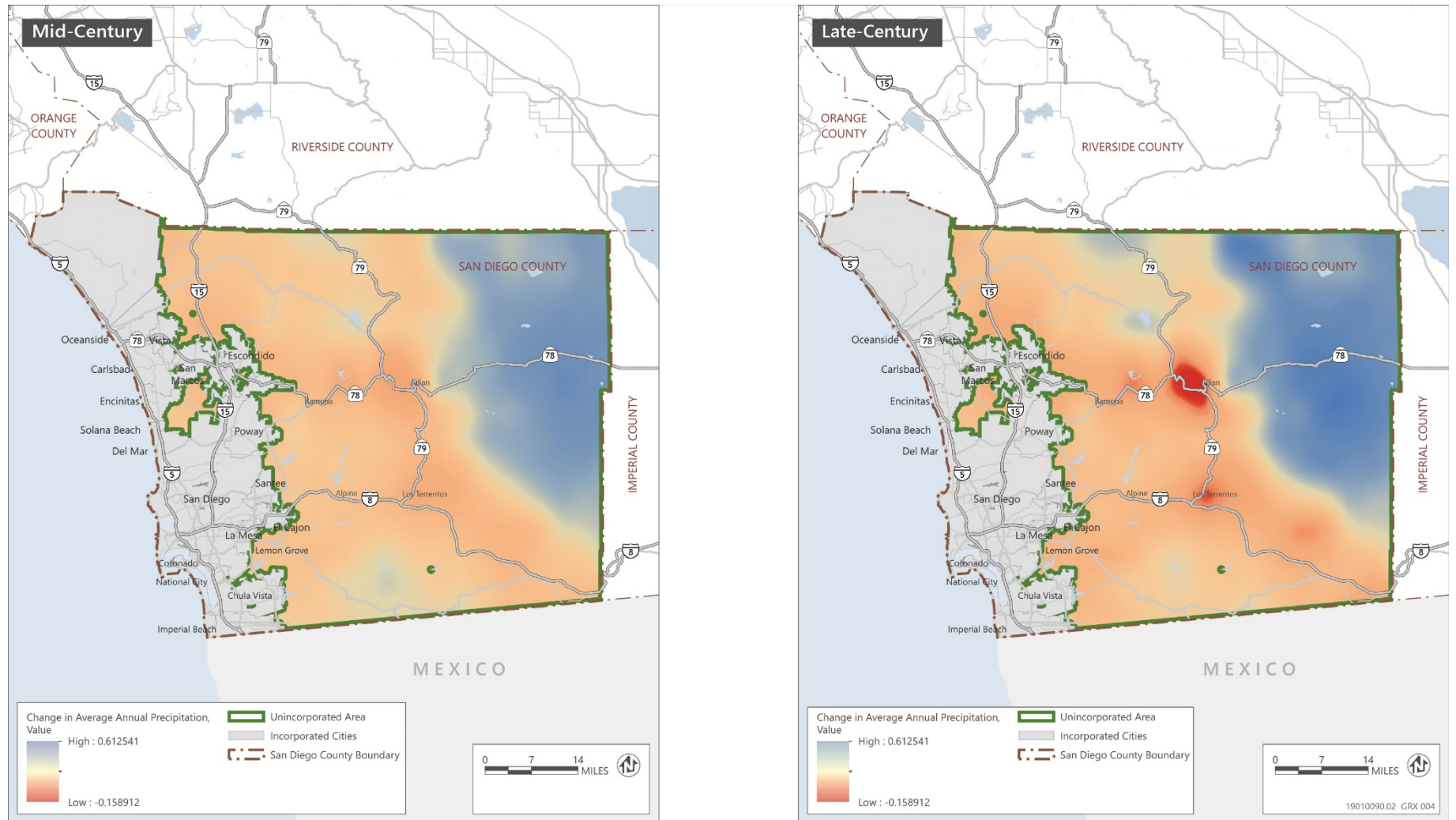
Figures VA-8.1 and VA-8.2 show the projected change in average annual precipitation in the unincorporated county for the medium and high emissions scenarios in mid-century and late-century. As shown in the figures, there is significant variation across specific locations within the unincorporated county with some areas projected to experience decreased levels of precipitation from historic values and some areas projected to experience a significant increase in precipitation. In particular, the areas adjacent to and west of Julian are expected to experience a significant decrease in average annual precipitation by late century under the high emissions scenario.

Figure VA-8.1 Change in Average Annual Precipitation, Medium Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Figure VA-8.2 Change in Average Annual Precipitation, High Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

SECONDARY CLIMATE CHANGE EFFECTS

Human Health Hazards

Climate change is closely linked to human health and public safety. In addition to direct impacts on public health and safety from drought, extreme heat, flooding, landslides, wildfires, and sea-level rise, several indirect impacts threaten public health and safety:

- climate change could increase disparities in vulnerable communities, which are often already experiencing disproportionate pollution burden and environmental impacts;
- extreme heat and wildfires can worsen air quality;
- climate influences the spread of vector-borne infectious diseases; and
- climate-induced extreme weather events can affect mental health.

As part of the EJ Element development process, the County conducted a screening analysis to identify EJ Communities (EJCs) based on geographic, socioeconomic, public health, and environmental burdens. The County of San Diego Environmental Justice Element, the Environmental Justice Communities Report (2020) was prepared in compliance with the requirements of SB 1000. SB 1000 requires that starting in 2018, general plans include an EJ element or EJ-related goals, policies, and objectives in other elements of general plans for disadvantaged communities (herein referred to as EJCs). The California Environmental Protection Agency's (CalEPA) California Environmental Health Screening Tool (CalEnviroScreen 3.0) is a mapping tool developed by the Office of Environmental Health Hazards Assessment to help identify low-income census tracts in California that are disproportionately burdened by and vulnerable to multiple sources of pollution. CalEnviroScreen 3.0 uses environmental, health, and socioeconomic information based on data sets available from state and federal government sources to produce scores for every census tract in the state. In compliance with SB 1000, which offers several methods for identifying communities, the County conducted a customized analysis using a combination of CalEnviroScreen 3.0 scores, the County's *Live Well San Diego* community initiative, and engagement with Community Planning Groups. EJCs are more vulnerable to climate change, as they already face disproportionate environmental impacts and may have fewer resources to prepare for, respond to, and recover from hazard damage. Climate change is likely to increase disparities in EJCs. For example, low-income communities are often more likely to be located in floodplains, coastlines, or other at-risk locations susceptible to extreme weather (U.S. Global Change Research Program 2020). EJCs are discussed in further detail in Section 2.2, "Sensitivity and Potential Impacts."

While some populations will be more severely affected than others, all persons in the unincorporated county will experience impacts of climate change. The San Diego Air Basin, which includes all of the unincorporated county, is currently considered as having some of the worst air quality in the country, ranking as one of the most polluted regions in the United States for ozone (American Lung Association 2020). Higher temperatures as a result of climate change are likely to increase the production of ground-level ozone, a respiratory irritant that is a component of smog. Ground-level ozone is associated with various negative health outcomes, including reduced lung function, pneumonia, asthma, cardiovascular-related morbidity, and premature death (EPA 2013). Many of the same populations that are vulnerable to the effects of extreme heat, such as those with existing chronic health conditions and the elderly, are also vulnerable to the effects of poor air quality.

Studies have shown climate influences the population size, geographic distribution, behavior, and reproduction of vectors (rodents, mosquitoes, ticks, fleas, and others) that transmit diseases to humans. The many factors that contribute to the incidence of vector-borne diseases, such as land use patterns and human behavior, present challenges in projecting their spread (Gubler et al. 2001). Additionally, cases of certain viruses are known to

increase during warm weather. Models for North America predict increases in infectious disease spread to humans, such as West Nile Virus carried by mosquitoes, caused by increasing temperatures and declines in rainfall (Harrigan et al. 2014). The California Department of Public Health estimates that several vector-borne infectious diseases will increase in prevalence in California, including malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, and West Nile virus (CDPH 2019).

Climate change may impact mental health through various pathways, including but not limited to increases in the frequency and severity of extreme weather events, increasing economic instability, and uncertainty about the future of the planet. Extreme weather events such as fires and floods can have acute mental health impacts and can be linked to increases in anxiety and depression in certain populations (Kar and Bastia 2006). Climate change can also precipitate chronic impacts including negative impacts on livelihoods (e.g., increased droughts reduce profitability for farmers), leading to mental health impacts such as chronic stress and depression (Hanigan et al. 2012).

Climate change will likely increase socioeconomic disparities in communities that already experience disproportionate environmental burdens, worsen air quality, increase the spread of vector-borne diseases, and affect mental health outcomes.

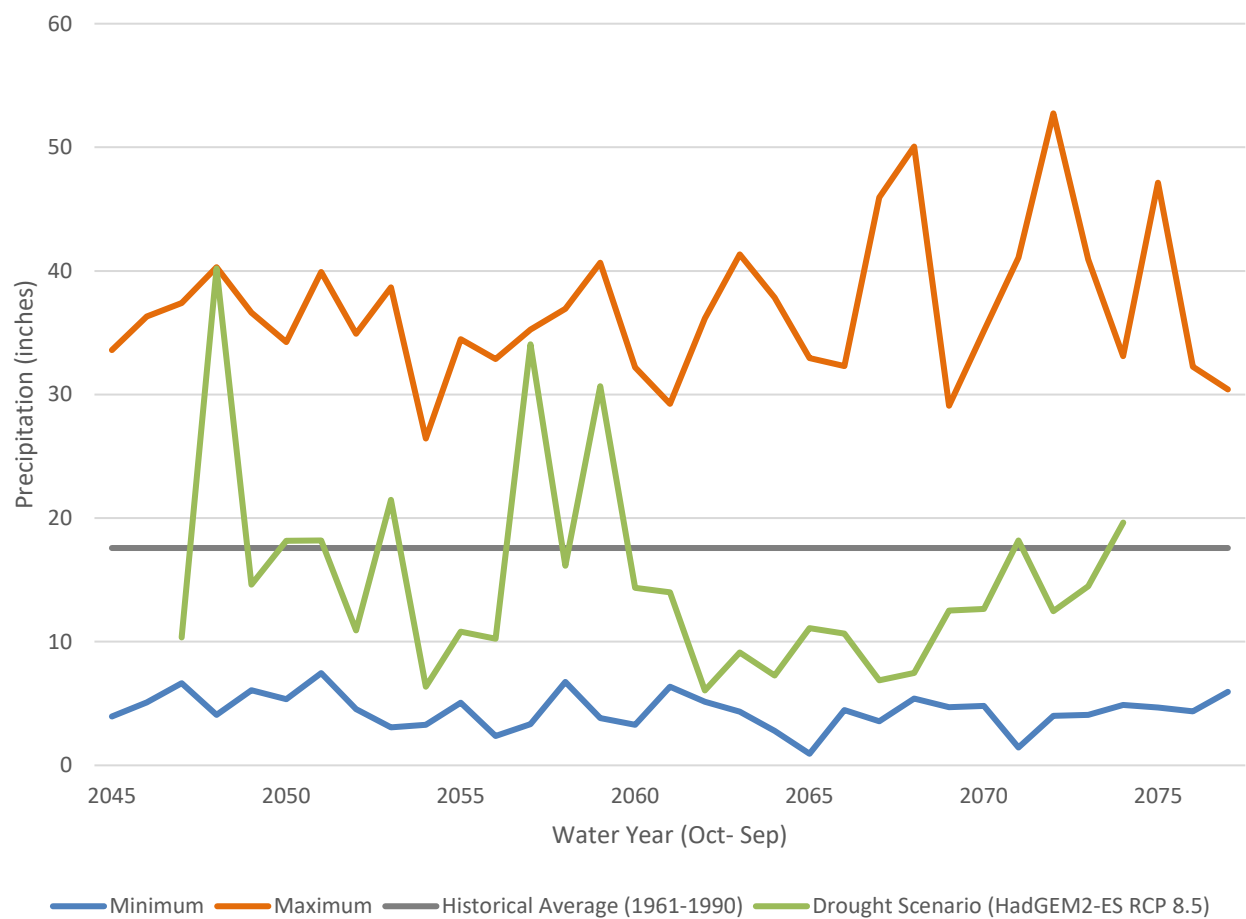
Drought and Water Supply

A large percentage of the unincorporated county's water supply is imported from the State Water Project and the Colorado River via the Metropolitan Water District of Southern California (MWD). Snowpack in the Sierra Nevada Mountains of Northern California plays a key role in water supply for the region, replenishing the watersheds and reservoirs used as state water resources. Due to increases in climate variability and rising temperatures, California has already seen signs of decreased snowmelt in Northern California: snowpack in the Sierra Nevada is expected to decline by as much as 33 percent by mid-century and 66 percent by end of century, relative to historic baseline snowpack (Bedsworth et al. 2018). Warmer temperatures have also caused California snowpack to melt faster and earlier in the year. This change in California's snowpack disrupts the normal timing of groundwater and surface water recharge and makes it harder to store and use during hotter times of the year or during drought conditions. Reduced snowpack and earlier snowmelt will lead to more frequent water shortages and less water available to the State Water Project and other water supply systems. High temperatures are also projected to affect the Colorado River streamflow by reducing the Upper Colorado Basin flow by 10 to 45 percent by mid-century (Vano et al. 2014; Udall and Overpeck, 2017). This lack of a reliable imported water supply puts stress on the unincorporated county's already limited local supply due to its arid climate, limited surface supply, shallow aquifers, and lack of permeable soils (SDCWA 2016).

In addition to the State Water Project and the Colorado River, the unincorporated county receives a portion of its water supply from local sources such as groundwater. Of the region's water supply portfolio, groundwater makes up about five percent and could be affected by projected changes in annual precipitation (SDCWA n.d.). The Sustainable Groundwater Management Act (SGMA) regulates groundwater and requires governments and water agencies of high and medium priority basins to develop groundwater sustainability agencies and ground water sustainability plans. These plans are intended to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge by 2040 for critically over-drafted basins and by 2042 for the remaining high and medium priority basins. The unincorporated county contains three SGMA-mandated basins: San Luis Rey Valley (medium priority), San Pasqual Valley (medium priority), and Borrego Valley (high priority). Future periods of drought may result in greater overdraft of these basins.

As shown in Table VA-3 above, under both the medium and high emissions scenarios, the unincorporated county is not expected to experience significant overall changes in average precipitation. However, the unincorporated county would experience increased variability in precipitation. The unincorporated county and state have a highly variable climate that is susceptible to prolonged periods of drought. Recent research suggests that extended drought occurrence (a “mega-drought”) could become more pervasive in future decades (CEC 2020b). An extended drought scenario is predicted for all of California from 2051 to 2070 under the HadGEM2-ES simulation and high emissions scenario. The extended drought scenario is based on the average annual precipitation over 20 years. This average value equates to 78 percent of the historic median annual precipitation averaged for the North Coast and Sierra California Climate Tracker regions. As shown in Figure VA-9, the study area’s observed historical average annual rainfall accumulation is 17.5 inches. Under the anticipated drought scenario between 2051 and 2070, the study area’s average annual rainfall accumulation would decrease to 14.6 inches (CEC 2020b). Predicted drought conditions due to climate change will result in stress on reliable water supply and will likely result in water shortages. During extended drought periods, alternative local water storage methods will increasingly be relied upon.

Figure VA-9 Projected Late Century Drought Conditions



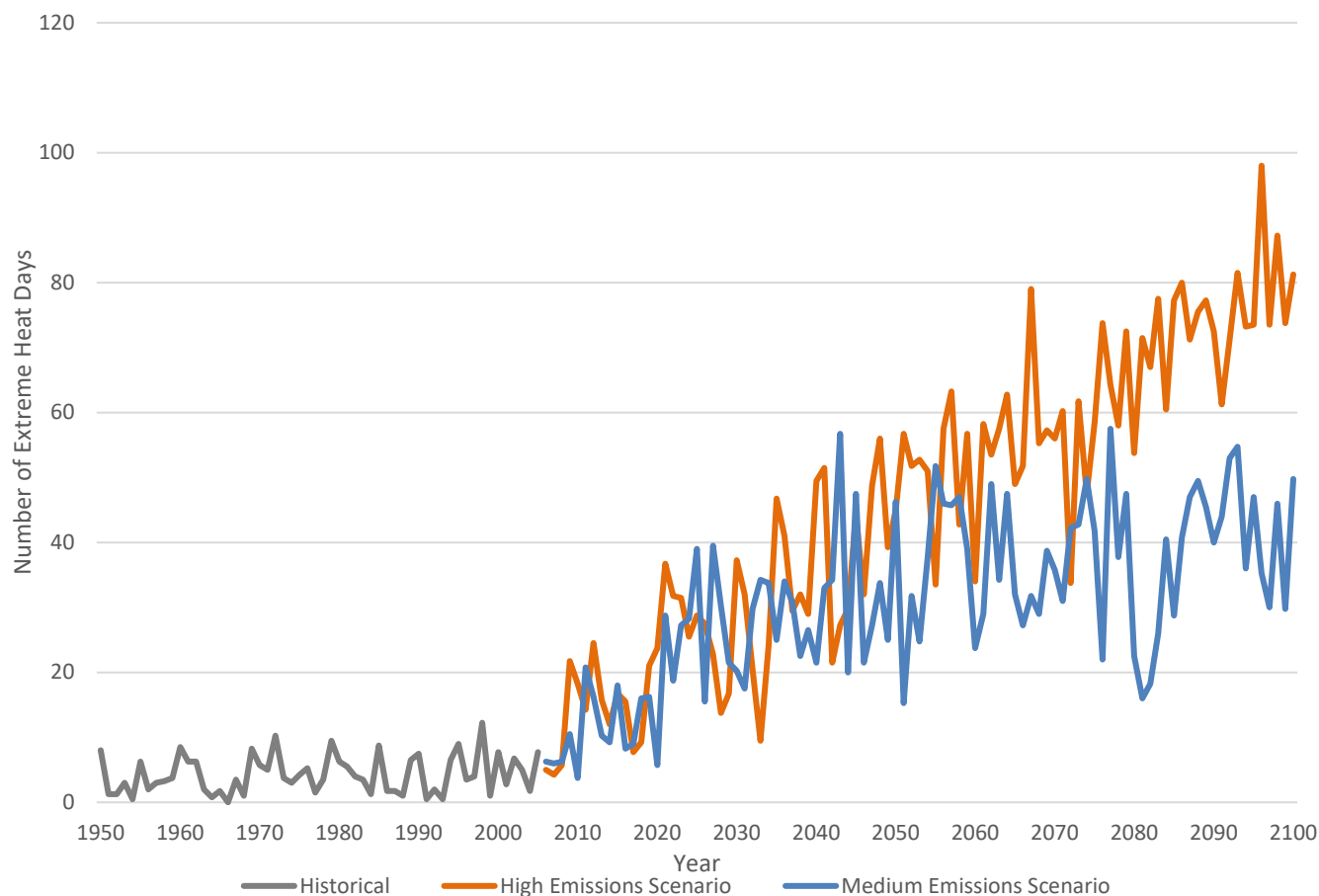
Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Extreme Heat Events

Due to the unincorporated county’s unique geography of inland valleys and low mountains, it is susceptible to extreme heat events. Extreme heat events include extreme heat days and heatwaves. Extreme heat days occur when the daily maximum/minimum temperature exceeds the 98th historical percentile of the daily maximum/minimum temperatures. Heatwaves are characterized as periods of sustained extreme heat over multiple days (i.e., four or more consecutive extreme heat days).

Cal-Adapt defines an extreme heat day as a day in a year when the daily maximum/minimum temperature exceeds the 98th historical percentile of daily maximum/minimum temperatures based on observed historical data from 1961–1990 between April and October. For the four census tracts in the unincorporated county chosen for the extreme heat study area, the extreme heat day threshold ranges from 96.6°F to 104.2°F. Historically, the study area experienced an average of four extreme heat days per year, typically occurring between April and October. As a result of rising average maximum temperatures from climate change, the study area is projected to experience up to 34 extreme heat days annually by mid-century and 39 extreme heat days by the late century under the medium emissions scenario. Under the high emissions scenario, the study area is projected to experience up to 45 extreme heat days annually by mid-century and 69 extreme heat days by the late century (CEC 2020c). As shown in Figure VA-10, the number of extreme heat days is already increasing from historic averages and will continue to increase through the end of the century.

Figure VA-10 Projected Annual Extreme Heat Days



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

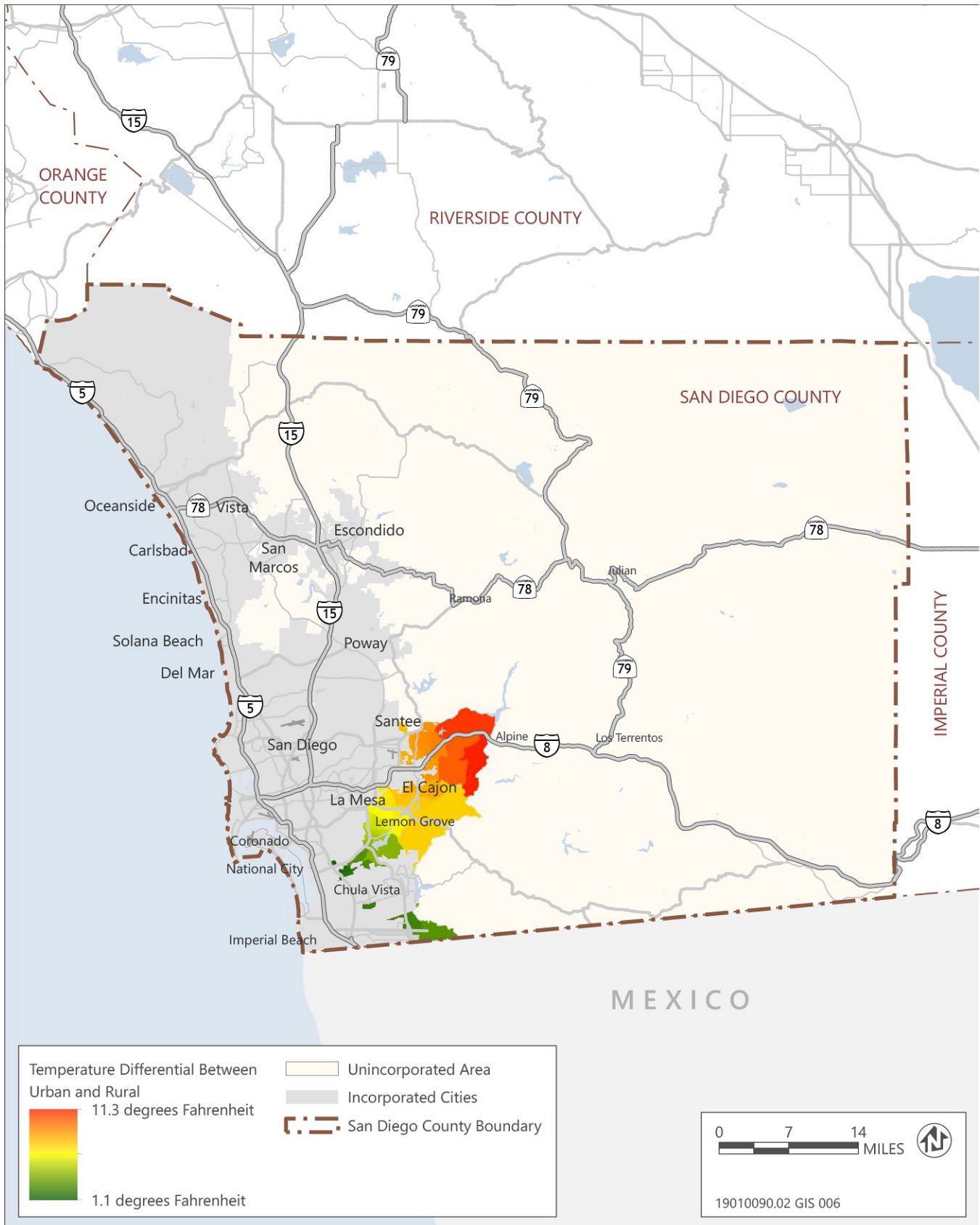
Cal-Adapt defines heatwaves as four or more consecutive extreme heat days. These events have historically been infrequent in the study area, as the historical annual average is one heatwave approximately every five years. The study area is expected to experience an increase in heatwave frequency as the climate changes. Under the medium emissions scenario, the study area is projected to experience six heat waves per year by mid-century and eight heatwaves per year by the late century. Under the high emissions scenario, the study area is projected to experience eight heatwaves per year by mid-century and 14 heat waves per year by the late century (CEC 2020c).

Urbanized areas can experience higher temperatures, greater pollution, and negative health effects, especially during summer months than rural communities. This phenomenon is known as the UHIE. Urban heat islands are created by a combination of heat-absorptive surfaces (e.g., dark pavement and roofing), heat-generating activities (e.g., automobile engines and industrial generators), and the absence of “green spaces” (vegetative surfaces that provide evaporative cooling). During extreme heat days and heatwaves, asphalt and darker surfaces reduce nighttime cooling (as retained heat is released from these surfaces). The UHIE is known to intensify extreme heat days and heatwaves. However, due to coastal wind patterns, the UHIE index is lower in portions of the unincorporated county near the coast, while a higher index is seen in the more rural inland areas. These elevated inland temperatures occur because oceanic winds move heat generated by urbanized coastal cities of the county further inland.

In 2015, the CalEPA released a study that defines and examines the characteristics of the urban heat island, and scientifically assigns a score based on atmospheric modeling for each census tract in and around most urban areas throughout the state. Figure VA-11 shows CalEPA’s Urban Heat Island Map for census tracts in the unincorporated county that are considered urban or urban-adjacent; thus, only a small portion of the unincorporated county is mapped. Census tracts are color-coded according to the approximate average temperature difference between the specific census tract and a nearby upwind rural reference point, with green representing the smallest temperature differential and red representing the greatest temperature differential. These maps do not reflect the total heat in each area, just the increase in temperature that is due to the UHIE itself.

As temperatures rise from climate change, extreme heat days and heatwave events are likely to occur more frequently. In addition, populations and assets in urban areas are more susceptible to higher temperatures due to the prevalence of paved surfaces and lack of evaporative cooling from vegetation. This increased exposure to higher temperatures is a public health risk and may increase stress on sensitive infrastructure.

Figure VA-11 California Environmental Protection Agency's Urban Heat Island Map



Sources: Data downloaded from CalEPA in 2020; adapted by Ascent Environmental in 2020.

Extreme Precipitation and Flooding

Variability in the climate is likely to result in changes to the frequency, intensity, and duration of precipitation events causing heavy rainfall, thunderstorms, and hail. Similar to other California regions, the high year-to-year variability of precipitation in the unincorporated county is severely affected by extreme precipitation events (days having precipitation at or exceeding the 95th percentile), which accounts for 80 percent of the year-to-year variability (Jennings et al. 2018). Most of the heaviest events occur during winter. While days with measurable precipitation become less frequent in Southern California, extreme precipitation events will intensify. It is predicted that the state will experience prolonged periods of drought followed by extreme precipitation. Historically, the unincorporated county experienced an average of four extreme precipitation events per year. Under the medium emissions scenario, the unincorporated county is expected to experience four extreme precipitation events per year by mid-century and six extreme precipitation events per year by the late century. Under the high emissions scenario, the unincorporated county is expected to experience five extreme precipitation events per year by mid-century and six extreme precipitation events per year by the late century (CEC 2020d).

Extreme precipitation in the unincorporated county typically occurs in the form of rainstorms driven by atmospheric rivers. An atmospheric river is a narrow band of the atmosphere that transports large amounts of water vapor and produces heavy precipitation across Southern California in the winter (NOAA 2015). Atmospheric rivers can last for several days, bringing heavy rains to lower elevations. Climate change can result in longer and wider atmospheric rivers that carry larger amounts of water vapor compared to historic conditions (Espinoza et al. 2018). Larger atmospheric rivers would result in greater precipitation volumes and more frequent thunderstorms and hail, which can cause flooding and high winds, damaging infrastructure, and endangering public safety.

The unincorporated county currently experiences localized flooding during extreme precipitation events due to overflowing drainage channels, low lying areas with poor drainage, and debris build-up in basins (San Diego Water Management Group 2013). As more intense precipitation events occur over short periods, the unincorporated county is likely to experience an increase in flood events.

Landslides

Landslides are events where a mass of earth or rock moves down a slope, which can be triggered by both geologic (e.g., earthquake) and climatologic factors. The likelihood of landslides can be significantly higher when heavy rainfall events occur after wildfires. The combination of increased temperatures, increased likelihood of wildfires, and increased occurrence of extreme precipitation events could result in more frequent and larger landslides in the western coastal plains and eastern mountains of the unincorporated county.

Wildfires

Wildfire risk is determined by several factors: wind speeds, drought conditions, available wildfire fuel (i.e., dry vegetation), past wildfire suppression activity, and expanding wildland-urban interface (Westerling 2018). Climate change is expected to worsen many of the factors that contribute to greater wildfire risk by increasing the intensity of severe wind events and creating hotter and drier landscapes more susceptible to burning.

As discussed above, climate change will result in changes in precipitation patterns, increased temperature, and drought conditions. Wetter months may lead to increased vegetative growth while following periods of drought will allow for the vegetative growth to dry up creating greater amounts of fuel for fires. Climate change will also worsen existing severe wind events, which fuel the spread and intensity of wildfires. Santa Ana wind events blow in an offshore direction in parts of Southern California and are caused by the formation of large high-pressure systems

over eastern California, Nevada, and Utah, producing winds that are strong and extremely dry. Santa Ana winds have caused some of the region’s most damaging wildfires and account for some of the worst extreme heat events that have occurred along the unincorporated county’s coastal zone. While future wind events are predicted to decrease, the intensity of a severe wind event over a shorter amount of time is predicted to increase (CNRA, OPR, & CEC 2019).

Cal-Adapt provides projections for annual mean hectares burned within the unincorporated county. This projection only accounts for areas within the unincorporated county that could experience wildfire events. In addition to the medium and high emissions projections included in Cal-Adapt, modeling for wildfires includes three scenarios for population growth: low, central, and high. These population growth scenarios account for a range of potential development in the wildland-urban interface. Table VA-4 shows the projected change in annual average area burned within the unincorporated county under medium and high emissions scenarios for the central population growth scenario. Figure VA-12.1 and VA-12.2 show the projected annual average hectares per 6-km by 6-km grid cell burned during wildfires in the unincorporated county for the medium and high emissions scenarios at mid-century and late-century time scales. Generally, the total area burned annually by wildfire is expected to decrease by late century under both emissions scenarios. However, as shown in Figures VA-12.1 and 12.2, anticipated wildfire effects are not homogenous across the unincorporated county: the western and central portions of the unincorporated county in particular are projected to experience greater incidence of wildfires.

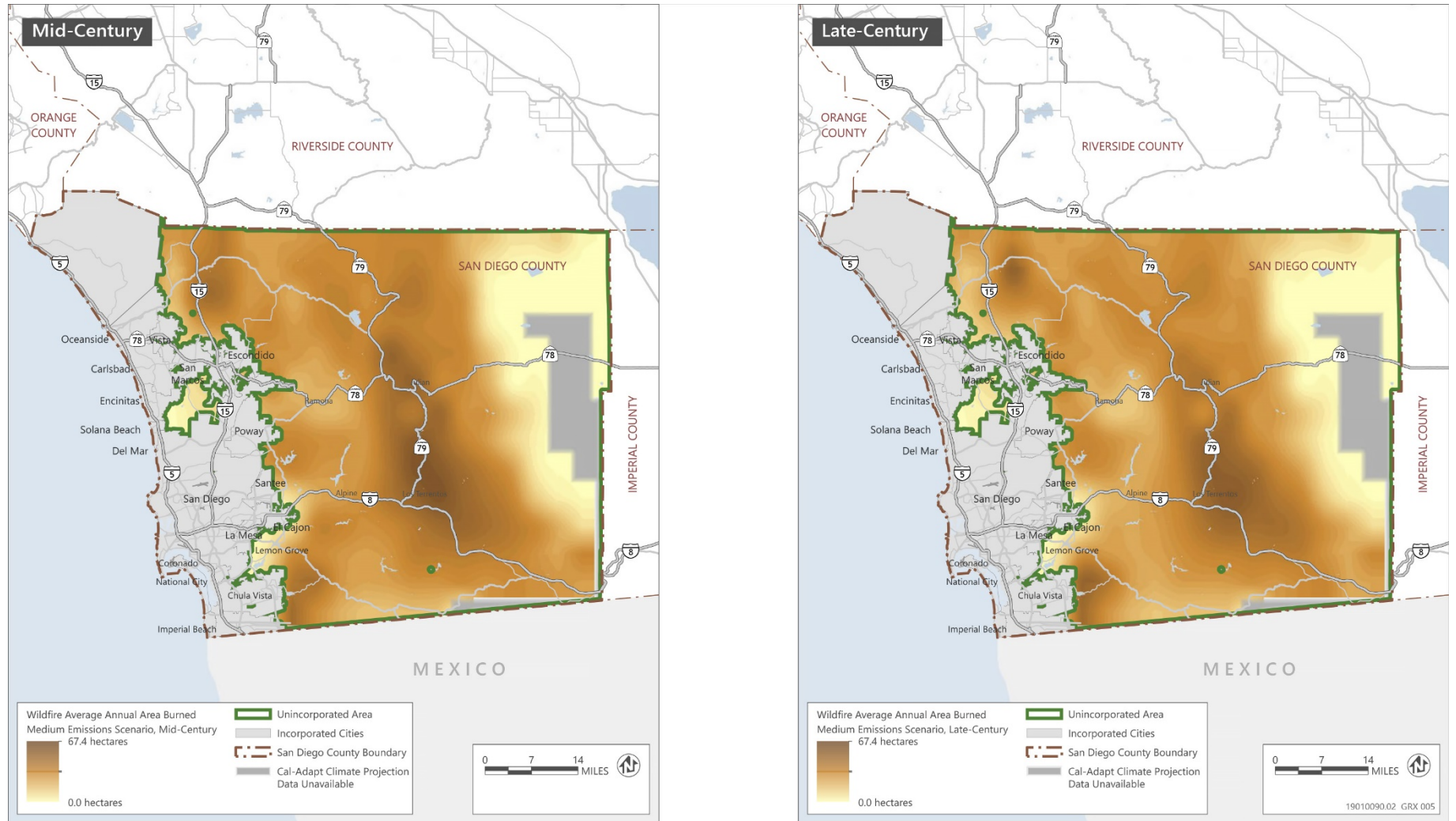
Table VA-4. Changes in Annual Average Area Burned in the Unincorporated County of San Diego					
Annual Average Area Burned	Historic Annual Average Area Burned (1961-1990)	Medium Emissions Scenario (RCP 4.5)		High Emissions Scenario (RCP 8.5)	
		Mid-Century	Late Century	Mid-Century	Late Century
Annual Average Area Burned (hectares)	5,311	5,533	5,111	5,283	4,372
Notes: in = inches, RCP = Representative Concentration Pathway Source: CEC 2020e					

Sea-Level Rise

Rising sea levels are considered as a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea-level rise poses the greatest risk during coastal storms which increase tidal elevations. The large waves associated with storm surges can cause flooding in low-lying areas, loss of coastal wetlands, saltwater contamination of drinking water, impacts on roads and bridges, and increased stress on levees (DWR 2020). In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean.

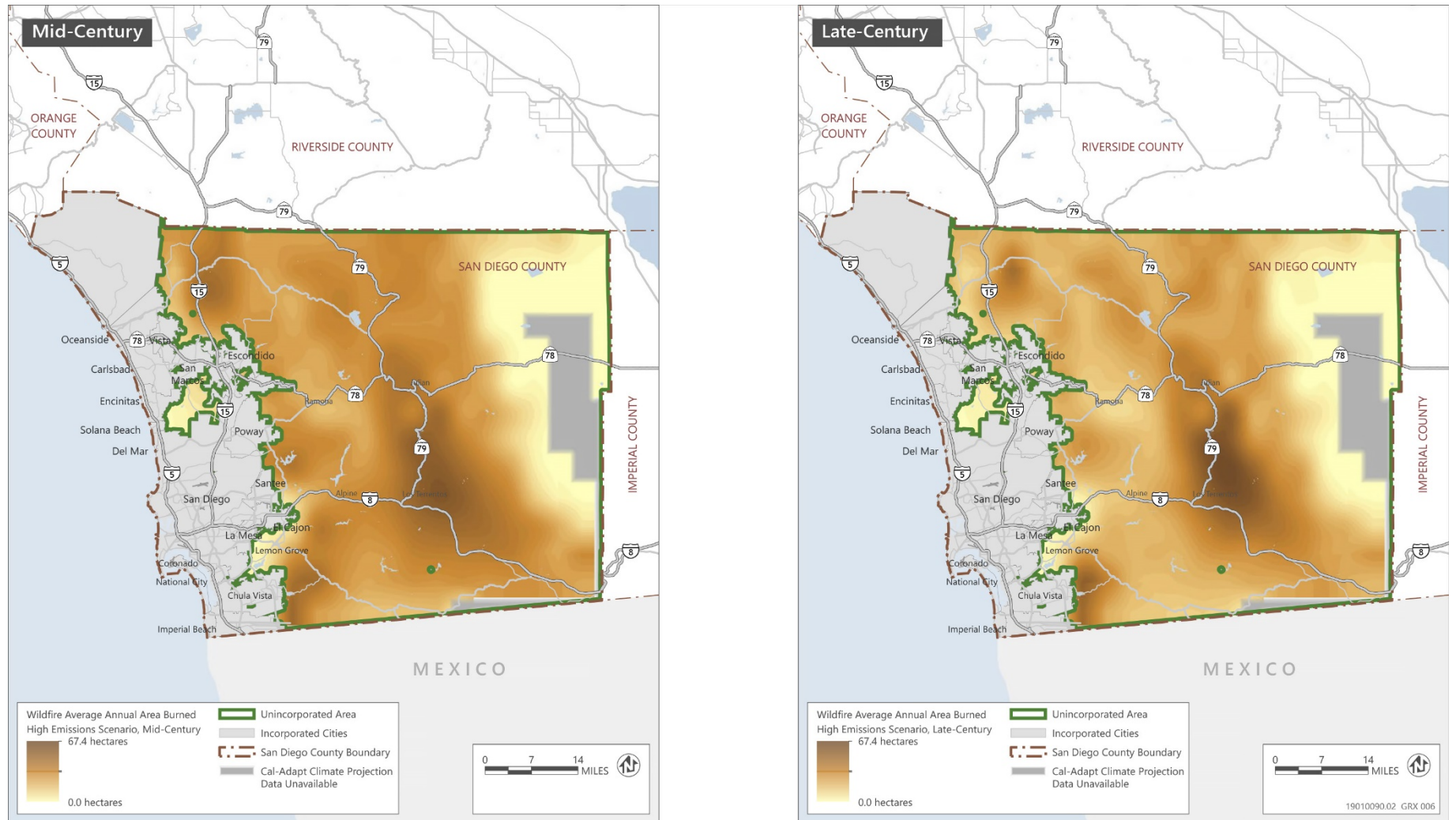
According to the Local Coastal Program Land Use Plan (County of San Diego 2018b), the unincorporated county’s coastal zone is two miles inland from the coast and encompasses approximately 1.64 square miles (1,050 acres), none of which contains coastline. However, Cal-Adapt projections show that areas of the unincorporated county may be inundated in the latter half of the 21st century. As shown in Figure VA-13.1, under the medium emissions scenario, a few small portions of the unincorporated county may be inundated by the late century. These include residential areas east of the San Elijo Lagoon Ecological Reserve and areas adjacent to the intersection of Interstate 805 and State Route 54 near Chula Vista. As shown in Figure VA-13.2, under the high emissions scenario larger portions within the same areas of the unincorporated county could be inundated by mid-century. By the late century, residential land uses in the San Dieguito Community Plan area, Lincoln Acres (County Island), and areas in the Sweetwater Community Plan Area could be inundated.

Figure VA-12.1 Annual Average Area Burned by Wildfire, Medium Emissions Scenario



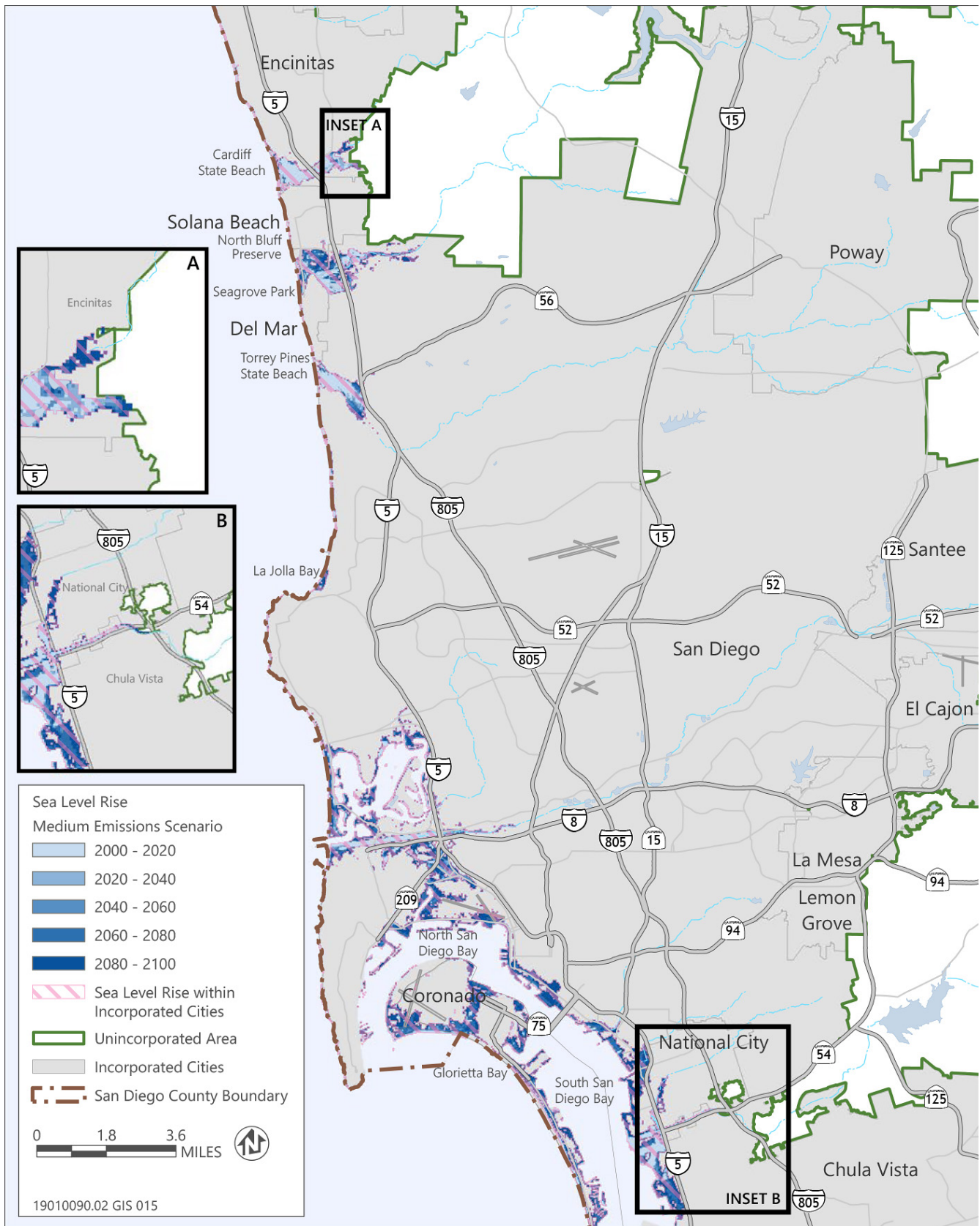
Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Figure VA-12.2 Annual Average Area Burned by Wildfire, High Emissions Scenario



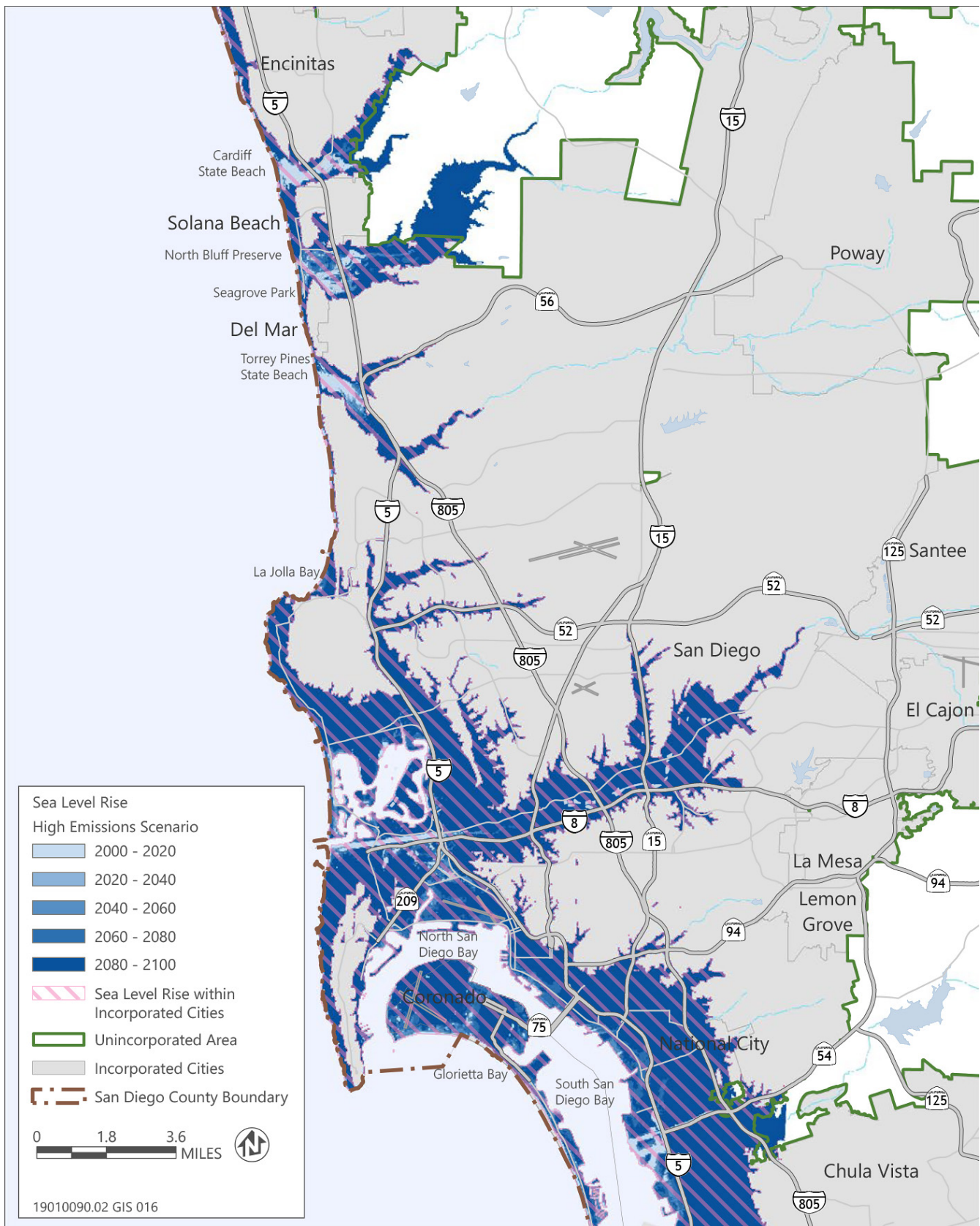
Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Figure VA-13.1 Sea-Level Rise Projections for Unincorporated County of San Diego, Medium Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Figure VA-13.2 Sea-Level Rise Projections for Unincorporated County of San Diego, High Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

2.2 Sensitivity and Potential Impacts

Climate change effects will impact the unincorporated county differently, such that some population groups and physical assets will be affected much more severely than others. Key populations and assets identified in the unincorporated county are organized into the following overarching categories: populations, transportation, energy, water, biodiversity and habitat, and emergency services.

Location-specific geographic information system (GIS) analysis was conducted to assess the potential impacts of climate change effects on EJC and several types of critical assets in each of these categories. These assets include railroads, highways, airports, bridges, bus facilities, communication facilities, oil and gas pipelines, electric power facilities, wastewater facilities, emergency response facilities, hospitals, and schools. The climate change effects analyzed were increased flooding, increased wildfire risk, and sea-level rise under the high emissions scenario at both mid- and late century timescales:

- **Flooding:** Projected changes in precipitation due to climate change were overlaid on the unincorporated county's existing floodplains and floodways (see Figure VA-5). The analysis identified EJC and critical assets that were located in both existing flood risk areas and areas where precipitation was predicted to increase due to climate change.
- **Wildfire:** Projected changes in wildfire risk were overlaid on the unincorporated county's existing FHSZ map (see Figure VA-3). The analysis evaluated whether any EJC and critical assets were located in both very high FHSZs and areas where the predicted annual number of hectares burned was greater than the historical average.
- **Sea-Level Rise:** This analysis identified EJC and critical assets that would be inundated by predicted sea-level rise (see Figure VA-13.2).

A summary of the potential impacts of secondary climate change effects on each asset category is provided in Tables VA-5 through VA-10 below.

2.2.1 POPULATIONS

EJC and communities of color are more susceptible to climate change-related hazards due to limited access to financial resources, health challenges or disabilities, living or working conditions, or historical and current marginalization. These factors, among others, can lead to increased susceptibility to, and disproportionate harm from climate impacts. Vulnerable populations in the unincorporated county include EJC, low-income persons, communities of color, linguistically isolated persons, senior citizens, persons with disabilities, and persons experiencing homelessness, among others.

Climate change impacts human health through environmental changes, such as more extreme heat, more frequent wildfires, a decline in air quality, increases in allergens, and greater prevalence of infectious diseases. The resulting human health impacts include, but are not limited to, increases in the risk of asthma, allergies and other respiratory illnesses, cardiovascular disease, vector-borne diseases, mental health impacts, civil conflicts and migrations, malnutrition, injuries, health-related illness, and death (Bell et al. 2016). While all persons in the unincorporated county will experience health impacts from climate change, the populations most vulnerable to these health impacts are the same communities that experience health inequities or systemic differences in health status that are preventable and unfair (CDPH 2019). The vulnerable communities described below, particularly EJC which have a disproportionate environmental burden, face climate change impacts that compound and exacerbate existing public health sensitivities and vulnerabilities.

For the San Diego region, extreme heat is a particular concern. In fact, according to the Centers for Disease Control and Prevention, extreme heat is responsible for more deaths nationally than any other natural or weather-related disaster (CDC 2020). Prolonged exposure to extreme heat can result in heat stress and heat stroke, and the associated dehydration can also exacerbate chronic illnesses such as renal disease. Populations most at risk include children, older adults, unsheltered persons, persons with disabilities, outdoor workers, and low-income communities of color. Extreme heat increases the prevalence of ozone formation, which exacerbates asthma, respiratory diseases, and cardiovascular diseases. In addition, extreme heat impacts mental health through increased incidence of disease, death, violence, aggression, and suicide. It is also important to note that some medications are sensitive to heat and may lose effectiveness or cause harmful side effects when exposed to heat (Rudolph et al. 2018).

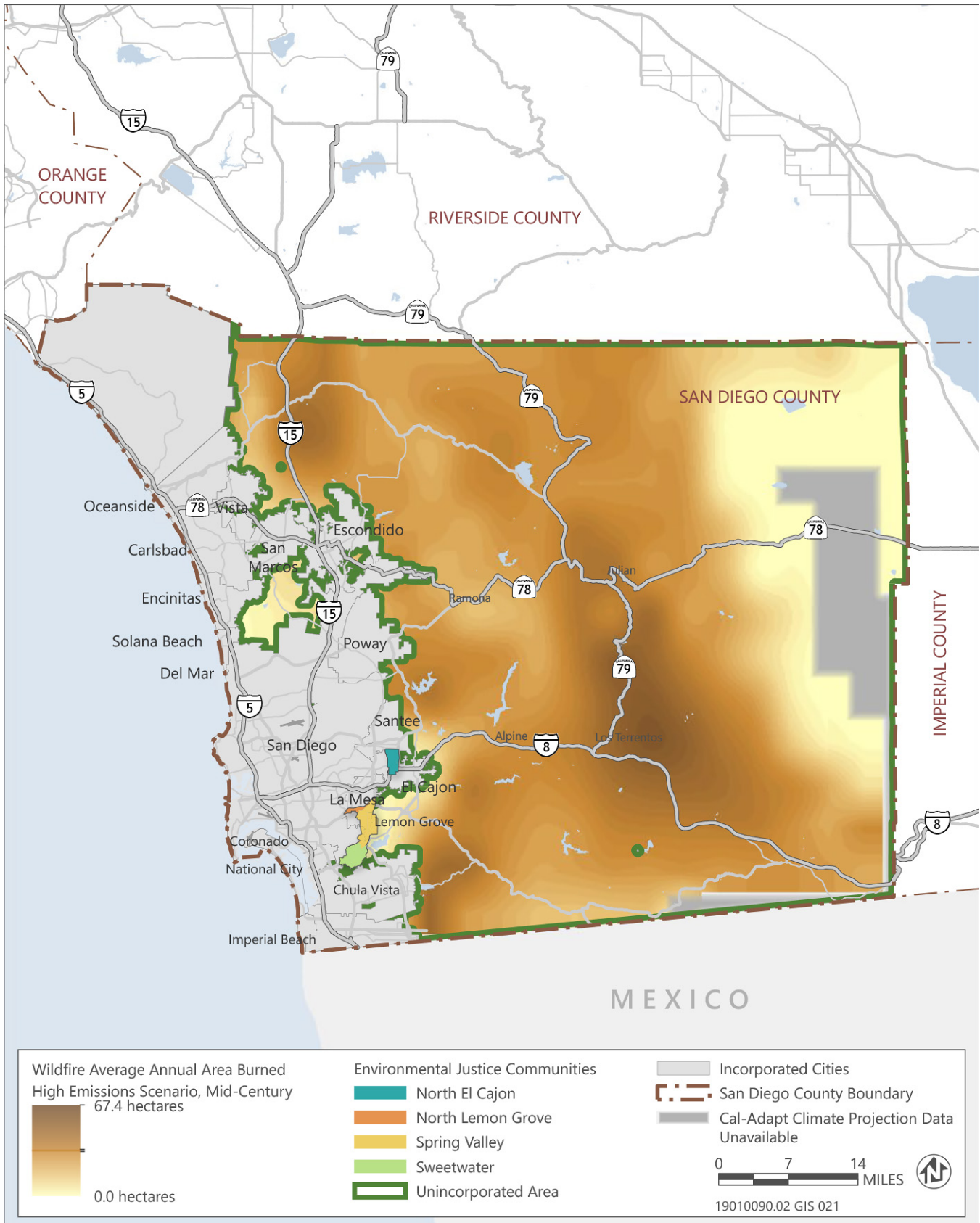
Furthermore, wildfires are another major public health concern for the San Diego region. Although EJs are not located in areas where wildfire risk is predicted to increase, unlike other climate-induced natural disasters that have more localized health impacts, a single wildfire can influence the health outcomes of multiple regions because wildfire smoke can travel long distances and worsen the air quality for weeks. Wildfires are a major source of particulate matter, which is an air pollutant that increases one's risk for respiratory illnesses, cardiovascular disease, negative birth outcomes, and premature death (Bell et al. 2016). Wildfire smoke also increases one's exposure to carbon monoxide, ground level ozone, and toxic chemicals (e.g., pesticides, plastics, and paints) released from burned building and other man-made materials. This poor air quality limits outdoor physical activity, which is important for preventing obesity and improving cardiovascular, bone, and mental health. Even when sheltering indoors, individuals are at risk of exposure to hazardous air quality because wildfire smoke penetrates into homes, particularly older homes (Rudolph et al. 2018). Moreover, wildfires can also cause immediate health impacts through burns, injuries, and heat stress. Beyond these immediate health impacts, the stress, displacement, and loss of home and community from wildfires can cause significant mental health impacts, such as anxiety, depression, and post-traumatic stress disorder (Hanigan et al. 2012).

Though vulnerable populations represent only a portion of the unincorporated county's total population, it is important to plan for all groups that, for one reason or another, lack available resources or capacity to adapt to climate change impacts. Population data for the unincorporated county were calculated using data from the U.S. Census Bureau's 2019 American Community Survey 5-Year Estimates for all 176 census tracts that overlap with the unincorporated county's boundaries. Climate impacts to population groups are presented in Table VA-5.

ENVIRONMENTAL JUSTICE COMMUNITIES

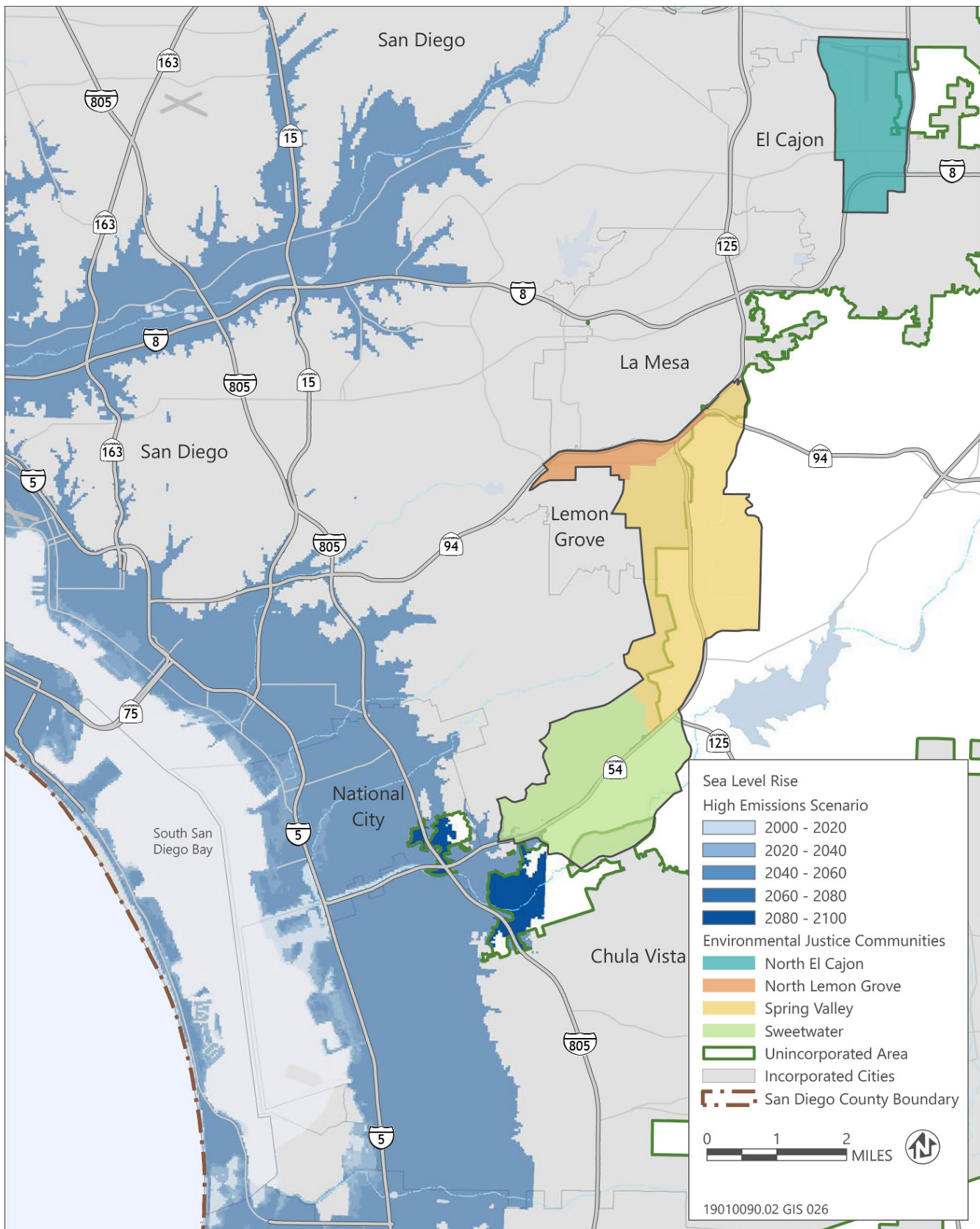
As described in the County of San Diego Environmental Justice Element, Environmental Justice Communities Report (2020), the County used a three-step custom methodology for identifying EJs. The first step used CalEPA's CalEnviroScreen 3.0, the second step relied on the County's *Live Well San Diego* community initiative, and the third step was to engage with Community Planning Groups and jurisdictions that share land use authority of identified areas to determine if they would like to opt in or out of an EJ designation. Through the County's custom EJ identification process, 17 census tracts met the criteria to be considered EJs and were grouped into four proposed EJs: North El Cajon, North Lemon Grove, Spring Valley, and Sweetwater. These four EJs identified are shown in Figures VA-14 and VA-15 below, which overlay climate hazards over EJs. As shown in Figure VA-14, the EJ of Spring Valley is located in an area that has experienced wildfires. However, none of the EJs are in very high FHSZs where wildfire risk is predicted to increase over historical levels. GIS analysis indicates that while the EJs of Spring Valley and Sweetwater are located in areas of existing flood risk, they are not located in areas where precipitation was predicted to increase due to climate change. Lastly, as shown in Figure VA-15, the EJ of Sweetwater may be exposed to late century sea-level rise inundation in the high emissions scenario in the southwestern portion of the community.

Figure VA-14 Environmental Justice Communities and Wildfire Area Burned



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

Figure VA-15 Preliminary Environmental Justice Communities and Sea-Level Rise, High Emissions Scenario



Sources: Data downloaded from Cal-Adapt in 2020; adapted by Ascent Environmental in 2020.

LOW-INCOME COMMUNITIES

Incorporated areas of San Diego County are generally more urbanized, have higher populations, and represent a different economic profile than rural areas. The countywide population is culturally and economically diverse; approximately 12 percent of the countywide population, including incorporated areas, were living below the federal poverty level in 2019 (U.S. Census Bureau 2019a). In contrast, within the unincorporated areas of the county, about 9 percent of the population lived below the federal poverty line in 2019.

COMMUNITIES OF COLOR

The unincorporated county's population is 52 percent white, 30 percent Hispanic and Latino, 8 percent Asian, 4 percent Black, 1 percent American Indian or Native Hawaiian, and 4 percent who identify as other or multiracial (U.S. Census Bureau 2019b). Across the U.S., including California and the unincorporated county of San Diego, communities of color are disproportionately vulnerable to and impacted by climate change. This vulnerability is often due to variables such as location, employment type, income level, and access to resources, which are often the result of historic inequitable planning processes (Lynn et al. 2011).

LINGUISTICALLY ISOLATED COMMUNITIES

Communities of color can also face challenges due to limited English proficiency, and may not be able to access important information regarding climate hazards and are often left out of community planning and emergency planning processes. Approximately 30 percent of the unincorporated county's population speaks a language other than English at home. Of this 30 percent, about a third speak English at a level characterized as less than "very well" (U.S. Census Bureau 2019c).

SENIOR CITIZENS

Vulnerable populations also include elderly populations who are 65 years of age and older. The unincorporated county's population in 2019 was approximately 16 percent elderly (U.S. Census Bureau 2019d).

PERSONS WITH DISABILITIES

During hazard events such as wildfires, flooding, or extreme storms, non-English speakers, the elderly, and other vulnerable populations such as persons with disabilities may require additional assistance to adequately respond. Challenges that these populations face include potential inability to access emergency supplies, evacuate, or receive and understand emergency information. Further, the effects of climate change hazards can result in infrastructure disruptions including power outages. Such events could result in additional health hazards for the elderly or persons with disabilities who rely on power to sustain medical equipment/assistive technology use.

HOMELESS

The County conducts "point-in-time" counts of sheltered and unsheltered persons and families each year. These counts represent the best estimate of the number of individuals experiencing homelessness countywide. According to the 2020 Point-In-Time Homeless Count, the countywide population of unsheltered persons was at least 3,971 people (Regional Task Force on the Homeless 2020). Individuals experiencing homelessness are especially vulnerable to climate change impacts such as increased heatwaves and extreme heat days, flooding, and impacts on human health. This vulnerability stems from lack of shelter, resources to respond to events, and sanitation. In addition to impacts from existing climate change risks, emergency events such as wildfires and flooding can disproportionately affect low-income residents and communities. Extreme weather events can result in the loss of housing stock and reduced regional housing affordability, resulting in increased occurrences of homelessness (Center for American Progress 2019).

Table VA-5. Climate Change Impacts to Populations

Climate Change Effects	Populations						
	EJCs	Low-Income Communities	Communities of Color	Linguistically Isolated	Senior Citizens	Persons with Disabilities	Homeless
Human Health Hazards	- Increased exposure to poor air quality and infectious disease compared to non-EJCs. - Exacerbated economic insecurity resulting in mental health concerns	- Increased exposure to poor air quality and infectious disease compared to non-low-income population. - Exacerbated economic insecurity resulting in mental health concerns	Increased exposure to poor air quality and infectious disease compared to non-communities of color.	Increased exposure to poor air quality and infectious disease compared to non-linguistically isolated population.	Increased exposure to poor air quality and infectious disease compared to non-senior citizen population.	- Increased exposure to poor air quality and infectious disease compared to non-disabled population. - Exacerbated economic insecurity resulting in mental health concerns.	- Increased exposure to poor air quality and infectious disease compared to non-homeless population. - Exacerbated economic insecurity resulting in mental health concerns.
Drought and Water Supply	Water shortages during droughts are more likely to impact EJCs	Water outages during droughts are more likely to impact low-income households.	Water outages during droughts are more likely to impact communities of color.	Limited ability to interpret and react to drought and available water supply messaging.	Increased hazards to human health from limited access to potable water.	Increased hazards to human health from limited access to potable water.	Increased hazards to human health from limited access to potable water.
Extreme Heat Events	- Increased vulnerability to heat-related health risks. - Increased exposure to heat at home from limited ability to afford air conditioning systems. - Increased exposure to UHIE.	- Increased vulnerability to heat-related health risks. - Increased exposure to heat at home from limited ability to afford air conditioning systems. - Increased exposure to UHIE.	- Increased vulnerability to heat-related health risks. - Increased likelihood of limited access to air conditioning and cooling facilities. - Increased exposure to UHIE.	- Increased vulnerability to heat-related health risks. - Issues accessing cooling resources	- Increased vulnerability to heat-related health risks. - Increased exposure to UHIE.	- Increased vulnerability to heat-related health risks. - Increased exposure to outdoor heat without access to air conditioning or protection. - Increased exposure to UHIE.	- Increased vulnerability to heat-related health risks. - Increased exposure to outdoor heat without access to air conditioning or protection. - Increased exposure to UHIE.

Table VA-5. Climate Change Impacts to Populations

Climate Change Effects	Populations						
	EJCs	Low-Income Communities	Communities of Color	Linguistically Isolated	Senior Citizens	Persons with Disabilities	Homeless
Extreme Precipitation and Flooding	- Potential inability to receive and interpret warning messages and evacuation notices. - EJCs are located in a flood-prone area.	- Limited access to warning messages and County precautionary measures. - Populations are more likely to be located in a flood-prone area and would be exposed to increased risk of flooding	- Limited access to warning messages and County precautionary measures. - Populations are more likely to be located in a flood-prone area and would be exposed to increased risk of flooding.	Potential inability to receive and interpret warning messages and evacuation notices.	- Limited mobility and ability to react to flooding events. - Limited ability to prepare for extreme weather events and reliance on existing supplies and infrastructure.	- Limited mobility and ability to react to flooding events. - Limited ability to receive warnings and access to shelter.	Limited ability to receive warnings and access to shelter.
Landslides	Potential inability to receive and interpret warning messages and evacuation notices.	Limited access to warning messages and limited ability to evacuate.	Limited access to warning messages and limited ability to evacuate.	Potential inability to receive and interpret warning messages and evacuation notices.	Limited ability to evacuate due to lack of mobility or limited situational understanding from cognitive conditions.	Limited ability to evacuate due to lack of mobility, limited situational understanding from cognitive conditions, or reliance on medication or devices.	Limited ability to receive warnings and ability to evacuate.
Wildfires	- Increased exposure to poor air quality and related health risks - Potential inability to receive and interpret warning messages and evacuation notices.	- Increased exposure to poor air quality and related health risks - Limited access to warning messages and limited ability to evacuate.	- Increased exposure to poor air quality and related health risks - Limited access to warning messages and limited ability to evacuate.	- Increased exposure to poor air quality and related health risks - Potential inability to receive and interpret warning messages and evacuation notices.	- Increased exposure to poor air quality and related health risks - Limited ability to evacuate due to lack of mobility or limited situational understanding from cognitive conditions.	- Increased exposure to poor air quality and related health risks - Limited ability to evacuate due to lack of mobility, limited situational understanding from cognitive conditions, or reliance on medication or devices.	- Increased exposure to poor air quality and related health risks - Limited ability to receive warnings and ability to evacuate.

Table VA-5. Climate Change Impacts to Populations							
Climate Change Effects	Populations						
	EJCs	Low-Income Communities	Communities of Color	Linguistically Isolated	Senior Citizens	Persons with Disabilities	Homeless
Sea-Level Rise	- Sweetwater EJC is susceptible to sea-level rise. - Decreased ability to recover.	Decreased ability to recover.	Decreased ability to recover.	Decreased ability to recover.	Decreased ability to recover.	Decreased ability to recover.	N/A
Notes: County = County of San Diego; EJC = Environmental Justice Communities; N/A = not applicable; UHIE = urban heat island effect Source: Ascent Environmental 2020							

2.2.2 TRANSPORTATION

The public roadway system including bicycle and pedestrian facilities in the unincorporated county are operated and maintained by the County. In addition to the public roadway system, the County and private operators provide freight and cargo services via truck, rail, or air travel. The County provides a comprehensive multi-modal transportation system that is an essential asset for the movement of people and goods countywide (County of San Diego 2011). One of the major effects of climate change on the unincorporated county's roadway system is the reduction in the overall lifespan of transportation infrastructure (CNRA, OPR, & CEC 2019). The effect of climate change on roadway, trail, and bicycle facilities such as increased average temperatures and extreme heat can result in the degradation of pavement. These effects can increase roadway hazards including potholes and roadway cracks. Further, additional climate change-related hazards such as flooding can wash out soil supporting roadways. Climate change-related impacts on roadway facilities can disrupt vehicular access and commerce between cities and industries and increase the risk to human safety by damaging or blocking evacuation routes and limiting access for emergency responders. If substantial, this roadway damage can also disrupt access to regular medical care for individuals with chronic illnesses, such as those who require dialysis treatment. Based on the GIS analysis, bridges, highways, freeways, and major roads in the unincorporated county are susceptible to late century sea-level rise and mid- and late century increase in wildfire risk. Several major roads may experience increased late-century flood risk as well.

Transit services in the unincorporated county are operated by the Metropolitan Transit System (MTS) and the North County Transit District (NCTD). The transit systems available in the unincorporated county include limited regional or local bus services and light rail. Transit access, safety, and cost can be impaired by climate change impacts such as extreme heat. Transit stops without adequate sheltering (i.e., bus shelters or street trees) can lead to dangerous exposure to extreme heat. GIS analysis indicates that approximately 13 transit stops may be affected by late century sea-level rise, and several transit stops are located in very high FHSZs where wildfire risk is expected to increase by mid- and late century. Additionally, bus and rail transit vehicles can undergo increased stress to maintain proper air conditioning and engine cooling during extreme heat events and risk failure (Cambridge Systems 2015).

The San Diego and Arizona Eastern Railway Desert Line is the primary rail line in the unincorporated county. Rail lines are vulnerable to extreme heat events and are susceptible to "buckling," where tracks come out of alignment, resulting in serious safety issues (Transportation Research Board 2008). The eight airports within the unincorporated county are most sensitive to rising temperatures and severe weather patterns as they may affect flight take-off and in-air flight safety. Climate impacts to the transportation system groups are presented in Table VA-6.

Table VA-6. Climate Change Impacts to Transportation

Climate Change Effects	Assets				
	Roadways	Emergency Access/ Evacuation Routes	Transit Facilities and Services	Railroads	Bicycle Paths and Trails
Human Health Hazards	Damage to roadways, if substantial, can disrupt access to regular medical care for people with chronic illnesses.	Damage to roadways, if substantial, can potentially reduce emergency response time but is unlikely to significantly reduce access.	Increased spread of infectious disease may lead to decreased transit ridership.	N/A	N/A
Drought and Water Supply	N/A	N/A	N/A	N/A	N/A
Extreme Heat Events	Increased likelihood of roadway damage from heat expansion.	Damage to roadways, if substantial, can potentially reduce emergency response time but unlikely to significantly reduce access.	- Increased heat exposure for riders at stations without adequate cover. - Increased stress on transit vehicles.	Increased likelihood of buckling.	Increased likelihood of damage from heat expansion.
Extreme Precipitation and Flooding	Increased likelihood of roadway damage from pavement saturation or washout of supporting soils.	- Potential closure of evacuation routes due to damage or water coverage. - Reduced ability for emergency services access.	Risk of physical damage.	Risk of physical damage.	Risk of physical damage.
Landslides	Risk of physical damage.	- Potential closure of evacuation routes due to damage or landslide coverage. - Reduced ability for emergency services access.	Risk of physical damage.	Risk of physical damage.	Risk of physical damage.
Wildfires	Risk of physical damage.	- High risk for areas on single-access roads. - Potential closure of evacuation routes due to damage or ongoing wildfire. - Reduced ability for emergency services access.	Fixed routes limit effectiveness in evacuation and may experience physical damage.	Fixed routes limit effectiveness in evacuation and may experience physical damage.	Risk of physical damage.
Sea-Level Rise	Increased likelihood of roadway damage from pavement saturation or washout of supporting soils.	- Potential closure of evacuation routes due to damage or water coverage. - Potential removal of vehicle access to low-lying areas. - Reduced ability for emergency services access.	Risk of physical damage.	N/A	Risk of physical damage.

Notes: County = County of San Diego; N/A = not applicable
Source: Ascent Environmental 2020

2.2.3 ENERGY

Electrical and natural gas infrastructure within the unincorporated county is owned and operated by San Diego Gas and Electric (SDG&E). Electricity delivered to consumers in the unincorporated county includes a mix of power sources from elsewhere in the region and state, as well as on-site generation of electricity from local public and private facilities. The County supports the development and maintenance of electricity generation and transmission facilities, and the maintenance and operation of facilities on County-owned sites (i.e., on-site solar panels).

Based on the GIS analysis, power plants and electricity substations in the unincorporated County are susceptible to mid-and late century increase in wildfire risk. Three power plants and one substation are located in existing flood risk areas where precipitation is expected to increase by late century. One petroleum pipeline is located within the late century sea-level rise inundation zone, and one natural gas pipeline is located in a very high FHSZ where wildfire risk is expected to increase by late century.

Impacts on electricity resources from climate hazards can include stress and physical damage to the electricity generation, transmission, and distribution system. Transmission facilities face increasing climate change-related risks as a result of increased frequency of wildfires, severe wind, and extreme heat events. Extreme heat and drought can add stress to transmission systems, resulting in system failure. Wildfires, flooding, landslides, and severe wind can cause physical damage to or destruction of transmission facilities. Hazards such as landslides, wildfires, and flooding can also affect underground natural gas pipelines, exposing and/or damaging these pipelines. The damage resulting from climate change-related hazards on electricity and natural gas infrastructure can have a greater impact on disadvantaged populations, particularly communities that are low-income or individuals who have low mobility or lack the financial means to make repairs to their property. Moreover, the increasingly regular power safety shut-offs may prevent people from using prescribed medications and treatments that rely on electricity and refrigeration.

Studies of SDG&E's electricity and natural gas infrastructure show that hazards from sea-level rise and wildfire are the largest threats from climate change. As flooding may occur from a storm event, power system infrastructure in the coastal regions may be damaged and could be impacted for several weeks (CNRA, OPR, & CEC 2019). As flooding becomes more frequent, electrical lines will become more susceptible to corrosion. Though impacts on natural gas infrastructure would be less severe than impacts on electrical facilities because gas pipelines are generally located underground, natural gas infrastructure will require increased maintenance due to climate change-related impacts (Bruzgul et al. 2018). San Diego faces the highest risk of wildfires in the wildland-urban interface (WUI), which are located primarily in the unincorporated county (CEC 2019). Electrical facilities are both subject to damage from climate change-related wildfire events and may also be the cause of wildfires. Faulty transmission lines and electrical infrastructure damaged during high-wind or storm events could result in sparks that ignite wildfire, especially in areas with dry brush and other wildfire fuels. Climate impacts on energy resources are presented in Table VA-7.

Table VA-7. Climate Change Impacts on Energy

Climate Change Effects	Assets	
	Electricity Transmission Lines and Natural Gas Pipelines	Electricity Generation
Human Health Hazards	Power shut-offs can prevent residents' use of prescribed medications and treatments that rely on electricity and refrigeration.	N/A
Drought and Water Supply	Increased stress on system and potential failure.	- Increased stress on systems and potential failure. - Reduced effectiveness of hydro-electric generation facilities.
Extreme Heat Events	Increased stress on system and potential failure.	Increased electricity demand for building cooling.
Extreme Precipitation and Flooding	Risk of potential damage/failure.	- Reduced effectiveness of hydro-electric generation facilities. - Risk of potential damage/failure. - Risk of physical damage and increased stress on generation facilities from turbulent weather.
Landslides	Risk of potential damage/failure.	Risk of potential damage/failure.
Wildfires	Risk of potential damage/failure.	- Increased smoke cover reduces effectiveness of solar facilities. - Risk of physical damage/failure.
Sea Level-Rise	Risk of potential damage/failure.	N/A
Notes: County = County of San Diego; N/A = not applicable Source: Ascent Environmental 2020		

2.2.4 WATER

The unincorporated county's water resources will be affected by climate change due to the alteration of precipitation frequency and volume, and a slight increase in the occurrence of extreme precipitation events. Extreme precipitation events that occur with more intensity over a short period could cause flooding, limiting access to or damaging water facilities. As previously discussed, snowmelt in Northern California is also projected to occur earlier in the year, causing springtime recharge to occur before the warmer and drier summer months when it is most needed. Reduced snowpack also reduces water captured for storage in surface water bodies and aquifers for potable drinking water. As a result, the unincorporated county will experience decreased water supply during the spring and summer months, which are also projected to become drier and warmer as a result of climate change (CEC 2020).

Changes in rainfall and snowmelt timing can affect SDCWA's ability to provide adequate and safe drinking water on a reliable basis. As temperatures in the unincorporated county increase, there will also be a higher demand for potable water. While SDCWA may be able to rely on groundwater to provide additional supply, drawing from these sources can substantially lower water tables, resulting in land subsidence. Furthermore, drought conditions can increase the concentration of industrial chemicals, heavy metals, and agricultural runoff contaminants in groundwater (Rudolph et al. 2018). For rural and low-income communities reliant on groundwater sources, this increased risk of toxic exposure can lead to many potential health effects depending on the contaminant, such as hepatitis, dysentery, and cancer. Precipitation variability will also affect the

unincorporated county's local surface and groundwater supply causing the unincorporated county to rely on other sources such as Quantification Settlement Agreements (agreements dependent on the State's water supply from the Colorado River), desalination, and potable reuse. It is estimated that by 2040, countywide water demand will increase by 30 percent from 2015 levels due to population and economic growth, further straining the need for sustainable water supply (SDCWA 2016). Increased episodes of drought and increased water demand could result in water shortages for the region, endangering residents, and ecological systems (e.g., flood control or sensitive habitat, recreational areas).

SDCWA and its member agencies contribute to the region's local water supply which is comprised of surface water, groundwater, and recycled water. Countywide, including incorporated areas, 24 reservoirs are served by seven major streams and other local sources. The reservoirs are mainly used as emergency water storage. Groundwater, though limited in the San Diego region, supplies various unincorporated areas of the county such as the community of Lakeside. Recycled water in the region has increased over time and provides non-potable water to recreational areas in the unincorporated county. In 2015, SDWCA began operation of the Claude "Bud" Lewis Carlsbad Desalination Plant to diversify its drought-proof water supply portfolio. The plant is able to treat and deliver 50 million gallons of water per day and serves the San Diego region (SDCWA 2021a; SDCWA 2021b).

The unincorporated county's stormwater infrastructure was developed to maintain flood control while directing water flow westward to the Pacific Ocean. The system consists of conveyance pipelines known as municipal separate stormwater systems which discharge storm and non-stormwater. The County identifies the highest priority water quality conditions within each watershed and specific goals, strategies, and schedules to address those priorities, including numeric goals and activity levels, and requirements for water quality monitoring and assessment (CNRA, OPR, & CEC 2019).

Wastewater facilities are also threatened by climate change. Flooding could release sewage and hazardous and/or toxic materials if wastewater treatment plants are inundated, storage tanks are damaged, and pipelines severed. Wastewater treatment facilities in the unincorporated county have already been impacted during large storms that have caused sewage spills. During these flooding-induced spill events, there is an increased risk of contracting water-borne illnesses and fungal infections. Climate impacts on water resources are presented in Table VA-8.

Table VA-8. Climate Change Impacts on Water				
Climate Change Effects	Assets			
	Flood Control	Water Conveyance	Available Water Supply	Water Treatment
Human Health Hazards	• N/A	• N/A	• Increased concentration of industrial chemicals, heavy metals, and agriculture runoff contaminants in groundwater drinking sources.	• Increased risk of contracting water-borne illnesses and fungal infections during sewage spill events.
Drought and Water Supply	• N/A	• Reduced efficiency of water conveyance from limited supply and increased energy costs.	• Significant reduction in water available during droughts from reduced reserve supplies and changing water runoff patterns.	• N/A
Extreme Heat Events	• Potential damage to channels and other engineered flood control facilities.	• Increased stress on conveyance system.	• Increased demand for potable water.	• Potential damage to channels and other engineered flood control facilities.

Table VA-8. Climate Change Impacts on Water

Climate Change Effects	Assets			
	Flood Control	Water Conveyance	Available Water Supply	Water Treatment
Extreme Precipitation and Flooding	- Increased demand for flood control facilities and increased risk of damage from overflow or ground saturation surrounding facilities. - Increased demand for flood control and storm surge facilities and increased risk of physical damage.	- Risk of physical damage. - Increased stress on conveyance system.	Increased risk of water contamination and reduction in available potable water.	- Increased demand for flood control facilities. - Increased risk of damage from overflow or ground saturation surrounding facilities.
Landslides	Risk of physical damage.	Risk of physical damage.	Risk of physical damage.	Risk of physical damage.
Wildfires	Risk of physical damage.	Risk of physical damage.	Increased demand for water for wildfire refugees, exposed individuals, and for fire suppression.	Risk of physical damage.
Sea-Level Rise	Increased demand for flood control facilities and increased risk of damage from overflow or ground saturation surrounding facilities.	Potential physical damage to conveyance facilities.	Increased risk of water contamination and reduction in available potable water.	Increased demand for flood control facilities and increased risk of damage from overflow or ground saturation surrounding facilities.

Notes: County = County of San Diego; N/A = not applicable
Source: Ascent Environmental 2020

2.2.5 BIODIVERSITY AND HABITAT

The San Diego region is known for its vast diversity of ecosystems. The primary effects of climate change that play the largest role in ecosystem behavior are temperature and precipitation. An increase in average temperature may result in vegetation changes, affecting the timing of flowering and the onset of breeding (CNRA, OPR, & CEC 2019). As vegetation changes occur, the animal species that depend on certain plant communities for food supply and habitat may be affected. The projected increase in the duration, frequency, and intensity of droughts may threaten the structural integrity of certain ecosystems and impact species differently. An example of this impact is when vegetative species become weak due to drought conditions and are then more susceptible to destruction from pests (CNRA, OPR, & CEC 2019). In addition, wildfire threatens vast areas of biodiverse lands that may not recover from high-intensity fires. Climate impacts on biodiversity and habitat are presented in Table VA-9.

Table VA-9. Climate Change Impacts on Biodiversity and Habitat			
Climate Change Effects	Assets		
	Hillside Habitat	Flood Control Habitat	Recreation
Human Health Hazards	• N/A	• N/A	• Reduced access to recreation areas and activities as a result of poor air quality or risk of infectious disease spread.
Drought and Water Supply	• Damage to habitats from lack of rainfall and diversion of water to potable supplies.	• Damage to habitats from lack of rainfall and diversion of water to potable supplies.	• Increased risk of erosion from continued use of recreation areas during drought conditions.
Extreme Heat Events	• Increased risk of erosion from limited soil moisture and risk to vegetation health.	• Risk to vegetation and wetland species health.	• Increased risk of erosion from limited moisture in soil at outdoor recreation areas.
Extreme Precipitation and Flooding	• Increased saturation significantly increases the risk of subsidence. • Risk of physical damage to habitats from excess precipitation and runoff.	• Increased stress on flood control habitat. • Oversaturation of habitat can result in washout and remove important vegetation and soils.	• Risk of physical damage.
Landslides	• Increased likelihood of subsidence as a result of post-fire flooding and debris flow, extreme precipitation, and flooding.	• Destruction of wetland habitat can reduce flood control abilities.	• Risk of physical damage.
Wildfires	• Risk of physical damage to habitats. Increased wildfire frequency results in limited recovery time for habitat.	• Destruction of wetland habitat can reduce flood control abilities.	• Risk of physical damage.
Sea-Level Rise	• Increased saturation significantly increases the risk of subsidence.	• Increased stress on flood control habitat. • Oversaturation of habitat can result in washout and remove of important vegetation and soils.	• Risk of physical damage to outdoor water recreation areas.
Notes: County = County of San Diego; N/A = not applicable Source: Ascent Environmental 2020			

2.2.6 EMERGENCY SERVICES

Emergency operation facilities are critical facilities that provide essential products and services to the general public. Emergency operation facilities can include hospitals or other health care facilities, police and fire stations, and communication facilities. An increase in emergency events related to climate change will place more demand on emergency operation facilities, emergency personnel, infrastructure, and equipment in the unincorporated county. Due to climate change, the unincorporated county could experience more frequent hazard events including coastal storms, erosion, floods, wildfires and post-fire debris flow, drought, and extreme weather. As temperatures increase and heat waves occur more frequently, the unincorporated county is likely to see potential public health impacts. Sea-level rise, erosion, floods, landslides, and wildfires may threaten transportation routes, emergency services stations, and evacuation routes, which would hinder prompt emergency response during such events. As climate change worsens existing hazards, the County may need to rely on emergency services more over time.

Additionally, physical damage to emergency services facilities could occur as a result of climate change-related hazards. Based on the GIS analysis, one fire station is located within the late century sea-level rise inundation zone. Fire stations and police stations in the unincorporated county are susceptible to mid-and late century increase in wildfire risk. One fire station and one police station are located in existing flood risk areas where precipitation is expected to increase by late century. Schools often serve as community resources and gathering spaces during emergencies and may be impacted by climate change as well. Based on the GIS analysis, two schools are located within the late century sea-level rise inundation zone, several are susceptible to mid-and late century increase in wildfire risk, and four are located in existing flood risk areas where precipitation is expected to increase by late century. Lastly, notification of emergencies and evacuation instructions rely upon functioning communication facilities such as AM/FM antennas, broadband radio transmitters, and television transmitters. Communications facilities within the unincorporated county may be affected by mid-century increase in wildfire risk and late-century increase in flood risk. Climate impacts on emergency services are presented in Table VA-10.

Table VA-10. Climate Change Impacts on Emergency Services

Climate Change Effects	Assets		
	Emergency Response Personnel	Emergency Facilities	Telecommunications
Human Health Hazards	Increased exposure to infectious diseases and personal injuries.	Increased stress on health care facilities in responding to health impacts from exposure to poor air quality, extreme heat, infectious diseases, and other climate-induced effects.	Increased demand on telecom systems during climate-induced natural disasters and infectious disease outbreaks.
Drought and Water Supply	Increased demand for emergency services and reduced water availability for fire suppression.	Increased demand on facilities for emergency response and preparedness planning.	Increased stress on telecom systems.
Extreme Heat Events	Increased exposure to heat-related health impacts for emergency responders.	Increased demand for cooling centers.	Increased stress on telecom systems.
Extreme Precipitation and Flooding	- Increased exposure to flood conditions for emergency responders. - Potential increases in emergency response times. - Increased challenges in responding to emergencies, providing treatment, or performing search and rescue operations.	- Increased stress on evacuation centers and risk of physical damage to emergency facilities. - Risk of physical damage.	- Risk of physical damage. - Risk of disruption to communication abilities in the unincorporated county and region.
Landslides	Increased exposure to hazard areas for emergency responders.	- Risk of physical damage. - Increased demand on evacuation shelters.	Risk of physical damage.
Wildfires	Increased exposure of emergency response personnel to extreme health risk including smoke inhalation and dangerous fire conditions.	- Risk of physical damage. - Increased demand on evacuation shelters.	Risk of physical damage.
Sea-Level Rise	Increased exposure to flood conditions from emergency response.	Increased stress on evacuation centers and risk of physical damage to emergency facilities.	N/A

Notes: County = County of San Diego; N/A = not applicable; telecom = telecommunication
Source: Ascent Environmental 2020

2.3 Adaptive Capacity

The County and regional partners and agencies have established plans, policies, and programs that address climate change impacts. These efforts, however, do not comprehensively identify strategies that will be taken by local and regional governments to address the full scope and magnitude of potential climate change impacts. Climate change will increase the frequency and severity of climate change-related hazards in the future, requiring updates to emergency response and land use planning, new policies and programs, and strategic partnerships. A summary of the County's existing efforts to adapt to climate change effects is presented below.

2.3.1 EXISTING PLANS AND REPORTS

CALIFORNIA'S FOURTH CLIMATE CHANGE ASSESSMENT SAN DIEGO SUMMARY REPORT

The San Diego Regional Summary Report, prepared in 2018, is one of a series of 12 climate vulnerability assessments in California which provide an overview of climate science, specific strategies to adapt to climate impacts, and key research gaps needed to safeguard the region from climate change. The Summary Report breaks down regional vulnerability by land use, infrastructure and services, communities, and cross-border climate interactions while providing adaptation strategies applicable to the unincorporated county.

The report can be found here: [California's Fourth Climate Change Assessment San Diego Summary Report](#)

CALIFORNIA DEPARTMENT OF TRANSPORTATION CLIMATE CHANGE VULNERABILITY ASSESSMENT 2019 DISTRICT 11 TECHNICAL REPORT

The Caltrans District 11 Technical Report, prepared in 2019, assesses the vulnerability of the State Highway System to the impacts of climate change in District 11. District 11 encompasses San Diego and Imperial County which stretch from the Pacific Ocean to the Arizona border. The technical report was developed to better understand the vulnerabilities of the California State Highway System from greater intensity and frequency weather-related and longer-term climate change events including temperature, precipitation, wildfire, sea-level rise, storm surge, cliff retreat, and both wildfire and flooding. The report identifies the vulnerability of Caltrans assets to these climate change-related natural hazards. In addition, through a partnership with regional agencies, the report explains how State Highway System projects should be prioritized to adapt to climate change. Caltrans' approach to adaptation is to consider risk-based implications of damage and economic loss during the project design phase. This method for inherently considering climate change effects in project design was developed by the Federal Highway Administration and is known as the Adaptation Decision-Making Assessment Process.

The report can be found here: [California Department of Transportation Climate Change Vulnerability Assessment 2019 District 11 Technical Report](#)

SAN DIEGO ASSOCIATION OF GOVERNMENTS SAN DIEGO FORWARD: THE REGIONAL PLAN

Every four years, SANDAG prepares and updates a regional plan that forecasts population and employment growth to inform transportation infrastructure decisions to provide greater mobility, strengthen the economy, promote a healthy environment, and support communities. The current regional plan is the 2015 Regional Plan. The 2015 Regional Plan includes strategies to increase sustainability and address climate change by focusing on housing and job growth in areas near transit, preserving open space and sensitive habitat, investing in transit

options that lead to reductions in GHG emissions, and considering the potential impacts of climate change on transportation projects.

In 2019, SANDAG prepared a 2019 Federal Regional Transportation Plan that complies with federal requirements for the development of regional transportation plans, retains air quality conformity approval from the U.S. Department of Transportation, and preserves funding for the region's transportation investments. A continuing action identified in the 2019 Federal Regional Transportation Plan is to "develop strategies to enhance our region's ability to adapt to the consequences of climate change, including planning and design strategies to help communities to cope with hazardous events such as storms, heatwaves, wildfires, or ongoing drought" (SANDAG 2019)

SANDAG is currently preparing the 2021 Regional Plan, with a focus on solutions to reduce GHG emissions from passenger vehicles and light trucks. Adoption of the 2021 Regional Plan is anticipated in late 2021.

The 2015 Regional Plan can be found here: [SANDAG 2015 Regional Plan](#)

The 2019 Federal Regional Transportation Plan can be found here: [SANDAG 2019 Federal Regional Transportation Plan](#)

SAN DIEGO REGIONAL CLIMATE COLLABORATIVE REGIONAL ADAPTATION NEEDS ASSESSMENT

The Regional Adaptation Needs Assessment, prepared by the SDRCC and SANDAG in June 2020, was developed to identify local climate vulnerabilities and opportunities for the San Diego region and the regional transportation system to address changing climate and coastal hazards (Caltrans 2020). The overall methodology for the assessment consisted of two rounds of interviews. The first round included interviews with local jurisdictions to better understand local priorities, approaches, and needs related to transportation and climate adaptation. The second round included interviews with climate adaptation experts to understand short-term and long-term climate change-related projects in the San Diego region. The assessment concluded that the state has numerous policies and funding sources for climate mitigation efforts; however, jurisdictions believe that the state has unclear guidance on climate adaptation. The assessment also concluded that San Diego would benefit from a coordinated effort between jurisdictions to understand how adaptation planning is being integrated and implemented. The next steps of the process will be to prepare a regional economic guidance document and equity in adaptation and resilience planning document by December 2021.

The report can be found here: [San Diego Regional Climate Collaborative Regional Adaptation Needs Assessment](#)

SAN DIEGO COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

The San Diego County OES updated its MJHMP in 2017. The MJHMP is intended to enhance public awareness and understanding, create a decision tool for management, promote compliance with state and federal program requirements, enhance local policies for hazard mitigation capability, provide inter-jurisdictional coordination of mitigation-related programming, and achieve regulatory compliance. The 2017 MJHMP updated includes an assessment of risk and vulnerability associated with hazards including wildfire/structure fire, flood, coastal storms/erosion/tsunami, earthquake/liquefaction, rain-induced landslide, dam failure, drought, hazardous materials incidents, terrorism, and emerging risks from climate change. While climate change itself was not included as a hazard, the impact of climate change on existing hazards was included in the evaluation of the hazards, and their impacts. Risks discussed in the MJHMP as a result of climate change include extreme heat, coastal storms/erosion, wildfire, flooding, and drought/water supply. In addition to identifying risks, the 2017

MJHMP provides goals, objectives, and potential actions to provide long term hazard reduction or enhancement of capabilities. Objectives related to climate change hazard mitigation include:

- Objective 7.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to coastal storms/erosion.
- Objective 7.B: Protect existing assets with the highest relative vulnerability to the effects of coastal storms/erosion.
- Objective 7.C: Coordinate with and support existing efforts to mitigate severe coastal storms/erosion.
- Objective 8.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to landslide.
- Objective 8.B: Protect existing assets with the highest relative vulnerability to the effects of a landslide.
- Objective 8.C: Coordinate with and support existing efforts to mitigate landslide.
- Objective 9.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to floods.
- Objective 9.B: Protect existing assets with the highest relative vulnerability to the effects of floods within the 100-year floodplain.
- Objective 9.C: Coordinate with and support existing efforts to mitigate floods (e.g., U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and California Department of Water Resources).
- Objective 9.D: Minimize repetitive losses caused by flooding.
- Objective 10.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to structural fire/wildfire.
- Objective 10.B: Protect existing assets with the highest relative vulnerability to the effects of structural fire/wildfire.
- Objective 10.C: Coordinate with and support existing efforts to mitigate structural fire/wildfire.
- Objective 10.D: Address identified data limitations regarding the lack of information about the relative vulnerability of assets from structural fire/wildfire.
- Objective 11.A: Educate the community about drought, its potential impacts, and individual mitigation techniques that they can engage in to help prevent drought or reduce the impact of drought.
- Objective 11.B: Protect vulnerable populations from the effects of extreme heat

The report can be found here: [San Diego County Multi-Jurisdictional Hazard Mitigation Plan](#)

COUNTY OF SAN DAN DIEGO GENERAL PLAN

The County's General Plan was most recently updated in 2011 and provides the long-term vision and policy direction guidance for residents, County staff, decision-makers, and the broader community. The General Plan serves as the foundation for most County regulatory documents and addresses land use, community mobility, conservation, and open space, safety, noise, and housing. Although the General Plan does not contain specific climate change adaptation and resilience goals or policies, the Safety Element and Conservation and Open Space Element include some climate change-related policies. The Safety Element addresses existing hazards and identifies policies the County will implement to reduce the risk to human life and facilities associated with these hazards. The Conservation and Open Space Element includes climate change-related goals that address the topics of sustainable land development, architecture and buildings, mobility, solid waste materials, energy, water supply, and governance and administration.

The plan can be found here: [County of San Dan Diego General Plan](#)

COUNTY OF SAN DIEGO CLIMATE ACTION PLAN

The County's CAP, adopted in February 2018, but subsequently rescinded by the Board of Supervisors due to an Appeal Court order in June 2020, provides a comprehensive roadmap for the County to address the reductions of GHG emissions and the impacts from climate change. Chapter 4, *Climate Change Vulnerability, Resiliency, and Adaptation*, relies on the former APG's nine-step processes for vulnerability assessments and adaptation planning. Adaptation strategies that are presented in the CAP include preparation for the increase in temperature and extreme heat; preparation for changes in precipitation patterns and water supply; preparation for increased wildfire risk; preparation for flood risk; and preparation for sea-level rise. The CAP acknowledges that significant efforts and collaboration between multiple agencies and members of the community will be required to implement these strategies. The CAP is in the process of being updated.

The 2018 plan can be found here: [County of San Diego Climate Action Plan](#)

SAN DIEGO COUNTY OPERATIONAL AREA EMERGENCY OPERATIONS PLAN

The San Diego County Operational Area Emergency Operations Plan is used countywide to respond to major emergencies and disasters. It provides an emergency management system that addresses various disaster types and situations. The plan also addresses the roles and responsibilities of all County departments and their relationship with departments of other jurisdictions in the incorporated county. The plan includes a list of strategies for communication, collaboration between agencies, and resource and supply distribution in the event of an emergency.

The plan can be found here: [Emergency Operations Plan Summary](#)

SAN DIEGO COUNTY WATER AUTHORITY WATER SHORTAGE CONTINGENCY PLAN

In 2017, SDCWA adopted its Water Shortage Contingency Plan to effectively manage water resources when the countywide water supply is under pressure. Though SDCWA has developed a diverse water supply portfolio, supply is still threatened by climate change and drought. The plan provides background on historical drought events and provides lessons learned from those events to maintain a sustainable water supply. The plan contains a series of steps to pursue during a water shortage to minimize impacts to the region's quality of life and economy.

The plan can be found here: [San Diego County Water Authority Water Shortage Contingency Plan](#)

SAN DIEGO COUNTY WATER AUTHORITY 2015 URBAN WATER MANAGEMENT PLAN

Under the Urban Water Management Planning Act (Water Code Sections 10610 through 10656), SDCWA developed the 2015 Urban Water Management Plan to ensure a reliable water supply for the region. The report includes annual water supply reports which include documentation of local and imported water supplies. The overall objective of the plan was to develop a mix of drought-resilience water resources available to the region to avoid periods of water shortages. The plan also discusses the agency's role in reducing GHG emissions and climate change and its research efforts in water systems vulnerability to climate change impacts. Under the Urban Water Management Planning Act, an urban water supplier is required to submit an updated plan every five years. SDCWA is currently in the process of developing its 2020 Urban Water Management Plan.

The plan can be found here: [SDCWA 2015 Urban Water Management Plan](#)

SAN DIEGO COUNTY WATER AUTHORITY REGIONAL WATER SUPPLY PORTFOLIO DIVERSIFICATION

In 1991, the San Diego region was 95 percent reliant on MWD for imported water. MWD made significant cuts to deliveries to San Diego due to ongoing droughts, resulting in water supply issues in the region. To increase resilience and reliability, the SDCWA Board of Directors approved a strategy to diversify the region's water supply portfolio by developing new local and imported water supplies. Because of these efforts, the region reduced its dependence on MWD's supply to 45 percent. SDCWA and its 24 member agencies worked together to enhance local water supplies such as groundwater, recycled water, seawater desalination, and through conservation efforts. These local supplies are now able to meet more than a third of the region's water demand.

Additional long-term water supply planning efforts include a water conservation and transfer agreement with the Imperial Irrigation District, canal lining projects to reduce water lost in earthen canals due to seepage, and infrastructure projects to improve water delivery and storage. Lastly, SDCWA has undertaken conservation efforts to improve water-use efficiency in residential, commercial, and agricultural uses.

A description of these efforts can be found here: [San Diego County Water Authority, Water Supplies](#)

2019 SAN DIEGO INTEGRATED REGIONAL WATER MANAGEMENT PLAN

The 2019 IRWM Plan is an update from the 2013 IRWM Plan and was developed by members of the public, stakeholder workgroup members, the Regional Advisory Committee, and the Regional Water Management Group. The 2019 IRWM Plan reflects the most recent priorities of the region under the direction of the California Department of Water Resources 2016 Guidelines. The 2019 IRWM Plan provides a mechanism for: 1) coordinating, refining, and integrating existing planning efforts within a comprehensive, regional context; 2) identifying specific regional and watershed-based priorities for implementation projects; and 3) providing funding support for the plans, programs, projects, and priorities of existing agencies and stakeholders. The IRWM Plan supports the concept of sustainable water resource planning and provides a series of goals and objectives adopted to address climate change and adaptation strategies. The plan also identifies climate vulnerabilities to the water system within the San Diego region which are to be addressed through implementation of the goals and objectives provided.

The plan can be found here: [2019 San Diego IRWM Plan](#)

2.3.2 SUMMARY OF ADAPTIVE CAPACITY

Table VA-11 evaluates the specific climate change effects covered under each of the plans and reports discussed above. As shown in Table VA-11, multiple planning documents include some policies or programs to address the climate change-related impacts that are expected to impact the unincorporated county. Mitigation and adaptation measures for existing hazards including flooding, storms and extreme weather events, and wildfires are well documented in these plans and reports. Other climate change-related hazards such as impacts on human health, drought and available water supply, extreme heat and heatwaves, landslides, and sea-level rise are mentioned in various regional planning efforts. However, these efforts do not analyze how climate change will worsen existing hazards and are not focused on adaptation or increased resilience. Policies that mention climate change in existing plans are broad-based strategies to reduce risk from climate change. Thus, it is important to develop specific and targeted policies to address the resilience of the most vulnerable populations and assets in the unincorporated county. Subject to consideration and approval by the Board of Supervisors in 2021, the goals and policies developed from this report will be incorporated in the General Plan Safety Element to fill the gaps that have not been addressed in other County or regional planning efforts.

Table VA-11. Adaptive Capacity in Existing Plans and Reports

Plan or Report	Climate Change Hazard						
	Human Health Hazards	Drought and Water Supply	Extreme Heat Events	Extreme Precipitation and Flooding	Landslides	Wildfires	Sea-Level Rise
California's Fourth Climate Change Assessment SD Regional Report	✓	✓	✓	✓		✓	✓
Caltrans Climate Change Vulnerability Assessment			✓	✓		✓	✓
SANDAG Regional Plan		✓	✓	✓	✓	✓	✓
San Diego Regional Climate Collaborative Adaptation Needs Assessment							
County MJHMP		✓	✓	✓	✓	✓	✓
County General Plan	✓			✓	✓	✓	
County Climate Action Plan			✓	✓		✓	✓
San Diego County Operational Area Emergency Operations Plan		✓		✓	✓	✓	
SDCWA Water Shortage Contingency Plan		✓					
SDCWA Urban Water Management Plan		✓		✓			
SDCWA Regional Water Supply Portfolio Diversification		✓					
Integrated Regional Water Management Plan		✓					

Notes: County = County of San Diego; MJHMP = multi-jurisdictional hazard mitigation plan; SDCWA = San Diego County Water Authority

2.4 Vulnerability Scoring

The unincorporated county's vulnerability to each identified climate change impact is assessed based on the magnitude of risk posed to populations and assets, and any existing measures in place to mitigate for these impacts. The APG 2.0 provides a qualitative scoring process that uses inputs from multiple sources and rates potential impacts and adaptive capacity on a scale from Low to High. As recommended by APG 2.0, scoring was based on the project team's judgment in combination with a broad range of inputs such as scientific studies and regional reports, feedback received during public workshops, and stakeholder opinions. A description of each qualitative rating for both factors is provided in Table VA-12.

In order to perform the vulnerability scoring process, the County reviewed the climate exposure analysis, sensitivity of populations and assets, and also performed a comprehensive assessment of existing plans, policies, and programs that are in place to address climate vulnerabilities. In cases where few areas of the unincorporated county were projected to experience a specific climate change effect and where consequences to public health, safety, and other metrics of concern were minor, potential impact scores were rated as "low." Adaptive capacity scores were higher if multiple existing policies and programs were in place to sufficiently address impacts, and lower in cases where programs and policies were not found, or were determined to be insufficient.

Table VA-12. Potential Impact and Adaptive Capacity Scoring

Score	Potential Impact	Adaptive Capacity
Low	Impact is unlikely based on projected exposure; would result in minor consequences to public health, safety, and/or other metrics of concern.	The population or asset lacks capability to manage climate impact; major changes would be required.
Medium	Impact is somewhat likely based on projected exposure; would result in some consequences to public health, safety, and/or other metrics of concern.	The population or asset has some capacity to manage climate impact; some changes would be required.
High	Impact is highly likely based on projected exposure; would result in substantial consequences to public health, safety, and/or other metrics of concern.	The population or asset has high capacity to manage climate impact; minimal to no changes are required.

Source: CalOES 2020

For example, the impacts of climate change on human health are already being felt as poor air quality conditions become more frequent due to wildfires and extreme heat, and incidences of heat-related illnesses rise. Based on the climate change exposure analysis, portions of the unincorporated county will likely see an increase in wildfire risk and major increase in temperatures and frequency of extreme heat events. The impact is highly likely and there are substantial consequences to public health and safety. Thus, this vulnerability receives a potential impact score of “high.” As discussed in more detail in Section 2.4.1, “Impacts to Populations,” the County has several policies and programs in place to address human health impacts, including those that would be worsened by climate change. The County’s Health and Human Services Agency provides resources for the prevention and treatment of infectious diseases, heat-related illnesses, and mental health concerns. The County’s Vector Control Program has also initiated efforts to reduce vector-borne disease. However, climate change will increase the need for these existing programs and services. Greater capacity may be required, and some additional policies and programs may be needed to sufficiently protect human health. Thus, this vulnerability receives an adaptive capacity score of “medium.”

After rating potential impacts and adaptive capacity, an overall vulnerability score is determined for each climate change impact. This scoring can help the County understand which effects pose the greatest threats and should be prioritized in future planning efforts. Table VA-13 presents the rubric used to determine overall vulnerability scores based on the ratings for potential impacts and adaptive capacity.

Table VA-13. Vulnerability Scoring

		Vulnerability Score		
Potential Impacts	High	3	4	5
	Medium	2	3	4
	Low	1	2	3
		High	Medium	Low
		Adaptive Capacity		

Source: CalOES 2020

Vulnerability scoring for each climate change-related impact identified in Table VA-5 to VA-10 is included below and organized by the same overarching categories: populations, transportation, energy, water, biodiversity and habitat, and emergency services. Similar impacts have been combined to reduce redundancy.

2.4.1 IMPACTS TO POPULATIONS

As part of the development of the General Plan EJ Element, the County screened for populations that could be considered EJs. Other vulnerable groups include low-income areas, communities of color, and senior communities. Additionally, individuals experiencing homelessness are also more vulnerable to climate change impacts, and these populations have the potential to grow due to economic conditions and increased frequency of climate change-related hazards.

Major climate change-related impacts to populations in the unincorporated county include hazards to human health including increased air pollutants hazardous to human health, exposure to infectious diseases, and exposure to wildfires, flooding, and extreme heat. Based on projections of climate change impacts, the unincorporated county is expected to experience higher average temperatures, and more frequent droughts, extreme heat events, flooding, and wildfires.

The County and partner agencies have already developed numerous planning efforts to address human health impacts from climate change. The County provides resources for the prevention and treatment of infectious diseases, heat-related illnesses, and mental health concerns through the County's Health and Human Services Agency. The County has initiated efforts to reduce vector-borne disease under the Department of Environmental Health's Vector Control Program. Measures that the County has in place to protect residents from extreme heat include General Plan policies that support cool roofs, cool pavements, and shade tree planting to reduce UHIE. In an emergency, SDCWA ensures a safe and reliable water supply through its Emergency Operations Center and foster enhanced communication between SDCWA and its 24 member agencies. SDCWA's Regional Water Supply Portfolio Diversification program provides a water supply plan in the event of extreme drought periods or a time of low water supply. The County engages in proactive land use planning to prevent flood damage to residences and businesses through the Flood Damage Prevention Ordinance. Residents can stay informed of emergency flood events through the San Diego Flood Warning System. Additionally, the County's Emergency Alert System provides information during any emergency event, including evacuation orders.

The County has also implemented initiatives to reduce wildfire risk such as efforts led by the County's Resilience Review Working Group. Additionally, the General Plan Safety Element contains goals and policies to minimize fire hazards including defensible space and site design requirements, fire resistant construction, and fuel management, and coordination of fire protection services between local agencies. Because wildfires may increase the probability of a landslide occurrence, efforts to increase wildfire resilience in the unincorporated county also mitigate increased landslide risk. Additional efforts to address landslide risk include the County's Guidance for Determining Significance, Geologic Hazards, which provides mitigation strategies on how to prevent or lessen the impacts from a landslide in land use development projects.

Lastly, to address impacts to people during Public Safety Power Shutoffs, SDG&E has established community resource centers that are open during Public Safety Power Shutoffs. Community resource centers provide information, resources, and necessities to customers in the unincorporated county. Table VA-14 provides a summary of the vulnerability scores for the potential climate change impacts on vulnerable populations.

Table VA-14. Vulnerability Scoring of Impacts to Populations

Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Increased human health risk (i.e., poor air quality, infectious diseases, mental health concerns, limited access to potable water, heat-related illnesses)	High	Medium	4
Reduced available water supply from extended drought periods	High	High	3
Increased exposure to flood risk from extreme precipitation and sea-level rise	Medium	High	2
Increased exposure of people to landslides	Medium	High	2
Increased exposure of people to wildfires	High	Medium	4
Lack of electricity during Public Safety Power Shutoffs implemented during times of high wildfire risk	High	Medium	4
Limited ability to prepare for climate events and to respond and evacuate	Medium	High	2

2.4.2 IMPACTS TO TRANSPORTATION

Transportation facilities play an important role in the unincorporated county's economic prosperity and emergency response to climate change-related hazards. These facilities not only provide access throughout the region for the movement of workers and goods, but also provide evacuation routes and access to emergency services during hazard events. Damage to transportation facilities such as highways and railways can have a negative impact on the region's economy. Furthermore, these disruptions could disproportionately affect low-income communities or individuals with disabilities from accessing necessary employment centers, health centers, or other services.

The primary impacts of climate change on transportation facilities are physical damage to roadways, railways, and transit facilities from extreme heat events, flooding, sea-level rise, landslides, and wildfires. Climate change impacts including extreme heat days, heat waves, and heavy precipitation events can reduce the likelihood of individual use of alternative modes of transportation (i.e., public transit, biking, walking) due to various factors including exposure to extreme heat or heavy precipitation and flooding. Further, increases in the spread of infectious disease can significantly reduce transit ridership as individuals seek to reduce exposure to areas in which they are near other people.

The roadway network in the unincorporated county is maintained and operated by various State and regional agencies. These agencies collaborate to effectively prepare and adapt to climate change impacts to the transportation system. SANDAG and Caltrans have developed plans and programs to identify roadway network vulnerabilities as well as guidance for how to prioritize transportation projects. Project prioritization through Caltrans' Adaptation Decision-Making Assessment Process will help the unincorporated county's transportation system increase resilience as climate impacts become more frequent and severe over time. SANDAG's 2015 Regional Plan provides strategies to incorporate climate adaptation in the design of new projects and improvements of existing infrastructure.

The County's General Plan Mobility Element contains goals and policies that address the safe and efficient operation, maintenance, and management of the transportation network. Policy M-1.2 emphasizes the importance of an interconnected road network that provides both primary and secondary access/egress routes

to support emergency services during wildfires. However, the County has limited policies and programs in place to address climate change effects on the transportation network.

Similarly, the MJHMP includes goals, objectives, and actions that are intended to address existing hazards but may also result in increased resilience of transportation infrastructure in the unincorporated county. For example, Objective 9.B and 10.B call for the protection of vulnerable assets, including transportation infrastructure, within 100-year floodplains and high-risk wildfire areas. However, it is important to note that many more assets may become vulnerable as climate change effects expand areas at risk of flooding and wildfire. The vulnerability scores for impacts on transportation facilities and infrastructure in the unincorporated county are provided in Table VA-15.

Table VA-15. Vulnerability Scoring of Impacts to Transportation			
Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Increased risk of damage to roadways from extreme heat events	Medium	Medium	3
Increased risk of damage to roadways from flooding or sea-level rise	Low	Medium	2
Increased risk of damage to roadways from landslides	Medium	Medium	3
Increased risk of damage to roadways from wildfires	Medium	Medium	3
Increased impacts to evacuation routes and emergency access during hazard events	High	High	3
Increased risk of damage to transit facilities	Low	Medium	2
Increased risk of damage to railways	Low	Medium	2
Increased risk of damage to bicycle paths and trails	Medium	Medium	3
Increased stress on transit service and reduced ridership from increased extreme weather events and spread of infectious disease	Medium	Medium	3

2.4.3 IMPACTS TO ENERGY

Energy systems include electricity transmission lines, natural gas lines, and energy generation facilities (e.g., solar photovoltaic systems) that are within or serve the unincorporated county. Climate change impacts to these resources include increased demand on transmission systems and energy production, and risks of physical damage to infrastructure. Climate change impacts will make it increasingly difficult for unincorporated county utility providers to sustain energy generation rates, repair damaged energy transmission infrastructure, and meet the increased demand for energy during extreme heat events which are becoming more and more common.

The County relies on other agencies such as SDG&E for the provisioning of a majority of its electricity and natural gas supply. Energy infrastructure and facilities are also maintained by SDG&E. In the event of an emergency or a climate change-related hazard event, SDG&E and the California Independent System Operator issue preventative measures that may reduce stress on energy systems and reduce energy demand. These measures include conservation notifications such as Flex Alerts and operational notifications such as restricted maintenance operations or Public Safety Power Shutoffs. SDG&E has also invested in the implementation of wildfire safety measures, which are included in their 2020 Wildfire Mitigation Plan. SDG&E has improved its ability to forecast fire danger, built a network of utility-owned weather stations, fire-hardened electrical infrastructure, implemented a vegetation management program, and engaged in community outreach and education efforts (SDG&E 2020).

The County General Plan and CAP include policies that focus on reducing energy consumption by supporting green infrastructure, cool roof and pavement technology, and increased tree planting and landscaping. By reducing energy consumption, especially during extreme heat events, the County decreases stress on the electrical grid. The vulnerability scores for impacts to energy resources are shown in Table VA-16.

Table VA-16. Vulnerability Scoring of Impacts to Energy Resources

Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Increased system stress during droughts and extreme heat events	High	High	3
Increased system stress and physical damage from flooding, sea-level rise, and landslides	Low	Low	3
Risk of physical damage from wildfires	Medium	High	2
Increased demand for electricity generation during extreme heat events	High	Low	5
Reduced effectiveness of hydro-electric electricity generation facilities during drought and extreme precipitation events	Low	Low	3
Reduced effectiveness of solar electricity generation facilities due to increased smoke from wildfires	Low	Low	3

2.4.4 IMPACTS TO WATER

Limited water supply and damage to the flood control system are the main climate vulnerabilities of the unincorporated county's water resources. Extreme precipitation events, flooding, and sea-level rise have the potential to damage existing flood control and water conveyance facilities. Failure of flood control facilities could result in damage to other structures within the unincorporated county and risks to human safety.

Though the majority of the county's water supply is exported from areas outside of the unincorporated county, the unincorporated county's local water supply is managed by SDCWA and member agencies. SDCWA has initiated planning efforts during periods of low water supply by analyzing historic drought conditions in the agency's Water Shortage Contingency Plan. In addition, SDCWA has diversified its local water supply, protected conveyance systems, and established drought-resilience water resource measures as detailed in the SDCWA Regional Water Supply Portfolio Diversification Plan and 2015 Urban Water Management Plan. In addition, the County has also initiated efforts to establish a sustainable water supply through the protection of watersheds as discussed in the 2019 San Diego IRWM Plan.

The Flood Control Section of the County Department of Public Works is responsible for proper maintenance of stormwater drainage facilities, building new flood facilities, and issuing flood warnings in compliance with the Federal Emergency Management Association (FEMA). Under the MJHMP, the Flood Control Section is required to address damage to flood control and water conveyance facilities due to hazard events. The vulnerability scores for impacts on water resources are shown in Table VA-17.

Table VA-17. Vulnerability Scoring of Impacts to Water Resources

Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Increased risk of physical damage to flood control and water conveyance facilities	Medium	High	2
Increased demand for flood control and water conveyance facilities	Medium	High	2
Increase in water demand	Medium	Medium	3
Reduction in available water supply	High	Medium	4
Increased risk of contamination of potable water supply from sea-level rise	Low	Low	3

2.4.5 IMPACTS TO BIODIVERSITY AND HABITAT

The increase in wildfire intensity and frequency could severely damage biological resources in the unincorporated county, resulting in loss of habitat and slope supportive vegetation. Though wildfire allows for natural regrowth of hillsides, the increased frequency of wildfires may limit the ability of forests and grasslands to experience full regrowth. Without adequate time for regrowth, some vegetation may be completely removed from these landscapes. This lack of naturally occurring vegetation can result in the rapid reproduction of invasive species and reduction in hillside stability and increasing the changes of landslides. To mitigate these impacts from climate change, land use planning will need to be more cognizant of these stressors on habitats and species.

As discussed under Section 2.4.1, “Impacts to Populations,” the County has implemented many policies and programs to mitigate wildfire risk. Policy S-4.1 in the County’s Safety Element includes a requirement to balance fuel management needs with the preservation of native vegetation and sensitive habitats. Goals and policies in the County’s General Plan Conservation and Open Space Element include habitat preservation by limiting development near open and conservation areas.

Additionally, the County’s Multiple Species Conservation Program (MSCP) is intended to preserve native habitats and wildlife across political boundaries countywide. The primary objective of the MSCP is to preserve large, connected open space areas for the protection of rare, threatened, or endangered species and habitat in the region. Though the MSCP does not address climate change adaptation, its objective of preserving and enhancing native habitats allows for increased biodiversity and resilience in the face of a climate change disaster. By focusing on connected open space, species may be able to move or migrate in response to changing climate and conditions. The vulnerability scores for impacts on biodiversity and habitat are shown in Table VA-18.

Table VA-18. Vulnerability Scoring of Impacts to Biodiversity and Habitat			
Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Increased risk of damage to hillside habitat and flood control habitat	Medium	Medium	3
Reduced access to and increased risk of damage to recreation areas	Low	Medium	2
Loss of vegetation and habitat	High	Medium	4
Land subsidence from increased saturation	Low	Low	3
Decrease in species health and population	Medium	Medium	3

2.4.6 IMPACTS TO EMERGENCY SERVICES

The primary climate vulnerabilities in the unincorporated county regarding emergency services are the exposure of emergency responders to increased frequency of hazards, the demand for emergency facilities to provide shelter and safety for residents impacted by hazardous events, and reliance on telecommunication services to alert residents and emergency responders.

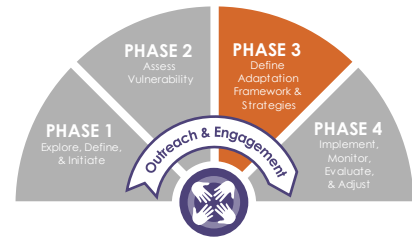
OES is responsible for emergency response in disaster situations. OES provides alerts and notifications to residents through various communication channels in the event of an emergency. OES is also responsible for ensuring resources are available and for implementing emergency response and recovery procedures. OES developed the MJHMP, which identifies goals, objectives, and potential actions to reduce hazard risks and enhance emergency response capabilities. The County has established the Community Emergency Response Team program to train residents to protect themselves, family, and neighborhood in the event of an emergency. OES’s Emergency

Operation Plan lays out the County’s emergency preparation framework and addresses 16 specific topics such as evacuation, communications, and shelter. The Emergency Operation Plan also provides guidance on emergency personnel cooperation and decision-making in times of increased demand for emergency services. Additional resources developed by OES include the Continuity of Operations and Local Assistance Centers. The vulnerability scores for impacts to emergency services are shown in Table VA-19.

Table VA-19. Vulnerability Scoring of Impacts to Emergency Services			
Vulnerability Description	Vulnerability Score		
	Potential Impact	Adaptive Capacity	Vulnerability
Increased exposure of emergency responders to heat-related sickness, smoke inhalation, and infectious disease	High	Medium	4
Increased demand for emergency response services	Medium	Medium	3
Increased demand for emergency facilities (e.g., hospitals, cooling centers, telecommunication systems, and evacuation centers)	High	High	3
Increased risk of damage to emergency facilities (e.g., hospitals, cooling centers, telecommunication systems, and evacuation centers)	Medium	Medium	3

3. Adaptation Framework

This section describes the adaptation framework and presents the goals and policies that the County will undertake to address climate vulnerabilities and increase resilience. The adaptation framework follows the process outlined in Phase 3 of APG 2.0 and relies on the vulnerability assessment conducted above to inform the preparation of the adaptation framework and strategies. Phase 3 is composed of the following primary steps:



Source: CalOES 2020; adapted by Ascent Environmental in 2020.

- **Summarize Vulnerability:** In this step, the highest scoring climate vulnerabilities identified in the vulnerability scoring process are summarized in “problem statements”. Problem statements provide concise, plain-English descriptions of the climate vulnerabilities and their consequences so that all stakeholders can understand the challenge and engage in strategy development.
- **Confirm Vision and Goals:** The purpose of this step is to confirm the community’s vision for adaptation and resilience, and to develop overarching adaptation goals.
- **Prepare Adaptation Strategies:** This step focuses on the preparation of adaptation strategies, in collaboration with stakeholders and the public. Strategies are actions that respond to the problem statements and fulfill the adaptation goals.
- **Prioritize Strategies:** Lastly, this step involves prioritizing adaptation strategies based on factors such as effectiveness, cost, and co-benefits to aid implementation and decision-making. This report considered prioritization during development of the adaptation policies. Higher priority policies were carried forward so that the County could focus its resources on a set of highly effective and feasible adaptation policies. Additionally, this step is further addressed in the General Plan Implementation Plan.

3.1 Vulnerability Summary

As discussed in Section 2.4, “Vulnerability Scoring,” the unincorporated county’s populations and physical assets face numerous climate impacts. In order to develop adaptation goals and policies that use the County’s limited resources effectively and build upon existing strengths, it is important to identify the highest scoring climate vulnerabilities. APG 2.0 does not specify a threshold for prioritizing vulnerability scores. Thus, the County elected to prioritize climate vulnerabilities that received an overall score of four or higher. Seven climate vulnerabilities received a score of either four or five. Although all climate vulnerabilities are addressed to some extent in the goals and policies below, by focusing on the highest scoring climate vulnerabilities, the County can better prioritize where adaptation efforts should be made.

The highest scoring climate vulnerabilities are presented below in the form of problem statements. Problem statements concisely describe the expected change in vulnerability of a population or asset due to climate change.

1. Increased human health risk (i.e., poor air quality, infectious diseases, mental health concerns, limited access to potable water, heat-related illnesses)

All persons in the unincorporated county will experience impacts of climate change, but EJs, low-income persons, communities of color, linguistically isolated persons, senior citizens, persons with disabilities, and persons experiencing homelessness are more susceptible to climate change-related health hazards. Many of these population groups have historically been disadvantaged due to financial burdens, health challenges or disabilities,

inadequate living or working conditions, or historical and current marginalization. They may live in areas where existing pollution burden or climate change-related risks are high, and have fewer resources to prepare for and recover from climate change. As climate change worsens existing hazards over time, it will become increasingly important for the County to protect vulnerable populations and proactively address health risks.

2. Increased exposure of people to wildfires

As shown in Figure VA-3 and described in Section 2.1.2, “Climate Change Effects,” residents of the western and central portions of the unincorporated county are located in very high FHSZs and will likely see an increase in wildfire risk by the end of the 21st century. Population groups that experience disadvantages from financial hardship, disabilities, inadequate living conditions, or live near single road access-only areas of the unincorporated county are more susceptible to harm from wildfire. As development increases in the wildland-urban interface and as climate change exacerbates wildfire risk, more unincorporated county residents are expected to be exposed to wildfire.

3. Lack of electricity during Public Safety Power Shutoffs implemented during times of high wildfire risk.

Due to increased wildfire risk, SDG&E has instituted Public Safety Power Shutoffs when forecasts indicate the potential for extreme weather. Although SDG&E endeavors to provide multiple days’ notice and warning to those who may be affected, these events are still disruptive to many residents, especially in rural areas of the unincorporated county. In addition to the impacts of lack of electricity, health hazards can result if residents are unable to use prescribed medications and treatments that rely on electricity and refrigeration, and food insecurity can worsen due to lack of refrigeration. Climate change is projected to increase wildfire risk in many areas of the unincorporated county and will likely lead to increased Public Safety Power Shutoff events.

4. Increased demand for electricity generation during extreme heat events.

The unincorporated county is projected to see an increase in extreme heat days from a historical annual average of four days to 39 days by mid-century and 69 days by late century under the high emissions scenario. In addition to the public health impacts, during periods of high temperatures, electricity demand increases because of increased air conditioning use to meet preferred indoor temperatures. As the unincorporated county experiences higher temperatures and more frequent extreme heat events due to climate change, the electricity demand will increase, placing greater stress on the electrical grid.

5. Reduction in available water supply.

The unincorporated county’s water supply will fluctuate due to regional changes in precipitation frequency and volume. Climate change will affect the quantity, quality, and reliability of both external sources and local sources of water. By 2040, countywide water demand is projected to increase by 30 percent from 2015 levels (SDCWA 2016). An unreliable water supply and increased demand could result in water shortages, threatening human health and ecological systems.

6. Loss of vegetation and habitat.

Historical periods of droughts and wildfire have resulted in damage to and loss of habitat and species. In the mid- and late-century drought scenarios, the unincorporated county is projected to receive significantly less precipitation. Increased frequency of drought conditions and increased wildfire risk will place added stress on ecosystems, threatening vast areas of biodiverse lands within the unincorporated county.

7. Increased exposure of emergency responders to heat-related sickness, smoke inhalation, and infectious disease.

Emergency personnel are likely to be at the forefront of climate change-related hazards, caring for residents and combating impacts such as flooding and wildfire. Thus, emergency personnel are more likely to be exposed to human health impacts such as heat-related sickness, smoke inhalation, and infectious diseases. As the demand for emergency services increases due to climate change, the exposure of emergency personnel to climate change-related risks will also increase.

3.2 Adaptation Vision and Goals

The County's vision statement for adaptation and resilience is:

In the midst of a changing climate, the County of San Diego will engage with the community and stakeholders to create a vision of adaptation and resilience to ensure a vibrant, healthy community and economy for future generations.

To achieve this vision, adaptation goals were developed that address the problem statements outlined above and focus on the highest priority climate change vulnerabilities in the unincorporated county. Each goal centers on the protection of a specific population or asset area. Goals were developed in alignment with existing County plans, policies, and programs. The six preliminary adaptation and resilience goals are:

- **Goal 1:** Increase community resilience to climate change and protection of vulnerable populations.
- **Goal 2:** Increase the resilience of transportation systems and protection of critical transportation infrastructure from climate change.
- **Goal 3:** Increase the resilience of energy resources and protection of critical energy infrastructure and systems from climate change.
- **Goal 4:** Protect water resources vulnerable to climate change and ensure a safe and reliable supply of water.
- **Goal 5:** Protect biodiversity and habitat vulnerable to climate change.
- **Goal 6:** Ensure that emergency services have adequate capacity to address increased needs due to climate change-related impacts.

3.3 Adaptation Policy Development and Prioritization

Under each of the six goals are specific policies the County will implement to address the challenges of climate change and build resilience. Several types of policies are included in this report so that the County may comprehensively address climate risks and vulnerabilities. Policy types include the following:

- **Programmatic:** Policies to expand or create new programs and initiatives.
- **Plans, regulations, and policy development:** Policies that require the development of new or revision of existing policies, plans, regulations, and guidelines.
- **Capital improvement/infrastructure projects:** Policies to address physical and functional needs in the built and natural environment.
- **Education/outreach/coordination.** Policies related to initiating or expanding partnerships and relationships, communicating and sharing information, and expanding awareness.
- **Evaluation.** Policies to improve feedback, input, and data and information or conduct further or new analyses.

A guiding objective of the policy development process was to build off of existing planning efforts to address priority climate vulnerabilities and respond to community concerns. Thus, the policies focus on gaps in adaptive capacity and areas where existing County policies can be enhanced. The County’s CAP included adaptation measures and actions that addressed changes in temperature and precipitation, and increased risk of flooding, wildfire, and sea-level rise. Relevant CAP strategies have been incorporated into this report. Policies were also included based on recommended strategies from the San Diego Regional Fourth Climate Change Assessment and APG 2.0, Appendix D.

Policy development was also informed by public and stakeholder input. Community members identified climate and safety hazards of greatest concern, which supported the prioritization of policies. Feedback from County department staff was used to confirm the feasibility of policies based on existing capacity, partnerships, and resources.

Lastly, implementation of adaptation policies can provide important benefits to the County beyond adaptation and resilience. These co-benefits have been included to show how implementation of one policy may provide a cascading positive impact in achieving other County goals. The following co-benefits are expected as a result of adaptation policies:

- | | |
|--|---|
| ■ Lowered energy demand | ■ Protection of structures and assets |
| ■ Lowered energy bills | ■ Protection of natural ecosystems and habitats |
| ■ Lowered building and operating costs | ■ Improved public health |
| ■ Reduced fossil fuel reliance | ■ Improved quality of life |
| ■ Improved air quality | ■ Improved food and economic security |
| ■ Improved water supply and quality | ■ Increased public awareness of climate change |
| ■ Reduced GHG emissions | |

3.4 Adaptation Goals and Policies

The adaptation framework consists of goals, policies, responsible party, implementation timeframe, and co-benefits, which are defined as:

- **Goal:** High-level objectives for adapting to climate change and protecting vulnerable populations and assets. Each goal may have several associated policies. The framework includes six goals.
- **Policy:** A program, legislative action, project, outreach campaign, or monitoring method the County will implement to reduce the impacts of climate change and build resilience.
- **Responsible County Department(s):** Various County departments have been identified to carry out the goals and policies of this plan. It is the responsibility of these County departments to establish partnerships with the partner agencies described below. Table VA-20 identifies the acronyms and names of County departments assigned to the adaptation policies.

Table VA-20. County of San Diego Responsible Departments
AWM – Agriculture, Weights and Measures DEH – Department of Environmental Health DGS – Department of General Services DPW – Department of Public Works HHSA – Health and Human Services Agency OES – Office of Emergency Services PDS – Planning & Development Services SDCFPD – San Diego County Fire Protection District DPR – San Diego Parks and Recreation

- **Partner Agencies:** Many goals and policies are best implemented through a collaborative effort involving County, state, and regional agencies. It is essential that the County leverages partnerships with these agencies to support the achievement of the adaptation goals. Table VA-21 identifies the acronyms and names of recommended partner agencies.

Table VA-21. Partner Agencies (Federal, State, Regional)

BIA – Bureau of Indian Affairs
 BLM – Bureau of Land Management
 CAL FIRE – California Department of Forestry and Fire Protection
 CalOES – California Office of Emergency Services
 Caltrans – California Department of Transportation
 CDFW – California Department of Fish and Wildlife
 DWR – California Department of Water Resources
 FEMA – Federal Emergency Management Agency
 Kaiser Permanente
 MTS – Metropolitan Transit System
 NCTD – North County Transit District
 Other unincorporated county-serving medical facilities
 PARKS – California Department of Parks and Recreation
 Public Land Management Non-profits
 Rady Children's Hospital
 Regional wastewater treatment agencies
 Regional water districts
 RTA – Reservation Transportation Authority
 San Diego RWQCB – San Diego Regional Water Quality Control Board
 SANDAG – San Diego Association of Governments
 Scripps Health
 SDCWA – San Diego County Water Authority
 SDG&E – San Diego Gas & Electric
 SWRCB – California State Water Resources Control Board
 Tribes
 UCSD – University of California San Diego
 USACE – United States Army Corps of Engineers
 USBR – United States Bureau of Reclamation
 USFS – United States Forest Service
 USFWS – United States Fish and Wildlife Service

- **Implementation Timeframe:** Identifies the timeframe over which policies would be implemented, categorized as short-term (1-3 years), mid-term (3-5 years), long-term (5 years or more), or ongoing.
- **Co-benefits:** Identifies co-benefits of the policy, which are the additional beneficial outcomes that would occur through implementation of the adaptation policy.

Each of the six preliminary goals and their associated policies are listed below.

GOAL A-1

Resilient Communities. Increase community resilience to climate change and protect vulnerable populations.

Policies

- A-1.1** Develop outreach and education programs on heat-related risks and strategies to prevent heat-related illness for outdoor workers.

- *Responsible County Department(s):* HHSA, AWM, DPR
- *Partner Agencies:* N/A
- *Implementation Timeframe:* Short-term
- *Co-benefits:* Increased public awareness of climate change, improved public health, improved quality of life

- A-1.2** Support and monitor ongoing analysis of heat-related illness.
- *Responsible County Department(s): HHSA*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Ongoing*
 - *Co-benefits: Improved public health, improved quality of life*
- A-1.3** Address housing insecurity and reduce the exposure of persons experiencing homelessness to safety and health impacts from climate disasters.
- *Responsible County Department(s): PDS, HHSA*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Ongoing*
 - *Co-benefits: Improved public health, improved quality of life*
- A-1.4** Increase the completeness and availability of emergency supplies and resources to all segments of the population, focusing especially on vulnerable communities and EJC. Resources include, but are not limited, to temporary shelter or housing, and items such as medical supplies and services.
- *Responsible County Department(s): OES, HHSA*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Improved public health, improved quality of life*
- A-1.5** Establish or expand on existing resilience hubs in areas where vulnerable populations are present. Resilience hubs are community-serving facilities to support residents and coordinate resource distribution and services prior to, during, and after natural hazard events.
- *Responsible County Department(s): PDS, HHSA*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved public health, improved quality of life, increased public awareness of climate change*
- A-1.6** Integrate climate change and health equity into traditional public health programs and core functions.
- *Responsible County Department(s): HHSA*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Improved public health, improved quality of life*
- A-1.7** Collaborate with federal, State, regional, and local partners to develop a community-wide outreach program to educate vulnerable populations, including EJCs, on how to prepare for and recover from climate change effects.
- *Responsible County Department(s): HHSA, OES*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Improved public health, improved quality of life, increased public awareness of climate change*
- A-1.8** Educate community members about the climate risks to historic, cultural, and tribal cultural resources, and the need to safeguard these cultural resources.
- *Responsible County Department(s): HHSA, OES*
 - *Partner Agencies: BIA, Tribes*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Improved public health, improved quality of life, increased public awareness of climate change*

- A-1.9** Minimize new residential development in very-high and high fire hazard severity zones.
- *Responsible County Department(s): PDS, SDCFPD*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved public health, improved quality of life*
- A-1.10** Increase resilience of existing development in high-risk areas built prior to modern fire safety codes or wildfire hazard mitigation guidance through educational campaigns.
- *Responsible County Department(s): SDCFPD*
 - *Partner Agencies: CAL FIRE*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Protection of structures and assets, improved air quality, improved public health, improved quality of life*

GOAL A-2

Resilient Transportation Systems. Increase the resilience of transportation systems and protect critical transportation infrastructure from climate change.

Policies

- A-2.1** Incorporate sea-level rise effects into capital improvement plans.
- *Responsible County Department(s): PDS, DPW*
 - *Partner Agencies: Caltrans, MTS, NCTD, SANDAG*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Protection of structures and assets*
- A-2.2** Update maintenance protocols to incorporate projected climate change effects and evaluate the potential for increased frequency or need to maintain transportation infrastructure.
- *Responsible County Department(s): PDS, DPW, DGS*
 - *Partner Agencies: Caltrans, MTS, NCTD*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Protection of structures and assets*
- A-2.3** Incorporate wildfire risk as a factor in project site review for roadway infrastructure
- *Responsible County Department(s): PDS, DPW, SDCFPD*
 - *Partner Agencies: USFS, CAL FIRE*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Protection of structures and assets*
- A-2.4** Use the best available science and resilient design features in transportation infrastructure to improve resilience to extreme climate events. For example, special roadway sealants can prevent roadways from softening during extreme heat. Other resilient design features include choosing appropriate roadway materials for wildfire prone areas, treating rail lines to be heat-resistant, and incorporating expansion joints into rails that reduce the risk of damage during high temperatures.
- *Responsible County Department(s): DPW*
 - *Partner Agencies: Caltrans, NCTD, MTS, RTA, SANDAG*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Protection of structures and assets*

A-2.5 Coordinate with regional transportation agencies to ensure redundancy of high-use transportation corridors to allow for continued access and movement in the event of an emergency.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: Caltrans, SANDAG*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Improved public health, protection of structures and assets*

A-2.6 Ensure that transit services can continue to operate during and after extreme events by coordinating with regional transit providers to identify alternative routes and stops if primary infrastructure is damaged or closed as a result of extreme events.

- *Responsible County Department(s): PDS*
- *Partner Agencies: Caltrans, NCTD, MTS, RTA*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Protection of structures and assets*

A-2.7 Collaborate with regional transit providers to increase shading and heat-mitigating materials on pedestrian walkways and transit stops.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: Caltrans, NCTD, MTS, RTA, SANDAG*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Improved quality of life, improved public health*

GOAL A-3

Resilient Energy Resources. Increase the resilience of energy resources and protect critical energy infrastructure and systems from climate change.

Policies

A-3.1 Prioritize the implementation of existing policies to increase parking lot shading, greening and landscaping, installation of cool roof and cool pavement technologies in EJC's and areas where high concentrations of vulnerable population reside.

- *Responsible County Department(s): PDS, DEH, DGS*
- *Partner Agencies: N/A*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Lowered energy demand, lowered energy bills, lowered building and operating costs, reduced fossil fuel reliance, improved air quality, reduced GHG emissions, improved public health, improved quality of life*

A-3.2 Establish policies and management plans to develop tree canopies and incentivize the use of best practices for long-term maintenance and preservation of trees to mitigate extreme heat and reduce building energy use.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: USFS*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Lowered energy demand, lowered energy bills, lowered building and operating costs, reduced fossil fuel reliance, improved air quality, reduced GHG emissions, improved public health, improved quality of life*

- A-3.3** Increase the resilience of existing residential and commercial development through structural strengthening, defensible space best practices, distributed energy systems, and energy efficiency upgrades.

- *Responsible County Department(s): PDS, DPW, SDCFPD*
- *Partner Agencies: CAL FIRE*
- *Implementation Timeframe: Long-term*
- *Co-benefits: Lowered energy demand, lowered energy bills, reduced fossil fuel reliance, improved air quality, reduced GHG emissions, protection of structures and assets, improved public health, improved quality of life*

- A-3.4** Work with utility providers in the region to identify high-risk areas (i.e., wildfire and landslide-prone areas) where it would be beneficial to increase the resilience of utility infrastructure through measures such as undergrounding overhead wires, replacing wood poles with steel poles, or relocating utilities.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: SDG&E*
- *Implementation Timeframe: Long-term*
- *Co-benefits: Protection of structures and assets*

- A-3.5** Work with utility providers in the region to harden existing energy infrastructure systems against damage from climate change-related effects and expand redundancy in the energy network through microgrids and decentralized energy systems.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: SDG&E*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Reduced fossil fuel reliance, improved air quality, protection of structures and assets, improved public health, improved quality of life*

- A-3.6** Coordinate with CAL FIRE, local fire agencies, fire safe councils, private landowners, and other responsible agencies to identify the best methods of fuel modification to reduce the severity of future wildfires, such as: prescribed fire, forest thinning, grazing, mechanical clearing, hand clearing, education, and defensible space.

- *Responsible County Department(s): PDS, DPW, SDCFPD*
- *Partner Agencies: USFS, CAL FIRE, PARKS*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Improved air quality, protection of structures and assets, improved public health, improved quality of life*

- A-3.7** Provide information to homeowners about statutory vegetation management requirements under the Defensible Space for Fire Protection Ordinance and promote fuel breaks to slow fire spread in forested and WUI areas.

- *Responsible County Department(s): PDS, DPW, SDCFPD*
- *Partner Agencies: USFS, CAL FIRE*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Protection of structures and assets*

GOAL A-4

Resilient Water Resources. Protect water resources vulnerable to climate change and ensure a safe and reliable supply of water.

Policies

A-4.1 Increase on-site greywater and rainwater reuse, stormwater reuse, and recycled water systems in new and existing public and private developments.

- *Responsible County Department(s): DPW, PDS, DEH, DGS*
- *Partner Agencies: SDCWA*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Lowered energy demand, improved water supply and quality, reduce GHG emissions*

A-4.2 Reduce indoor and outdoor potable water use in new and existing public and private developments.

- *Responsible County Department(s): PDS, DGS*
- *Partner Agencies: N/A*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Lowered energy demand, improved water supply and quality, reduce GHG emissions*

A-4.3 Invest in use of pervious pavements and landscaping in developed areas and restrict the use of paved surfaces.

- *Responsible County Department(s): PDS, DPW, DGS*
- *Partner Agencies: San Diego RWQCB*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Lowered energy demand, improved water supply and quality, reduce GHG emissions*

A-4.4 Evaluate and improve capacity of stormwater infrastructure for high-intensity rainfall events.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: SDCWA*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Improved water supply and quality, protection of structures and assets*

A-4.5 Evaluate vulnerabilities of water supply systems and networks and develop strategies to improve resilience.

- *Responsible County Department(s): DWR, PDS, DPW*
- *Partner Agencies: SDCWA, regional water districts*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Improved water supply and quality, improved public health*

A-4.6 Improve sewage and solid-waste management infrastructure to reduce vulnerabilities to flooding and inundation, especially older infrastructure that is undersized or inadequate.

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: regional wastewater treatment agencies*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Improved air quality, protection of structures and assets, improved public health, improved quality of life*

- A-4.7** Upgrade water and wastewater systems to accommodate projected changes in water quality due to greater variability in precipitation. For example, extreme precipitation and flooding can increase the amount of polluted runoff and sediment into rivers and lakes could and expose shallow wells and intake systems to high water contaminant levels.
- *Responsible County Department(s): PDS, DPW*
 - *Partner Agencies: regional wastewater treatment agencies*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved water supply and quality, improved public health, improved quality of life*
- A-4.8** Safeguard groundwater supply against contamination, degradation, or loss due to flooding or sea-level rise.
- *Responsible County Department(s): DEH DWR, PDS*
 - *Partner Agencies: SDCWA*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Improved water supply and quality, protection of natural ecosystems and habitats, improved public health, improved quality of life*
- A-4.9** Identify new locations for multi-benefit flood control (e.g., underused agricultural areas, small streams, wetlands) that encourage groundwater recharge while providing opportunities for aquaculture, recreation, and habitat restoration.
- *Responsible County Department(s): PDS, DPW*
 - *Partner Agencies: FEMA*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved water supply and quality, protection of structures and assets*
- A-4.10** Create incentives and programs to transfer knowledge and technologies to assist agricultural operations with new production methods and drought tolerant species.
- *Responsible County Department(s): AWM, DPW DEH*
 - *Partner Agencies: SDCWA, regional water districts*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Lowered energy demand, lowered energy bills, increased public awareness of climate change*
- A-4.11** Expand upon existing water conservation education outreach programs for residents and businesses.
- *Responsible County Department(s): DPW*
 - *Partner Agencies: SDCWA, regional water districts*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Lowered energy demand, lowered energy bills, increased public awareness of climate change*
- A-4.12** Collaborate with federal, State, and local agencies and organizations to identify future water supplies, explore alternative supply sources, and improve capacity.
- *Responsible County Department(s): DPW*
 - *Partner Agencies: SDCWA, regional water districts, SWRCB, DWR, USBR, USACE*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved water supply and quality, improved public health, improved quality of life*

GOAL A-5

Resilient Natural Systems. Protect biodiversity and habitat vulnerable to climate change.

Policies

- A-5.1** Engage in research on the effects of a warmer climate on the agricultural industry.
- *Responsible County Department(s): AWM*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Reduced GHG emissions, improved food and economic security, increased public awareness of climate change*
- A-5.2** Understand the tolerance of current crop mixes and livestock to withstand increased temperatures and flooding events so that new strategies can be adopted to maintain agricultural productivity.
- *Responsible County Department(s): AWM*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Reduced GHG emissions, improved food and economic security, increased public awareness of climate change*
- A-5.3** Expand upon and accelerate existing efforts to replant bare or disturbed areas after severe wildfire events or landslides to reduce erosion.
- *Responsible County Department(s): PDS, DEH, DPR, DPW*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Improved air quality, reduced GHG emissions, protection of natural ecosystems and habitats*
- A-5.4** Identify watershed restoration areas, with a focus on areas that are prone to flooding or sea-level rise.
- *Responsible County Department(s): PDS, DPR*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved air quality, reduced GHG emissions, protection of natural ecosystems and habitats*
- A-5.5** Collaborate with local and regional partners to provide robust trail and park maintenance to prevent and respond to damage from climate change effects including fallen trees, flood waters, wildfires, landslides, and severe storms.
- *Responsible County Department(s): DPR, PDS*
 - *Partner Agencies: USFS, BLM, Tribes, PARKS, Public Land Management Non-profits*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Protection of natural ecosystems and habitats, increased public awareness of climate change*
- A-5.6** Coordinate with federal, State, and local agencies to establish ecological recovery programs.
- *Responsible County Department(s): SDCFPD, DEH, DPR*
 - *Partner Agencies: USFS, CAL FIRE, CDFW, USFWS*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved air quality, reduced GHG emissions, protection of natural ecosystems and habitats*

A-5.7 Use nature-based solutions to improve resilience while promoting biodiversity (e.g., green infrastructure projects such as rain gardens or bioswales, habitat corridors, land conservation).

- *Responsible County Department(s): PDS, DPW*
- *Partner Agencies: N/A*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Improved air quality, reduced GHG emissions, protection of natural ecosystems and habitats*

A-5.8 In coordination with federal, state, and regional conservation planning agencies, conserve land identified as newly suitable for habitats and species of concern as a result of species migration due to climate change, as well as corridors between current habitat and future newly suitable lands.

- *Responsible County Department(s): PDS*
- *Partner Agencies: SANDAG*
- *Implementation Timeframe: Long-term*
- *Co-benefits: Improved air quality, reduced GHG emissions, protection of natural ecosystems and habitats*

GOAL A-6

Emergency Services. Ensure that emergency services have adequate capacity to address increased need due to climate change-related impacts.

Policies

A-6.1 Coordinate and improve emergency preparedness systems including emergency evacuation, emergency outreach materials, supplies, and alert systems.

- *Responsible County Department(s): SDCFPD, OES*
- *Partner Agencies: CAL FIRE, CalOES*
- *Implementation Timeframe: Mid-term*
- *Co-benefits: Protection of structures and assets, improved public health*

A-6.2 Ensure that emergency service providers have adequate access to emergency supplies, tools, and equipment such as water main repair parts, generators, pumps, sandbags, road clearing, and communications facilities.

- *Responsible County Department(s): OES, DPW*
- *Partner Agencies: N/A*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Improved public health, improved quality of life*

A-6.3 Build upon existing efforts, especially in EJC's or other underserved areas, to identify community safety locations that may serve as temporary shelter or refuge during hazard events.

- *Responsible County Department(s): OES*
- *Partner Agencies: N/A*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Improved public health*

A-6.4 Integrate findings of climate vulnerability into all phases of emergency planning.

- *Responsible County Department(s): OES*
- *Partner Agencies: N/A*
- *Implementation Timeframe: Short-term*
- *Co-benefits: Increased public awareness of climate change*

- A-6.5** Improve flood warning and information dissemination, with a focus on ensuring those who lack internet access and cell phones, and for whom English is a second language can receive and understand emergency warnings.
- *Responsible County Department(s): OES, DEH*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Protection of structures and assets, improved public health, improved quality of life, increased public awareness of climate change*
- A-6.6** Work with local medical providers and hospitals to ensure that medical facilities are prepared to meet increased demand because of hazardous events.
- *Responsible County Department(s): OES, HHSA*
 - *Partner Agencies: Scripps Health, Kaiser Permanente, UCSD, Rady Children's Hospital, other unincorporated county-serving medical facilities*
 - *Implementation Timeframe: Mid-term*
 - *Co-benefits: Improved public health*
- A-6.7** Ensure emergency workers are educated on exposure to health hazards that may be worsened by climate change including heat-related sickness, smoke inhalation, and infectious disease.
- *Responsible County Department(s): OES, HHSA*
 - *Partner Agencies: N/A*
 - *Implementation Timeframe: Short-term*
 - *Co-benefits: Increased public awareness of climate change, improved public health*
- A-6.8** Consider the installation of microgrids at critical emergency response facilities such as fire stations, community centers, and designated emergency evacuation sites.
- *Responsible County Department(s): OES, DPW, DGS*
 - *Partner Agencies: SDG&E*
 - *Implementation Timeframe: Long-term*
 - *Co-benefits: Improved public health*

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