

San Bernardino County Resilience Strategy

INTRODUCTION

San Bernardino County is actively seeking to reduce greenhouse gas emissions, as described in its *Regional Greenhouse Gas Reduction Plan*¹. Still, the region expects to feel the effects of climate change – particularly in regard to changes in the frequency and intensity of climate hazards, including extreme heat, wildfire, drought, flooding, air quality and human health hazards, severe weather and wind, and landslides. With such impacts in mind, the County conducted a *Vulnerability Assessment* to determine potential exposure and impacts of these climate hazards on the County.

The *Vulnerability Assessment* analyzed projected changes in San Bernardino County’s climate between a baseline time period (1976-2005) and mid-21st century (2036-2065). The County analyzed the degree to which certain communities, assets, and ecosystems could be impacted by the climate hazards mentioned above under the potentially exacerbating influence of climate change. The *Vulnerability Assessment* report then identified the most vulnerable and critical County sectors (e.g., transportation infrastructure and disadvantaged

A Vulnerability Assessment evaluates potential exposure and impacts to critical sectors in the County, including disadvantaged communities and transportation infrastructure, due to climate hazards, such as extreme heat and wildfire. The assessment considers how present-day hazards may increase in the future due to climate change.

Climate resilience refers to the ability of an asset, system, or organization to withstand the effects of climate change.

Climate adaptation strategies reduce the vulnerability of life, property, and natural resources to climate change effects. Adaptation strategies are usually implemented with the goal of increasing climate resilience.

¹ ICF International. 2014. San Bernardino County Regional Greenhouse Gas Reduction Plan. Final. March. (ICF 00543.12.) San Francisco, CA. Prepared for San Bernardino Associated Governments, San Bernardino, California. <http://gosbcta.com/plans-projects/plans-greenhouse.html>

communities) for a focused discussion on key impacts to the region through the lens of climate-related hazards.

This document builds on the findings of the *San Bernardino County Vulnerability Assessment* by presenting possible actions the County and other agencies with jurisdiction in the area could implement to address and ameliorate key vulnerabilities. The possible actions are referred to as “adaptation strategies,” as they aim to reduce vulnerability of life, property and natural resources to climate hazards. As disadvantaged communities were identified in the *Vulnerability Assessment* as one of the key vulnerable sectors, the motivation for these strategies is in part to better address Environmental Justice (EJ) community concerns. In doing so, this *Resilience Strategy* helps the County and its local jurisdictions fulfill requirements of SB 1000, which stipulates that the local general plan includes an environmental justice element and “identify objectives and policies that prioritize improvements and programs that address the needs of disadvantaged communities” upon the adoption or revision of two or more elements after January 1, 2018 (California Legislative Information, 2016). The OPR General Plan Guidelines also reference incorporating SB 1000 into issues such as circulation, housing, public facilities, and air quality, and a future update may provide more guidance on addressing SB 1000 in General Plans. Together, the full suite of adaptation strategies presented in this document represents a critical component of increased resilience across San Bernardino County.

While the focus of this report is on actions the County could take to increase adaptive capacity, these actions can also be coordinated across jurisdictions with the aim of creating an integrated resiliency plan. Ultimately, these adaptation strategies present a roadmap for building climate resilience in the County. Along with the *San Bernardino County Vulnerability Assessment*, this document can serve as a resource for local jurisdictions to address SB 379, which requires that climate change be incorporated into the safety element of Local Hazard Mitigation Plan revisions after January 1, 2017 (or before January 1, 2022 if a plan has not yet been adopted). Incorporation of climate change includes developing a vulnerability assessment, adaptation and resilience goals and policies and, in turn, implementation measures. Combined, this document and the *San Bernardino County Vulnerability Assessment* fulfill these requirements, providing a County-specific analysis for cities to draw on.

The County pulled inspiration for these adaptation strategies from several key sources. First, the County looked back to the first iteration of the *WRCOG Adaptation and Resiliency Study*, published in 2014. Many of the strategies proposed in that document maintained their relevancy and only needed updating, as the original report considered the impacts of heat, wildfire, and flooding, and focused on similar vulnerability areas. However, the *San Bernardino County Vulnerability Assessment* contained four additional hazards (drought, air quality and public health, severe weather and wind, and mudslides/landslides) and modified priority sectors, additional strategies had to be included. Ultimately, the County drew on the following resources to construct adaptation strategies:

- **WRCOG’s CAPTivate:** WRCOG’s 2014 effort produced the *Adaptation and Resiliency Study* mentioned above as well as the *Subregional Climate Action Plan* and the *Subregional Climate Action Plan Implementation Model Book*, both of which describe potential policies and actions the region could implement to mitigate the impacts of climate hazards.
- **Community Outreach:** The County participated in workshops and meetings with local planners and representatives to better understand climate hazards, their impacts on County assets, what actions are currently being taken to mitigate impacts, and what gaps could be addressed in this current effort. These workshops included the Planning and Development Technical Forum and the monthly City engineers’ meeting in April 2019 and the Community Vital Signs Steering Committee Meeting in May 2019, and meetings included small group discussions with community experts (e.g., City of Victorville, City of Ontario, Department of Airports, East Valley Water District, Bear Valley Electric Service, and Lake Arrowhead Community Services District).

Outcomes of these workshops and meetings included the identification of areas of highest concern, current and planned adaptation measures, and barriers to implementing those measures, which are detailed in the accompanying *San Bernardino County Vulnerability Assessment*.

- **Desk research:** The County looked to published literature on adaptation best practices as well as California laws and guidance to ensure that the recommendations in this document are up to date, represent the best available expertise, and are in line with California state practices.

FUTURE CLIMATE HAZARDS

The *San Bernardino County Vulnerability Assessment* evaluated the County's potential exposure and vulnerability to climate hazards, such as extreme heat, wildfires and reduced air quality. While climate change may worsen the severity of these hazards in the future, in reality climate hazards already present risks to the County in the present day. **The vulnerability assessment was not designed to debate climate change, or how to approach greenhouse gas emissions, but rather how to plan for the kinds of climate impacts that San Bernardino County already experiences and contends with.**

Ultimately, actions taken to increase adaptive capacity to climate hazards will increase resilience, economic vitality and community wellbeing in both the present and future.

The *Vulnerability Assessment* found the following projections for climate hazards in the County:

- **San Bernardino County is projected to experience major increases in extreme heat days, particularly in the southeastern and central portions of the County.** Southeastern, Valley and low-lying desert locations in the county – including the area near Big Bear Lake – could experience as many as 50 additional extreme heat days per year by mid-century. Furthermore, all areas of the county are projected to experience *at least* 27 additional extreme heat days (defined as days exceeding the 95th percentile of daily maximum temperatures over the historical baseline time period between 1976 and 2005).
- **Wildfire risk is expected increase steadily and become exacerbated through mid and end of century as a result of warmer temperatures, more frequent drought conditions and increased ignitions within an expanding urban-wildlife interface.** In particular, mountainous and forested terrain in the Valley region – including the communities of Rancho Cucamonga, Lake Arrowhead, and the I-15 corridor – are projected to experience up to 61 hectares burned (per 36 km² model grid cell) annually by mid-century (Westerling, 2018).

In turn, wildfires present a range of potential impacts. In the event of wildfires, evacuation is a major concern for disadvantaged communities. Wildfires could damage or destroy critical transmission/delivery wires, substations, and powerhouses, potentially contributing to power outages. They can also directly burn, damage or destroy transportation infrastructure, cause debris to block and/or damage assets, and can lead to transportation route shutdowns due to safety concerns and/or lack of access. An increase in wildfires can also lead to devastating impacts on biological resources that are not well adapted to quick recovery following wildfire. Some biological resources have a cultural significance in the area, so ensuring their survival would be particularly critical; for example, Joshua trees are threatened by heat, drought, and invasive species, and have little ability to recover from wildfire.

- **Due to climate change, droughts are expected to become more frequent and intense in San Bernardino County and, more broadly, throughout southern California by mid-century.** Areas in San Bernardino County that are likely to be impacted by drought include those projected to experience more intense heat over this century. The Valley region and Victor Valley –

communities that are projected to experience 35 to 45 additional extreme heat days by mid-century – also have communities with high social vulnerability according to Cal-OES’ social vulnerability index.

- **Current FEMA 100- and 500-year floodplains will continue to be vulnerable to floods in the future, and climate change may expand the area vulnerable to flooding because heavy precipitation events are projected to become more frequent and severe.** These current FEMA floodplains include areas near Barstow, Victorville, Twentynine Palms, Rancho Cucamonga, Ontario, and the City of San Bernardino.
- **Climate changes such as increasing air temperature and wildfire frequency may exacerbate air quality issues.** Due to its geography downwind of the Los Angeles metropolitan area and constricted by high mountain ranges, the valley in San Bernardino County already experiences some of the worst air quality problems in the country (American Lung Association, 2019). The County is also in a non-attainment area under the Clean Air Act, which means it does not meet national air quality standards. A 2015 study found that in 2013–2014, about 14% of children were diagnosed with asthma; this number had not improved since 2001 (San Bernardino County 2015) and may be worsened by deteriorating air quality.
- **Extreme storms are projected to become more intense and frequent by mid-century as a result of climate change.** In California, severe weather comes in the form of rain or snowstorms, often 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 during the cold season. In part due to expected increases in the severity of atmospheric river storms, the magnitude of 100-year return period rainfall event² is projected to increase up to 20% by mid-century in San Bernardino County. Increases are projected to be largest (~5 to 20%) within the elevated terrain of the San Gabriel and San Bernardino Mountains and surrounding hill country and smaller (~0 to 5%) elsewhere in the County.
- **Within San Bernardino County there are vulnerable populations and assets in landslide-prone areas that could be differentially impacted by these hazards.** Landslide susceptibility is currently highest in mountainous terrain, such as the San Bernardino, San Gabriel and San Jacinto Mountains, where complex geology and fault zones intersect steep terrain prone to wildfire risk and heavy precipitation events. Mountains and hills within the Mojave Desert also have high landslide risks.

ADDRESSING PRIORITY VULNERABILITY SECTORS

San Bernardino County selected seven priority sectors based on their importance to the growth and success of the County and their potential vulnerability to climate change. These sectors, and key associated climate impacts, are:

1. **Disadvantaged Communities and Social Vulnerability:** Climate change has disproportionately negative impacts on disadvantaged communities, who may be more exposed and sensitive to certain climate hazards and equipped with fewer resources to adapt. In particular, disadvantaged communities are vulnerable to extreme heat, wildfire, air quality and human health impacts, flooding, and drought.
2. **Extreme Weather-Resilient Development:** Of the seven hazards, the four related to extreme weather (wildfire, flood, mudslides, and severe weather) may require the most robust

² A 100-year return period storm has a 1% chance of occurring annually. The magnitude of the 100-year return period rainfall event refers to the amount (i.e., depth) of rainfall associated with these types of storms.

preparation, starting with the development of resilient infrastructure. Impacts from extreme weather tend to be more acute and devastating.

3. **Transportation Infrastructure and Operations:** Transportation assets are often exposed to the elements and, in turn, climate hazards. In particular, heat, wildfire, flooding, mudslides, and winter weather have the potential to greatly impact the transportation system in San Bernardino County.
4. **Electricity Resources and Reliability:** Generally, impacts to electricity resources and resiliency to climate hazards can be considered in two categories: stress on the system and physical damage to the system. Heat and drought stress the system, while wildfires, flooding, mudslides, and wind can cause physical damage. Increased high wildfire risk conditions may also result in an increased frequency of Public Safety Power Shutoff events (PSPS), further reducing electricity reliability in utility served communities.
5. **Water Sources and Reliability:** Climate change is projected to affect San Bernardino County's water resources by altering the amount, timing, and type (i.e. snow versus rain) of precipitation. Due to shifts in precipitation patterns, the County is projected to have less water available during spring and summer, which are also projected to become drier and warmer as a result of climate change. Together, these variables with increase stress on water systems.
6. **Natural Resources (Biological Resources and Agriculture):** Natural resources represent a critical source of food, tourism, and cultural significance to San Bernardino County. Agriculture and biological resources are both vulnerable to region-wide hazards such as extreme heat and drought, and potentially wildfire if located in high-risk areas.
7. **Plan Maintenance:** Climate change may increase the frequency or severity of climate hazards in the future, requiring an update to emergency response processes and land use planning. The County currently considers climate change risks in both its planning and emergency response frameworks. Looking forward, there are opportunities to integrate updated climate change information to better prepare the County for climate hazards and formulate potential adaptation options.

EXISTING RESILIENCE INITIATIVES IN SAN BERNARDINO COUNTY

San Bernardino County has previously taken initial resilience initiatives, particularly in its planning and emergency response documents. Understanding how the County already takes resilience into account can help SBCTA identify gaps and come up with adaptation strategies to target those gaps.

The documents below consider the impacts of climate change on the County:

- In the *San Bernardino County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP)*, approved in 2017, Section 4 includes risk assessments of multiple climate hazards, including wildfire, flood, and drought (County of San Bernardino 2017). Section 4.8 focuses specifically on hazards due to climate change and how projections of these hazards may increase in the future. However, San Bernardino County's MJHMP does not include recommended adaptation options.
- The County's *Emergency Operations Plan (EOP)*, revised in early 2018, also recognizes the increased occurrence of hazards due to climate change (County of San Bernardino 2018a). The Plan's appendices include hazard profiles for wildfires, floods, drought, and climate change, but similar to the MJHMP, the EOP does not recommend adaptation actions to mitigate these risks.
- The *California Department of Public Health* conducted a report analyzing climate change and its impacts on public health in the County in 2017 and recommends strategies with both near-term and long-term actions to increase the resilience of communities (Maizlish et al. 2017).

- San Bernardino County’s upcoming *County Policy Plan* recognizes the increased risk of natural hazards such as flooding and wildfire due to climate change in the Hazards Element section (County of San Bernardino 2018b). The recommended policies in the Hazards Element section include floodplain mapping, avoidance of new construction in high-risk areas, and adding resilient design to existing properties in high-risk areas. This Plan is still a draft and is not expected to be adopted until the second half of 2019; however, because it intends on guiding future decision-making for regional issues and services, the inclusion of climate adaptation can help the County prepare for future climate hazards.

In summary, the County currently does consider climate change risks in both its planning and emergency response frameworks. However, there are opportunities to integrate resiliency considerations to better prepare the County for climate hazards by highlighting and coordinating potential adaptation strategies, as well as more broadly involving community members in the planning and preparing process.

EXISTING RESILIENCE INITIATIVES IN LOCAL GOVERNMENTS

Local governments within the County have also developed climate adaptation, hazard mitigation, planning, and other types of documents that consider climate change hazards and propose measures to address them. The following plans are representative of local initiatives to address climate hazards and promote community resilience:

- The City of San Bernardino’s *Emergency Operations Plan (EOP)* identifies wildfires, flooding, drought, extreme heat, and winter storms as hazards of concern, with flooding considered the highest priority hazard. The EOP also provides risk maps for wildfire and flooding and identifies the number of critical buildings in high-risk zones. The EOP further describes completed and ongoing risk mitigation programs to protect against wildfire and flooding, as well as goals for continued risk mitigation. However, while the EOP describes the process for a general emergency operation, it does not include hazard-specific response plans. Furthermore, the EOP does not consider how climate change might increase the frequency and intensity of these hazards in the future.
- The San Bernardino Valley Municipal Water District *Hazard Mitigation Plan* includes a vulnerability assessment and risk mitigation strategies for flooding, wildfire, landslides, and drought. The vulnerability assessment includes a description of the hazard and risk zones within the District, as well as estimates for affected population, number of affected critical facilities, and economic losses. Within the mitigation strategies, the plan lists objectives and projects in place to reduce the risk. The plan does not mention climate change as a potential driver for exacerbated risks in the future.
- The City of Fontana’s *Local Hazard Mitigation Plan* contains hazard profiles for wildfire, flooding, and landslides that describe the hazard, the regulatory profile surrounding them, past occurrences, probability of future occurrences, and risk zone maps. It also includes a hazard profile for climate change and drought, which includes maps that show current and future extreme heat and describes future projections for a variety of climate hazards. The plan also includes a vulnerability assessment for each of these hazards (including climate change and drought), which intersects vulnerable populations and critical facilities with natural hazards. Although the plan is for the city, it also provides a list of County wildfire and flood mitigation programs, as well as state and federal resources. Its mitigation strategy lists several risk mitigation projects for each hazard, assigning a leading department and potential funding source to each one.

- The City of Fontana’s *General Plan Update 2015-2035*, which lays out the city’s vision for the next 20 years, has a chapter on Sustainability and Resilience; the resilience portion of this focuses especially on climate change planning. This involves a high-level vision, principles, and goals and policies that prioritize resilience in planning that go beyond emergency management. This plan incorporates resilience into planning through the “Sustainable Fontana” program and water conservation programs.
- The City of Victorville’s *General Plan 2030* includes sections on land use, circulation, housing, resources, noise, and safety. In the housing section, one of the environmental constraints listed that can limit housing development is flooding; however, this is addressed mostly from a permitting standpoint, rather than risk mitigation. The section on resources, which includes water supply and quality, biological resources, cultural resources, historic resources, and minerals, but does not consider how climate change may change the availability of these resources in the future. The safety section includes wildfire and emergency response planning but also does not consider how climate change may exacerbate natural hazards.
- The Town of Apple Valley’s *Local Hazard Mitigation Plan 2017 Plan Update* risk assessment contains hazard profiles, vulnerability assessments, and mitigation strategies for flooding, wildfire, and climate change. These items include risk maps and probability of future occurrences for flooding and wildfire, though climate change is not taken into account within the future projections. The climate change section focuses on extreme heat but also cites Cal-Adapt climate projections for other hazards, such as precipitation and wildfire. Vulnerability assessments intersect affected population and critical facilities with each hazard. The mitigation strategies list ongoing mitigation projects for flood, wildfire, and multiple hazards, assigning a leading department and potential funding source to each one.
- The City of Hesperia is one of the few cities in San Bernardino County that has its own *Climate Action Plan*. Moreover, the plan includes not just an emissions inventory and strategies to reduce GHG emissions, but also a section specifically for climate adaptation. The adaptation section references future climate projections for Hesperia and lists policies from the city’s General Plan that would reduce risk from wildfire, water supply loss, and flooding.
- Bear Valley Electric Service developed a *Wildfire Mitigation Plan* as part of CPUC Ruling 18-10-007, the purpose of which is to adopt a risk mitigation plan against wildfires. This includes strategies and programs during the design and construction phase of projects, inspection and maintenance, operational practices, situational and conditional awareness, and response and recovery. The plan mentions briefly that to consider the quickly changing environmental conditions due to climate change, the utility will increase on-ground inspections and install cameras to monitor remote areas.

GAPS IN RESILIENCE INITIATIVES

While the County and local governments have begun to incorporate climate hazard information and climate adaptation options into future planning and emergency response documents, most initiatives lack comprehensive resilience frameworks. For example, most risk mitigation and emergency response plans do not consider how natural hazard risks such as wildfire and flooding may worsen as a result of climate change. Exacerbated risks may require more robust emergency operations and planning to mitigate or recover from these hazards.

Furthermore, many plans do not acknowledge or quantify the portion of disadvantaged communities that may be more exposed climate hazards. Because these populations tend to have higher sensitivity

and less adaptive capacity against climate hazards, they are more vulnerable against risks such as extreme heat, natural disasters, and health hazards.

Climate adaptation is more often addressed in the County as an emergency response issue, which tends to prioritize wildfire and flooding, or looped in with general sustainability and GHG reduction initiatives. In reality, climate hazards also have unique effects on certain critical sectors, such as energy, transportation, and water. Due to the diversity of ways that climate change can affect the County, a multi-hazard, multi-sector approach can help build resilience by focusing on specific tasks assigned to leading departments.

The adaptation strategies below address the most critical vulnerabilities faced by San Bernardino County as determined in the *San Bernardino County Vulnerability Assessment*. Strategies range from infrastructure enhancements to developing new programs to improve operational practices. The strategies are actionable and efficient and can be carried out both by the County and in coordination with local governments.

ADAPTATION STRATEGIES

1. STRATEGIES FOR DISADVANTAGED COMMUNITIES

STRATEGY 1.1: IDENTIFY FUNDING PROGRAMS AND OTHER SUPPORT SERVICES FOR LOCAL AGENCIES TO PURSUE THAT COULD HELP PROVIDE RESOURCES FOR ECONOMICALLY DISADVANTAGED COMMUNITIES TO ADAPT

Resources exist that are designed to help homeowners finance energy efficiency, water conservation, renewable energy, and hurricane protection home improvements. These include rebates from utilities (including Southern California Gas and Southern California Edison) on energy efficient appliances (SoCalGas, 2019; SCE, 2019). However, disadvantaged communities, including elderly individuals, people with limited English skills, or low-income individuals, may not be aware of such programs. Identifying these resources and avenues for applying for them, coupled with outreach efforts in accessible formats, can help disadvantaged communities take advantage of the programs designed for their benefit. Accessible formats include materials presented in multiple languages, displayed in community centers and schools, and disseminated by community leaders, especially within populations that might not be well-represented in local government, might distrust local government, and/or might be particularly in need of these funding programs.

In addition, there exists funding programs and sources that local agencies can apply to help facilitate programs related to community climate resilience. Examples of relevant funding programs include the Caltrans SB1 Adaptation Planning Grants, USDA Community Planning Assistance for Wildfire (CPAW), and FEMA Hazard Mitigation Grant Program (HMGP).

- **Potential Implementing Agencies:** SBCTA, SBCOG

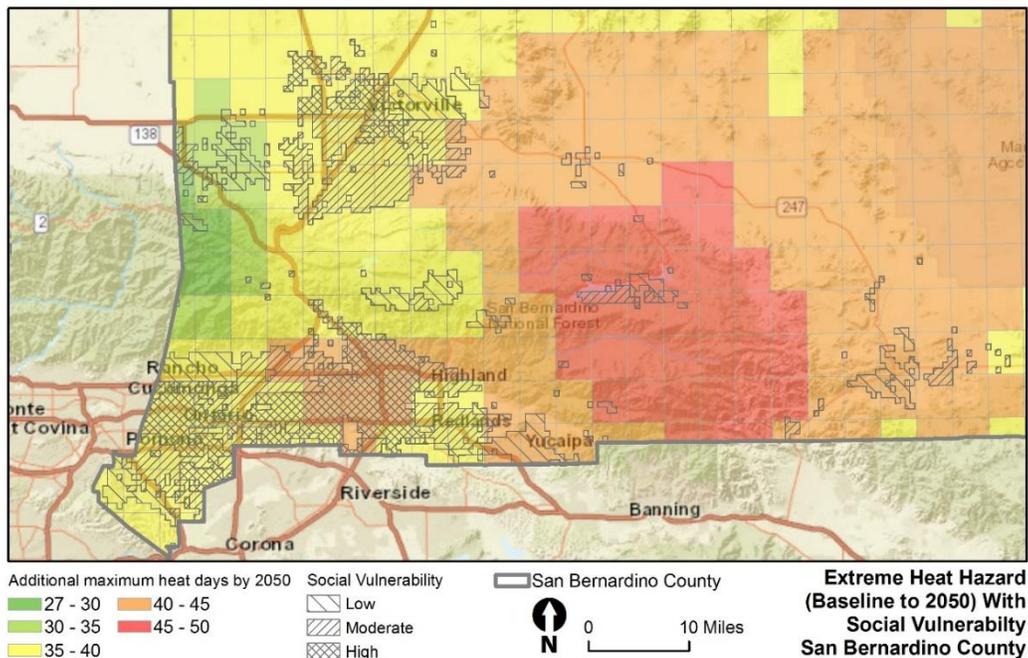
STRATEGY 1.2: ENCOURAGE LOCAL AGENCIES TO IDENTIFY AND MAP COOLING CENTERS AND RESILIENCE HUBS IN LOCATIONS ACCESSIBLE TO VULNERABLE POPULATIONS AND ESTABLISHED STANDARDIZED TEMPERATURE TRIGGERS FOR WHEN THEY WILL BE OPENED

Members of disadvantaged communities are most in need of a cooling center during extreme heat events. Existing facilities can be converted to resilience hubs, providing cooling services as well as shelter from other events such as poor air quality days. However, limited mobility and reduced access to

information can make disadvantaged individuals less aware of available cooling centers and resilience hubs or less able to travel to the nearest one. Communities can address this gap between need and accessibility by locating these facilities as close as possible to where disadvantaged individuals live. Establishing a set temperature for when cooling centers open based on community-defined extreme heat thresholds, and by setting other triggers for resilience hub operations, can help residents know with greater certainty if a center will be open, reducing confusion during times of emergency. Communities may also consider alternative thresholds established for “heat health events,” because vulnerable populations can experience adverse health impacts at a lower temperature threshold. San Bernardino County could help jurisdictions in the area work toward ensuring that a sufficient number of new cooling centers and resilience hubs are located in areas with higher concentrations of disadvantaged individuals, including homeless and low-income community members. Figure 1 shows where areas of projected increases in extreme heat intersect with the most socially vulnerable communities.

- **Potential Implementing Agencies:** SBCTA, SBCOG, San Bernardino County Department of Public Health (SBCDPH)

Figure 1: The intersection of social vulnerability and projected heat exposure in the Southwestern portion of the County. Maximum heat days refer to those with temperatures exceeding the 95th percentile of historical temperatures.



STRATEGY 1.3: IDENTIFY WAYS FOR INDIVIDUALS WITH RESTRICTED MOBILITY TO REACH COOLING CENTERS AND RESILIENCE HUBS

Communities and organizations can develop ways to ensure that individuals with mobility challenges, such as low-income residents, senior citizens, physically disabled individuals, and those without access to lifelines, can reach a cooling center or other resilience hubs. For example, senior citizen housing complexes with their own shuttle services can include these facilities as a destination during extreme heat events. Similarly, in locations with a large concentration of individuals with limited mobility, it may be effective to establish a temporary shuttle service to and from the nearest cooling center or resilience hub for the duration of the extreme event.

- **Potential Implementing Agencies:** SBCTA, SBCOG, Cal OES, transit operators, San Bernardino County Department of Public Health (SBCDPH)

STRATEGY 1.4: ENCOURAGE AND COORDINATE EMERGENCY, RESILIENCE, AND COOLING CENTERS TO ESTABLISH BACKUP POWER AND WATER RESOURCES IN CASE OF POWER OUTAGES AND EMERGENCIES

Extreme heat could result in power outages or brownouts that would disable cooling, resilience, or emergency centers. Backup power resources, such as generators or solar microgrids, can help these centers remain operational for communities during emergencies. Backup power mostly plays a role in continuing to run air conditioning in cooling centers, but it can also help with smaller (but still important) tasks, such as powering refrigerators to storing medicine.³

These facilities could also consider having backup water supplies (e.g. in the form of bottled water) if water services come under stress in the event of a power outage or constrained water supplies. Local governments may also consider installing water stations along bike facilities, transit centers, and other public locations for communities to use.⁴ This would require coordination with water utilities to make sure an adequate water supply is available in an easily accessible form, whether that be water fountains or bottled water.

Backup power could also come from Power Storage Units. Critically, power storage can also be mobile, so that it can serve communities most in need. For example, mobile battery trailers can be paired with corresponding mobile electrical switchgear to support the distribution system. Mobile power storage could also be attained through advances in Transportable Energy Storage Systems (TESS). These systems work to include lithium-ion batteries, a power conversion system unit, and an integrated thermal management system. If demonstrated to be a success, the trailer-mounted system could take the place of mobile diesel systems.

- **Potential Implementing Agencies:** SBCOG, utility companies

STRATEGY 1.5: CONTINUE TO DEVELOP RESOURCES AND MATERIALS THAT EFFECTIVELY COMMUNICATE WITH NON-ENGLISH SPEAKERS IN EMERGENCY AND EVACUATION SITUATIONS

It is vital that all residents have access to pertinent information during emergency situations such as updates on the status of the emergency, calls for evacuation, and the location of available shelters. Making this information available in multiple languages can help reach more people. In addition, emergency managers and response personnel can identify community leaders in non-English speaking communities with whom they can coordinate to help disseminate important information.

In March 2019, the California Governor’s Office of Emergency Services published the Statewide Alert and Warning Guidelines to address the need to “establish statewide guidelines for the purpose of enabling and encouraging consistent application of alert and warning best practices, procedures, and protocols.” The new Statewide Alert and Warning Guidelines require public agencies to include plans to disseminate information to non-English speakers, people with hearing or physical disabilities, and people beyond cellphone range who do not have landlines. These guidelines state:

It is important to locate trusted agents within communities who can help convey the intended meaning of a message and educate the impacted community on the jurisdiction’s alert and warning program. This may include religious leaders, non-profit agency representatives, local elected officials, or prominent business owners within the respective community. Leveraging the

³ Personal Communication: SBCTA Planners Workshop, April 24, 2019

⁴ Personal Communication: SBCTA Planners Workshop, April 24, 2019

relationships that have been established with these leaders will be a force multiplier when the time comes for a warning to be communicated out to the community. (State of California, 2019).

Building relationships with these community leaders and establishing a trusted presence in communities is an important pre-disaster strategy. This can include attending community events or markets, setting up face to face meetings in community areas (e.g., public schools), having multi-lingual staff attend government or utility events, printing materials in multiple languages, and training all staff to be able to interface with communities in a way that understands community needs and delivers digestible and relevant information.⁵

The County may also develop consistent regional messaging systems for certain hazards, such as heat waves and wildfires, so that the public is prepared and can react quickly. These messaging systems can serve not only to alert San Bernardino County residents, but also to ready healthcare facilities, operators of backup power generation, and other relevant emergency response agencies to act.⁶

- **Potential Implementing Agencies:** SBCTA, SBCOG, emergency agencies (Cal-OES, Cal Fire), San Bernardino County Library, Faith Advisory Council, San Bernardino County Superintendent of Schools (SBCSS)

STRATEGY 1.6: IDENTIFY DECISION MAKERS WITH AUTHORITY OVER POTENTIAL ADAPTATION STRATEGIES

It is important that decision makers are aware of the climate risks faced by the disadvantaged populations under their jurisdiction who might have limited capacity to adapt themselves (e.g., homeless, incarcerated persons in jails, students, renters in landlords' properties) and possible adaptive actions they can take to mitigate these risks. The County could develop outreach efforts with relevant public and private decision makers to help ensure the link between climate hazards and social vulnerability is considered in adaptation initiatives. Providing decision makers with the section on *Priority Sector 1: Disadvantaged Communities* within this report can help raise their awareness of this issue.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 1.7: COORDINATE WITH THE SAN BERNARDINO COUNTY HOMELESS PARTNERSHIP AND RELATED PROGRAMS TO ENSURE THAT SHELTERS ARE AVAILABLE DURING HIGHLY HAZARDOUS EVENTS.

Local communities should coordinate with agencies and organizations that provide homeless services to provide shelter during hazardous conditions, such as extreme heat events, poor air quality, and severe weather events. These emergency shelters should provide information about hazardous events and basic supplies such as insect repellent and hygiene supplies that can increase the adaptive capacity of individuals experiencing homelessness. Outreach and support efforts to homeless individuals would be essential to disseminate information on how to stay safe during hazardous conditions and where the nearest emergency shelter is located.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 1.8: IMPROVE SOCIAL CAPACITY IN LOCAL COMMUNITIES

Social support systems are essential to improving resiliency in a community, as these systems help ensure that community members know each other and therefore are more likely to check up on their

⁵ Personal Communication: East Valley Water District, April 18, 2019

⁶ San Bernardino County Community Vital Signs Workshop, May 20, 2019

neighbor during an emergency. San Bernardino County could work with local governments and community-based organizations to provide neighborhood emergency preparedness outreach to ensure that communities are prepared and know who lives around them in case individuals need assistance. This can especially increase resiliency for seniors living alone, persons with chronic illnesses, and persons without access to lifelines. Outreach events could also take place at existing community events, religious centers, and schools.

- **Potential Implementing Agencies:** SBCTA, SBCOG, San Bernardino County Library, Faith Advisory Council, San Bernardino County Superintendent of Schools (SBCSS)

2. STRATEGIES FOR SEVERE WEATHER-RESILIENT DEVELOPMENT

Figure 2: FEMA 100-year and 500-year Flood Zones. Data Source: FEMA Flood Map Service Center.

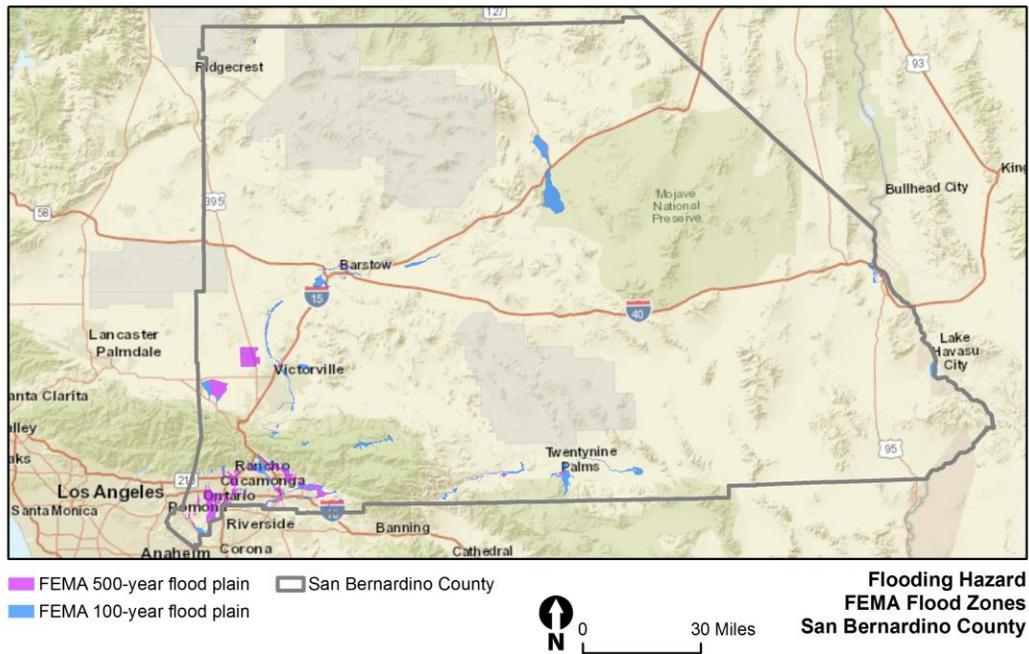
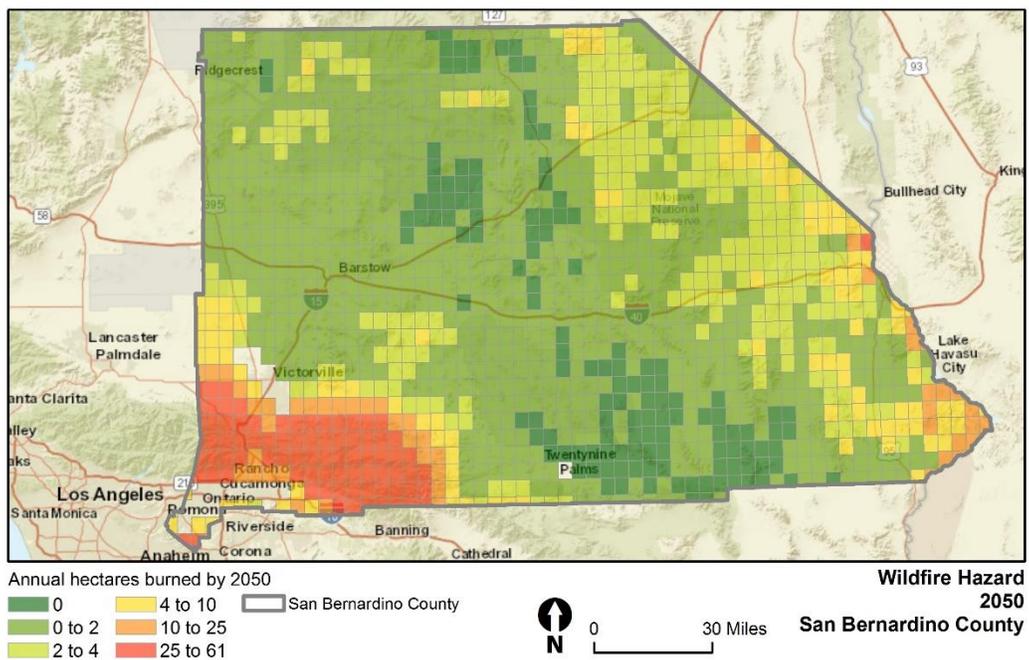


Figure 3: Annual Hectares Burned by Wildfire per 36 km² grid cell in 2050. Data Source: Cal-Adapt (Westerling, 2018).



STRATEGY 2.1: AVOIDING SITING IMPORTANT INFRASTRUCTURE AND CRITICAL COMMUNITY FACILITIES IN OR NEAR HIGH-RISK AREAS

San Bernardino County could coordinate with relevant agencies to avoid placing critical infrastructure in high-risk areas. For flooding, these areas include identified 100-year and 500-year floodplains (e.g.,

Figure 2), while for wildfires this means wildland-urban interfaces, particularly in locations surrounding the San Bernardino and San Gabriel Mountains (e.g., Figure 3). Important infrastructure and facilities include public safety buildings, electricity transmission, wastewater treatment, transit centers, and healthcare facilities. Siting infrastructure in lower-risk areas not only avoids costs from damage, but also costs from implementing adaptation strategies, since there will be a smaller need to protect infrastructure if it is not exposed in the first place.

Siting infrastructure in low-risk locations only works for new infrastructure or relocation projects, however. If a structure is already located in a high-risk zone, or if placing important infrastructure in high-risk zones is unavoidable, then the County will likely need to take next steps to increase the facility's defenses against climate hazards – such as raising or hardening infrastructure.

- **Potential Implementing Agencies:** SBCTA, SBCOG, San Bernardino County Flood Control District, San Bernardino County Transportation Authority

STRATEGY 2.2: ESTABLISH BUILDING AND NEIGHBORHOOD DESIGN STANDARDS THAT MINIMIZE HAZARDS IN HIGH RISK AREAS

If not already in place, local governments can establish design standards that apply retrofits to buildings in current high-risk areas. For fires, this can include fire-resistant building and landscaping materials. For floods, buildings directly in floodplains may need to undergo modification to reduce the potential for water to enter buildings by building flood defense systems or designing permeable pavement or stormwater capture systems to enable flood waters to drain away faster. For mudslides, this includes retrofits such as revegetating hillsides to hold loose soil in place, hardening infrastructure against mudslides, and using sandbags or other barriers to redirect the debris flow away from critical areas.

- **Potential Implementing Agencies:** SBCOG

STRATEGY 2.3: INCREASE RISK MONITORING TO FACILITATE RAPID RESPONSE AND RECOVERY

Because some climate hazards can be predicted, such as heavy precipitation, drought and severe wildfire weather, the County could monitor hazard forecasts and initiate response efforts prior to an event. This is especially important after a wildfire, since the effect of heavy precipitation on burn scars may trigger mudslides. For example, after a fire, agencies could enhance existing mapping and monitoring of burn scars to improve forecasts of mudslide susceptibility.

- **Potential Implementing Agencies:** SBCTA, SBCOG, Regional Academic and Research Institutions

STRATEGY 2.4: ENCOURAGE WATER UTILITIES TO ESTABLISH REDUNDANCY IN ELECTRICITY RELIABILITY

Water utilities, particularly those that supply water for combatting wildfires, can build redundancy into their power system that transports water in the County, to improve the County's ability to stay resilient against wildfires. This redundancy can come in the form of backup generators that will maintain water services in the event of large power outages. Installing backup generators is most critical for water utilities in wildfire-prone areas, both because those utilities' services will be called upon during a wildfire event and because wildfires can damage electricity poles, resulting in power outages that affect water utilities. However, electricity providers may also issue planned power outages, or Public Safety Power Shutoff (PSPS) events (CPUC 2019), on high-wildfire risk days to avoid creating wildfires, which disables the grid across a wide region.⁷ Thus, having a secondary power source is important for all water utilities, not just those located in wildfire risk areas.

⁷ Personal Communication: East Valley Water District, April 18, 2019

- **Potential Implementing Agencies:** SBCOG, Utility Companies

3. STRATEGIES FOR TRANSPORTATION INFRASTRUCTURE AND OPERATIONS

STRATEGY 3.1: INTEGRATE CLIMATE CHANGE ADAPTATION INTO TRANSPORTATION PLANS

The ability of transportation infrastructure to be resilient to the impacts of climate change depends on current condition, existing protections, availability of funds and institutional capacity. Currently, adaptation to climate change is not a formal consideration in County transportation plans. This includes the San Bernardino County Transportation Authority (SBCTA) Long Range Transit Plan (SBCTAa, ongoing), the County-wide Transportation Plan, Regional Transportation Plan, and Short-Range Transportation Plan (SBCTAb, ongoing). Integrating resilience and consideration of impacts such as flooding or extreme heat into transportation planning can help ensure that SBCTA best aligns with the federal FAST Act, protect long-term investments while reducing maintenance costs, increase safety and reliability, and mitigate cascading impacts into other sectors (FHWA 2018).

- **Potential Implementing Agencies:** SBCTA, SBCOG, Caltrans

STRATEGY 3.2: ENSURE REDUNDANCY OF CRITICAL ROUTES TO ALLOW FOR CONTINUED ACCESS AND MOVEMENT IN THE EVENT OF AN EMERGENCY

A key vulnerability to transportation infrastructure is the possibility for shutdowns in the case of a climate-driven emergency. If transportation infrastructure is affected so that key routes are closed, evacuation may not be possible. Critical services such as healthcare and emergency response may not be able to properly carry out their functions, and economic activities may slow or be halted. An example of this occurred in the roads leading to Big Bear Lake, in which a heavy storm flooded two major highways, forcing many vehicles to enter the area using a smaller back route.⁸ Because the smaller route was not used to heavy traffic, this resulted in road degradation and delays. Thus, creating redundancies in the transportation system can mitigate the potentially severe impacts of a shutdown of critical routes.

- **Potential Implementing Agencies:** SBCTA, SBCOG, state and federal transportation asset owners, other transportation asset owners, transit operators

STRATEGY 3.3: USE RESILIENT MATERIALS AND DESIGN APPROACHES FOR TRANSPORTATION INFRASTRUCTURE

Using up-to-date climate datasets to inform climate-related design standards can ensure that long-term transportation asset investments remain resilient to increasing threats presented by climate change, such as inland flooding and increased heat. The best available science, such as data available from Cal-Adapt, can be used to estimate future conditions to inform design standards. Important datasets include future climate projections, such as projections of extreme heat to ensure heat specifications related to pavement materials consider increasing temperatures.

However, ensuring existing infrastructure stands up to higher standards can be a costly and time-consuming process. As such, asset owners could prioritize critical infrastructure, infrastructure that is due for an upgrade or replacement, and/or easily updated assets for such changes. These design

⁸ Personal Communication: SBCTA Planners Workshop, April 24, 2019

changes may include more climate-resilient materials, such as concrete for busy intersections and roads instead of asphalt (which buckles in extreme heat and requires more maintenance), or modern climate-resilient equipment, such as improved traffic lights that are resilient to extreme temperatures.⁹ Further guidance is provided by the District 8 Technical Report, which is part of the Caltrans Climate Change Vulnerability Assessments (WSP 2019).

- **Potential Implementing Agencies:** SBCTA, SBCOG (asset owners), Caltrans

STRATEGY 3.4: UPDATE MAINTENANCE REGIMES TO INCORPORATE CLIMATE VULNERABILITIES

More pervasive or frequent climate hazards, such as storm-based flooding or extreme heat days, can impact day-to-day operations and maintenance. Updating maintenance regimes to better tackle these climate hazards can involve shifting outdoor physical labor hours to earlier in the morning during extreme heat days. Transportation agencies and airports might also increase stormwater drainage infrastructure maintenance to ensure that when storms do occur, there is proper drainage potential to mitigate surface-level flooding.

- **Potential Implementing Agencies:** SBCTA, SBCOG, airports, state and federal transportation asset owners, other transportation asset owners, transit operators

STRATEGY 3.5: USE ENHANCED SHADING AND HEAT-MITIGATING MATERIALS ON PEDESTRIAN WALKWAYS

Providing adequate shade on sidewalks is important for residents who walk or use public transportation to get to their destinations. To increase the comfort of pedestrians on hot days, local jurisdictions can install high albedo pavement, which absorbs less heat than traditional asphalt and helps reduce the urban heat island effect. Heat-reflective pavement can be applied either by replacing existing surfaces or by coating surfaces with a highly reflective coating (WRCOG 2014). Local jurisdictions may also add more trees along walkways to provide shade, particularly in residential and disadvantaged communities. The City of Ontario noted that this could help with both heat and air quality, and it could incentivize outdoor activity; in a survey they conducted, they found that residents would be more likely to walk if the sidewalks were tree lined.¹⁰

- **Potential Implementing Agencies:** SBCTA, SBCOG, regional transportation authorities (Caltrans), transit operators

4. STRATEGIES FOR ELECTRICITY RESOURCES AND RELIABILITY

STRATEGY 4.1: ENCOURAGE INCREASED ENERGY EFFICIENCY IN BUILDINGS THROUGH UPGRADING APPLIANCES AND BUILDING INFRASTRUCTURE RETROFITS

Energy efficiency initiatives that keep buildings cool in extreme heat while using less power can reduce energy demand on the grid. This can reduce stress on energy infrastructure and ensure that buildings are kept cooler for longer if a power outage does occur, since the building needs less energy to maintain its temperature. Local governments could finance energy efficiency initiatives through programs such as the California Energy Partnership Program or Statewide Energy Efficiency Program (ACEEE 2019), while

⁹ Personal Communication: Chino Hills Department of Public Works, April 18, 2019

¹⁰ Personal Communications: City of Ontario, May 15, 2019

building owners could upgrade their appliances and buildings to meet standards such as ENERGY STAR or the U.S. Green Building Council LEED program.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 4.2: COMMUNICATE CLIMATE RISKS TO ENERGY UTILITIES AND REQUEST THEY ENSURE THAT NEW AND UPGRADED INFRASTRUCTURE IS CLIMATE-RESILIENT

During infrastructure installation or upgrades, electrical service providers have the opportunity to protect electricity poles and transmission wires from climate hazards such as wildfire, flooding, and wind. Strengthened poles, such as ductile iron poles, may withstand forces like wind and storms that would otherwise cause them to fall, and covered wires are less exposed to wildfire.¹¹ Although replacing old infrastructure can be expensive, electrical service providers may find that updating infrastructure and enhancing systems that manage power supply in critical or high-risk areas would be worth the investment to avoid major damage during climate events.

- **Potential Implementing Agencies:** SBCTA, SBCOG, Utility Companies

STRATEGY 4.3: INVEST IN SUSTAINABLE BACKUP POWER SOURCES TO PROVIDE REDUNDANCY AND CONTINUED SERVICE FOR CRITICAL FACILITIES IN THE EVENT OF AN OUTAGE

Auxiliary power sources such as backup generators, microgrids, and on-site power generation (e.g., rooftop solar, combined heat and power) can allow critical services and equipment, such as healthcare or emergency cooling centers, to remain online in the event of a power outage. As explained above, natural hazards can damage power infrastructure in such a way to interrupt service, and ensuring that there are backup supplies can minimize the impact of these events. Local governments could identify the critical service providers in their jurisdiction that would need backup generators the most.

The County and local governments can engage with utility companies to recognize all parties have a stake in community-driven resilience. In turn, utilities can take precautionary measures to ensure that critical infrastructure (e.g., hospitals) have sustaining power during public safety power shutoffs (PSPS) initiated during times of severe wildfire risk. Local governments may also partner with utilities to plan for resiliency hubs (e.g., cooling centers, convenience stores, and mobile charging stations) that provide necessary services during prolonged outages, particularly in disadvantaged communities.

- **Potential Implementing Agencies:** SBCTA, SBCOG, critical service providers (e.g., hospitals, senior care centers, fire stations, grocery stores)

STRATEGY 4.4: ENCOURAGE JURISDICTIONS TO IMPROVE COOLING ENERGY EFFICIENCY AND REDUCE THE URBAN HEAT ISLAND EFFECT THROUGH THE USE OF NATURAL INFRASTRUCTURE

Natural infrastructure can improve energy efficiency in buildings by reducing the need for cooling in the face of higher temperatures. By providing shade and cooling the air through evapotranspiration, plants can decrease the amount of heat absorbed by infrastructure. Natural infrastructure strategies can range from strategically planting trees and other plants to provide shade over buildings to installing green roofs or green walls. Natural infrastructure carries many co-benefits as well, including air and water quality improvement, aesthetics, increased opportunities for outdoor recreation, and habitat creation.

- **Potential Implementing Agencies:** SBCTA, SBCOG

¹¹ Personal Communication: Bear Valley Electric Service, March 28, 2019

5. STRATEGIES FOR WATER RESOURCES AND RELIABILITY

STRATEGY 5.1: ENHANCE MAINTENANCE FOR STORMWATER EVENTS AND INFRASTRUCTURE

San Bernardino County could coordinate with relevant water agencies (e.g., East Valley Water District) to guide development and maintenance of improved water systems. These systems would serve to increase the reliability of potable water resources by 1) capturing runoff and 2) filtering suspended sediment in the water supply during heavy rainfall. For example, there is an opportunity to enhance the capture and reuse rainwater runoff during extreme precipitation events. These improved stormwater management systems may also mitigate water quality issues caused by excess runoff.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 5.2: ENCOURAGE WATER UTILITIES AND CONSUMERS TO IMPLEMENT WATER CONSERVATION POLICIES

Many cities, utilities, and other local agencies already carry out policies related to water conservation. This includes expanding their portfolio of water sources (e.g. expanding groundwater pumping and extraction), conservation and efficiency ordinances for residents, increased use of recycled water, and management techniques that reduce water usage, such as drawing less water in the winter when weather is cooler. These strategies could expand to other parts of the County that have not yet implemented them to help adapt to risks caused by drought.

San Bernardino County could coordinate with water utilities to develop mechanisms to decouple water usage rates from revenue, in order to counteract potential revenue losses in support of more aggressive conservation practices. For example, in 2008, the California Public Utilities Commission (CPUC) attempted this decoupling by adopting a Water Revenue Adjustment Mechanisms (WRAM) policy. The WRAM policy allowed excess-use charges to make up for revenue deficiencies that resulted from conservation practices of the majority of customers. Furthermore, customer bills were not as strictly tied to their water usage, so while usage rates declined, customer savings did not change significantly (CPUC 2016).

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 5.3: ENCOURAGE WATER UTILITIES TO ACQUIRE BACKUP GENERATORS FOR USE IN EMERGENCY SITUATIONS

During wildfire events when firefighters need reliable electricity to power water systems, backup generators could potentially serve as a power source if electricity is unavailable through the grid due to Public Safety Power Shutoff events (CPUC 2019).

- **Potential Implementing Agencies:** SBCTA, SBCOG, Utility Companies

6. STRATEGIES FOR NATURAL RESOURCES

STRATEGY 6.1: ENCOURAGE LAND MANAGERS TO INCORPORATE CLIMATE CHANGE PROJECTIONS IN FUTURE CONSERVATION AND LAND USE PLANS, INCLUDING RESEARCH AND MONITORING PLANS

Habitat conservation plans that currently exist in San Bernardino include the Desert Renewable Energy Conservation Plan, the Upper Santa Ana River Habitat Conservation Plan, and plans for specific cities within the County (California Department of Fish & Wildlife 2013, Upper SAR HCP). While these existing

plans may consider some of the impacts caused by climate change, an update may be needed to incorporate future climate change-enhanced risks. Local governments could work with relevant organizations, such as regional conservation authorities, as well as advocacy groups to figure out how to best protect these resources and impacted habitats under climate change in the future. These plans can include detailed research and analyses, as well as implementable actions and monitoring metrics to help keep communities aware of impending climate hazards that can affect natural resources and vulnerable habitats. While these plans mostly apply to biological resources and habitat conservation, incorporating future climate change projections is also important for agricultural resources; thus, considering these in other land use plans can also help the region adapt to climate change.

- **Potential Implementing Agencies:** SBCTA, SBCOG, regional conservation authorities

STRATEGY 6.2: ENCOURAGE FARMERS TO DEVELOP BEST PRACTICES FOR RESPONDING TO CLIMATE CHANGE

San Bernardino County can coordinate with farmers and the agricultural sector to implement a variety of techniques to mitigate impacts from climate hazards that pose a risk to crop and dairy production, or direct damages to farmland and equipment. To protect against wildfire, farmers can implement management techniques that control cattle grazing on their farms in order to reduce fuel load and prevent the rapid spread of wildfires. Similar prevention techniques can be put into place to protect against drought; there is high capacity to increase the use of recycled water for irrigation, since most of San Bernardino County's agricultural production is in nursery stock.

Along with these strategies, San Bernardino County can work with local universities or other research institutions to help identify other techniques that work best for the region. The County can distribute this information to regional farming organizations and offer resources to help carry these actions out.

- **Potential Implementing Agencies:** SBCTA, SBCOG, local universities and research centers

STRATEGY 6.3: PROMOTE FARMERS TO EXPLORE SECONDARY REVENUE STREAMS THAT SUPPORT A STRONG, SUSTAINED AGRICULTURAL SECTOR

In the event that the risk mitigation techniques mentioned above and the existing compensation programs are not enough to support farmers, secondary revenue streams can help economically sustain the agricultural sector. In the face of climate change, farmers may want to supplement their operations with activities such as agro-tourism and retail sales. Farmers can also make other use of their land, such as setting it aside for habitat conservation, carbon sequestration and offsets, and energy generation.

Local communities and governments can help implement this strategy by supporting these activities and altering development codes as necessary so that landowners face fewer barriers in carrying them out. Communities can also support marketing initiatives so that tourism and retail sales can increase if farmers choose to go down those routes.

- **Potential Implementing Agencies:** SBCOG

7. STRATEGIES FOR PLAN MAINTENANCE

STRATEGY 7.1: ADOPT AGENCY-TAILORED ADAPTATION STRATEGIES

San Bernardino County does not currently have a set of specific implementation strategies for climate resilience. Developing an implementation plan can help outline and prioritize actions that the County will take in both the short and long term. The *San Bernardino County Vulnerability Assessment* provides

guidance for developing detailed implementation plans related to resilience that are tailored to agencies and jurisdictions in San Bernardino County.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 7.2: INTEGRATE CLIMATE CHANGE ADAPTATION CONSIDERATIONS INTO PUBLIC SAFETY DOCUMENTS

While the public safety documents mentioned above do incorporate climate change into their risk assessments, there are few mentions of adaptation actions and strategies. The County can include climate change into these documents to prepare the jurisdictional staff and community members for climate-related disasters, especially as they may occur more often and with more severity in the future. Regular updates to the plans may include new climate projections when available, and the County can develop metrics to monitor the implementation of adaptation actions to ensure they are being carried out and working as intended.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 7.3: IMPROVE PUBLIC AWARENESS OF EMERGENCY RESPONSE ACTIONS

Ensuring that the public receives quick alerts of emergencies and knows how to respond can lower the potential number of injuries. San Bernardino County's Office of Emergency Services and Department of Public Health have programs in place to warn residents of natural disasters, such as the Emergency Alert System. The County can increase the effectiveness of these programs by updating them often, running training drills, and making sure that the appropriate resources (such as evacuation maps, phone numbers, and health or shelter facilities) are easily accessible by the public. The County can also conduct outreach and education to ensure that the public understands the available resources and knows how to prepare for emergencies. Emergency response program managers can give special attention to disadvantaged communities by including resources in languages other than English and by working with local community organizations that may interface more often with residents.

- **Potential Implementing Agencies:** SBCOG, San Bernardino County Office of Emergency Services and Department of Public Health

STRATEGY 7.4: ENSURE ROBUSTNESS AND REDUNDANCY IN COMMUNICATION AND EMERGENCY RESPONSE INFRASTRUCTURE

San Bernardino County can help its critical infrastructure related to emergency response, such as cell towers, major roads, and emergency centers, become able to withstand climate stressors and remain operational when needed. The County and local governments can work on strengthening these assets, especially in high-risk hazard areas, as well as provide secondary power (such as backup generators and microgrids) if the systems fail.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 7.5: MONITOR AND REFRESH CLIMATE CHANGE PROJECTIONS

A robust monitoring strategy is at the core of all adaptation approaches. San Bernardino County can use several statewide resources to ensure that climate projections used to assess potential future exposure to climate hazards are up to date. Updated California Climate Change Assessments are released every 3-5 years; the most recent report, the Fourth Assessment, was published in 2018 (California Climate Action Team 2018). The assessment provides technical information and projections for relevant climate

hazards, including both average and extreme heat and precipitation, drought, wildfire and flooding. The reports also summarize potential impacts to several priority sectors in the County, including electricity and agriculture, and summarize climate risks for specific regions in California. San Bernardino County is covered in both the Los Angeles and Inland Deserts regional reports. The Cal-Adapt online tool and data repository provides downscaled climate projections used in the California Climate Change Assessments and allows users to visualize climate scenarios and potential hazards at a local level. Looking forward, the County could take an active role in the development of the Fifth California Climate Change Assessment through community engagement and outreach calls, so that issues important to the County are best reflected at the State level.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 7.6: ASSIGN AN OVERSEEING CLIMATE COMMITTEE

The State of California has a Climate Action Team whose members coordinate statewide efforts on reducing greenhouse gases and implementing adaptation strategies. Several local governments throughout California also have their own climate teams, often coupled with a sustainability or resilience office, such as Los Angeles and San Francisco. The County of San Bernardino can likewise assign a climate committee responsible for coordinating tasks related to adaptation strategies.

This committee may take charge of updating climate-related documents and identifying places in the County's planning and emergency response processes for adaptation to integrate. This committee can coordinate its efforts not just with local governments, but also state and federal agencies. This will integrate land within the County that lies outside of local control as well as harmonize the region's adaptation actions with broader efforts.

In 2018, SB 1072 called for the establishment of a program to build and support regional climate collaboratives that will help under-resourced communities access state funding for climate mitigation and adaptation projects (Georgetown Climate Center 2019). As part of SB 1072 and this resilience strategy, WRCOG is working with the Local Government Commission to establish the Inland Southern California Climate Collaborative (ISC3), a new node of the statewide Alliance of Regional Collaboratives for Climate Adaptation (ARCCA). The Collaborative will help the County coordinate with its neighbors and to ensure that the region's voice is heard in state-level climate adaptation efforts.

- **Potential Implementing Agencies:** SBCTA, SBCOG

STRATEGY 7.7: ASSESS THE EFFECTIVENESS OF AND IMPLEMENT ADAPTATION STRATEGIES

San Bernardino County's unique geography, infrastructure, and politics may make some climate adaptation strategies work better for it than others. The County can assess the effectiveness of the suite of adaptation strategies provided to them and determine which strategies work best for their specific situation. This approach is especially important for local governments that may have to consider even more unique nuances when making decisions about planning or emergency response.

After prioritizing the best actions to take, the County and local governments can begin to implement the adaptation strategies listed here and elsewhere. The strategies vary greatly in scale by magnitude and time; a monitoring timeline can help organize tasks and align related strategies. The new Collaborative for inland southern California, which is currently in development, could help lead the implementation of these strategies.

- **Potential Implementing Agencies:** SBCTA, SBCOG

WORK PLAN

This section organizes the adaptation strategies into a work plan for San Bernardino County and a work plan for local governments.

COMMUNITY SUMMARY

Most of San Bernardino County’s population resides in the densely populated southwestern corner, including cities such as San Bernardino City, Fontana, Rancho Cucamonga, Ontario, Rialto, and Victorville. As such, strategies that work to mitigate climate hazards with an outsized impact on disadvantaged populations – extreme heat, flooding, air pollution, severe weather, and mud and landslides – are important considerations for this area.

The largest cities in San Bernardino – those in the Valley region – are projected to experience roughly 30-45 more maximum heat days by 2050. However, as the whole county is projected to experience more extreme heat days throughout the century, and as construction is a major source of employment in the county, all jurisdictions should be mindful of extreme heat.

The eastern portion of the County is largely undeveloped land and includes important habitat areas such as Joshua Tree National Park in Twentynine Palms. The primary climate concerns for biological resources in this area include wildfires and drought.

Energy infrastructure and transportation infrastructure are subject to impacts from heat, drought, wildfires, flooding, mudslides, and severe weather. All jurisdictions in the County rely on energy and transportation services, and so strategies aimed at mitigating the impacts of these hazards are important for all localities. For communities in the more densely populated southwestern corner of the County, a factor influencing vulnerability is the high number of energy consumers and transportation users. In the more rural eastern portion of the County, a factor influencing vulnerability is the more isolated nature of communities and the subsequent difficulties in accessing systems and performing repairs.

ADAPTATION STRATEGY SUMMARY TABLES

Implementation of the following strategies promotes regional resilience in San Bernardino County.

Strategy #	San Bernardino Strategy	Priority Sector
1.1	Identify funding programs and other support services For Local Agencies to Pursue that help provide resources for economically disadvantaged communities to adapt.	Disadvantaged Communities
1.2	Encourage local agencies to identify and map cooling centers in locations accessible to vulnerable populations and established standardized temperature triggers for when they will be opened.	Disadvantaged Communities
1.3	Identify ways for individuals with restricted mobility to reach cooling centers.	Disadvantaged Communities
1.4	Encourage and coordinate emergency and cooling centers to establish backup power and water resources in case of power outages and emergencies.	Disadvantaged Communities

Strategy #	San Bernardino Strategy	Priority Sector
1.5	Continue to develop resources and materials that effectively communicate with non-English speakers in emergency and evacuation situations.	Disadvantaged Communities
1.6	Identify decision makers with authority over potential adaptation strategies and responses.	Disadvantaged Communities
2.1	Avoiding siting important infrastructure in or near high-risk areas.	Extreme Weather-Resilient Development
2.2	Establish building and neighborhood design standards that minimize hazards in high risk areas.	Extreme Weather-Resilient Development
2.3	Increase risk monitoring pre-event and rapid response and recovery post-event.	Extreme Weather-Resilient Development
2.4	Encourage water utilities to Establish redundancy in electricity reliability.	Extreme Weather-Resilient Development
3.1	Integrate climate change adaptation into transportation plans.	Transportation Infrastructure and Operations
3.2	Ensure redundancy of critical routes to allow for continued access and movement in the event of an emergency.	Transportation Infrastructure and Operations
3.3	Update the data that informs design standards to help with long-term protection of these assets.	Transportation Infrastructure and Operations
3.4	Update maintenance regimes to incorporate climate vulnerabilities.	Transportation Infrastructure and Operations
3.5	Use enhanced shading and heat-mitigating materials on pedestrian walkways	Transportation Infrastructure and Operations
4.1	Encourage increased energy efficiency in buildings through upgrading appliances and building infrastructure.	Electricity Resources and Reliability
4.2	Communicate climate risks to energy utilities and request they ensure that new and upgraded infrastructure is climate-resilient.	Electricity Resources and Reliability
4.3	Invest in sustainable backup power sources to provide redundancy and continued service for critical facilities in the event of an outage.	Electricity Resources and Reliability
4.4	Encourage energy utilities to Improve cooling energy efficiency and reduce the urban heat island effect through the use of natural infrastructure.	Electricity Resources and Reliability

Strategy #	San Bernardino Strategy	Priority Sector
5.1	Enhance maintenance for stormwater events and infrastructure.	Water Resources and Reliability
5.2	Encourage water utilities and consumers to implement water conservation policies.	Water Resources and Reliability
5.3	Encourage water utilities to acquire backup generators for use in emergency situations.	Water Resources and Reliability
6.1	Encourage land managers to incorporate climate change projections in future conservation and land use plans, including research and monitoring plans.	Natural Resources
6.2	Encourage farmers to develop best practices for responding to climate change.	Natural Resources
6.3	Promote farmers to explore secondary revenue streams that support a strong, sustained agricultural sector	Natural Resources
7.1	Adopt agency-tailored resilience strategies.	Plan Maintenance
7.2	Integrate climate change adaptation considerations into public safety documents.	Plan Maintenance
7.3	Improve public awareness of emergency response actions.	Plan Maintenance
7.4	Ensure robustness and redundancy in communication and emergency response infrastructure.	Plan Maintenance
7.5	Monitor and refresh climate change projections.	Plan Maintenance
7.6	Assign an overseeing climate committee.	Plan Maintenance
7.7	Assess the effectiveness of and implement adaptation strategies.	Plan Maintenance

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