

# Appendix R:

# Resilience and

# Stormwater

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# Resilience and Stormwater

This appendix describes how the 2025 Regional Plan will enhance the resilience and reliability of the transportation system. It also discusses how SANDAG and partner agencies will reduce and mitigate the impact that surface transportation in the 2025 Regional Plan has on stormwater runoff. Pursuant to 23 CFR 450.306(b)(9), this must be addressed in the metropolitan transportation planning process.

## Resilience to Natural Hazards

### Introduction

The San Diego region is geographically unique and as such, experiences diverse climate impacts. Stressors such as wildfires, floods, severe storms, and heat waves are already impacting the region and its transportation system.

#### Defining Resilience

The California Governor's Office of Land Use and Climate Innovation defines resilience as the capacity "to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience."<sup>1</sup> Responding to natural hazards is a key component of resilience.

The 2025 Regional Plan addresses a number of elements that promote a resilient future, including planning for a healthy environment, transportation, housing, public facilities, and economic prosperity for the San Diego region. SANDAG is coordinating with other entities in the region to prepare our communities for the impacts of natural hazards to improve the resilience and reliability of the transportation system.

### Regional Coordination

SANDAG believes in creating a safe future for everyone in the San Diego region. Although we enjoy one of the most temperate climates in the world, that doesn't mean we are immune from the effects of natural hazards, including frequent heat waves, prolonged droughts, destructive wildfires, degraded air quality, extreme precipitation and flooding, and destructive storm surges. Our region must adjust how we respond to natural hazards today and become more resilient for the future.

As a federally recognized Metropolitan Planning Organization, Regional Transportation Planning Agency, and a Council of Governments, SANDAG is uniquely positioned to bring all 18 cities and the County of San Diego, together along with our highway and transit service providers and other key partners, to coordinate, collaborate, and promote solutions for a more resilient future.

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<sup>1</sup> "Getting Started with Climate and Resilience," California Governor's Office of Land Use and Climate Innovation, accessed August 15, 2024, [opr.ca.gov/climate/](https://opr.ca.gov/climate/).

SANDAG works with partners to advance regional resilience projects, offers resources to member agencies, and analyzes vulnerabilities of the transportation system, including which areas are prone to flooding and how to keep critical infrastructure available during an emergency.

Ensuring the resilience of the transportation network to the impacts of natural hazards is an important element of the 2025 Regional Plan. To achieve this, SANDAG recognizes the importance of a collaborative, transparent, and regional approach to resilience planning because the hazards that threaten the San Diego region go beyond jurisdictional boundaries. Over the past several decades, SANDAG has worked with local governments to help strengthen our communities, natural resources, and transportation system against the impacts of natural hazards. This includes providing tools and resources to aid local governments in climate adaptation planning.

### **Shoreline Resilience**

The San Diego region's beaches and shoreline provide recreational opportunities and are a vital component of the economy while also providing protection from coastal flooding. SANDAG promotes coastal resilience through its [Shoreline Preservation Strategy](#) which focuses on strategies to adapt to environmental hazards such as storm surge through shoreline management. For almost 30 years, SANDAG has monitored the status of the coastal sand sources to identify areas of significant erosion. This monitoring has led to the strategic decision to undergo two regional beach nourishment projects that have placed over 3.6 million cubic yards of sand in critical erosion hotspots. Funded in partnership with federal, state and local governments, this solution provides a natural way to protect critical infrastructure and housing, while promoting recreation and natural resource protection. A third regional beach nourishment project is in the planning phase.

### **Military Installation Resilience**

SANDAG and Navy Region Southwest worked together with regional partners to address impacts that could affect the resiliency of local naval installations and harm efforts to remain mission-ready. With support from grants awarded by the Department of Defense Office of Local Defense Community Cooperation, SANDAG identified major transportation corridors at the highest risk of impacts and of high strategic importance for Navy mission readiness. The [Military Installation Resilience](#) plan allows for the military within the San Diego region to promote solutions to overcome environmental hazards.

### **Regional Resilience Framework**

Adaptation involves taking actions that manage risks and reduce impacts, which over time contribute to a more resilient community. In the San Diego region, adaptation planning focuses on how to best adapt to the coastal storm surge, increased flooding, landslides, extreme temperatures, and wildfires. Adaptation planning builds capacity to better prepare our communities for these impacts and work towards a resilient region. SANDAG has prepared a [Regional Resilience Framework](#) that aims to simplify, unify, and streamline the adaptation planning process for the San Diego region. The Framework provides step-by-step guidance to adaptation planning, resilience tools for practitioners, and relevant resources for local jurisdictions.

## Regional Energy Strategy

Energy impacts nearly every facet of daily life—lighting, cooling and heating, business and industrial operations, transportation, and more—and is therefore fundamental to the regional economy and the quality of life of San Diego residents. SANDAG has prepared the [Regional Energy Strategy \(RES\)](#) that serves as the resilient energy policy blueprint for the San Diego region to support decision-making as the region strives to meet the energy needs of the growing population. SANDAG and local governments identified actions needed to promote a more resilient energy future.

## Multimodal Corridor Planning

In partnership with Caltrans, SANDAG is preparing 10 [Comprehensive Multimodal Corridor Plans](#) (CMCPs). The CMCPs are data-driven plans to reduce congestion, generate transportation choices while preserving community character, and create opportunities for enhancement projects. Corridor enhancement and improvement projects will consider resilience and integrate strategies that reduce disruptions from natural hazards and contribute to the longevity of multimodal corridor improvement. To date, SANDAG has completed six CMCPs, covering these corridors: Downtown, SRs 52, 67, 78 and I-8 and I-805/I-5 south. The remaining five (SRs 56, 94, 125 and I-15) will be completed in future years.

SANDAG also incorporates resilience solutions into its rail projects, like the LOSSAN Rail Realignment Project that aims to improve safety, reliability and operational flexibility of the rail corridor by double tracking the segment, minimizing risks from coastal flooding and bluff erosion and providing for greater track capacity and enabling increases in service.

## Promoting Resilient Land Use Planning

SANDAG also provides grant funding to local jurisdictions for smart growth development projects through the [Smart Growth Incentive Program](#) (SGIP). SGIP guidelines include several site-design policies that encourage strategies to address natural hazards. SGIP helps SANDAG towards its overarching goals to increase funding opportunities, and to prioritize and expedite projects to implement strategies to address existing transportation infrastructure vulnerable to natural hazards.

In addition to regional efforts, SANDAG is working on bi-national solutions. SANDAG works with other California and Mexico agencies to regularly update the [California-Baja California Border Master Plan](#) (BMP), which looks to prioritize and advance transportation infrastructure to and from the land ports of entry. SANDAG, through a Caltrans Sustainable Adaptation Planning Grant is also developing the [California-Baja California Border Resilient Planning](#) (BRP) that builds off of the BMP to coordinate and plan adaptation strategies to protect transportation infrastructure and the communities within the border region that are impacted by natural hazards.

## Fire

Much of the San Diego region is considered at high risk to fire.<sup>2</sup> To help communities be prepared to respond to this risk, it is important to account for evacuation needs in the transportation system. To that end, the County of San Diego's Operational Area Emergency Operations Plan coordinates the use of available resources with transportation agencies to ensure people have adequate means of transportation to assist with a timely evacuation and the County has developed agreements with regional transportation services providers, including bus, rail and paratransit operators.<sup>3</sup> In addition, the State's response to major destructive fires prompted legislative action in 2024, including mandated mapping across California of fire hazard severity zones that will help communities develop strategies to reduce wildfire risk.<sup>4</sup>

Additionally, the County of San Diego 2023 Consolidated Fire Code (Fire Code) includes requirements regarding access roads and ingress/egress specifications to ensure that access to roads and highways is maintained for evacuations and emergency responders.<sup>5</sup> Maintaining access to roads and highways further ensures that the regional economy remains vibrant with minimal impacts to goods movement. The Fire Code also includes requirements for a wide variety of wildfire-related components such as smoke detection and spark arresters, sprinkler systems and water supply, photovoltaic arrays and defensible space, construction methods and materials for wildfire exposure, as well as other policy areas that ensure people are safe and able to respond to and recover from events such as wildfire and extreme heat events. While not all jurisdictions within San Diego County adopt the Consolidated Fire Code, they are required to adhere to the California Fire Code and the California Building Code<sup>6</sup>. In addition, beginning January 1, 2026, the California Wildland-Urban Interface Code (CWUIC)<sup>7</sup> will go into effect statewide. This code includes provisions for fire safety, construction methods, defensible space, and vegetation management to mitigate the risks associated with wildfires, which are part of the regulatory framework guiding fire-safe planning and infrastructure design moving forward.

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<sup>2</sup> Planning for Extreme Heat in San Diego County: Technical Assistance Panel Report," Urban Land Institute San Diego/Tijuanna, last modified September 30, 2024, [ulidigitalmarketing.blob.core.windows.net/ulidcnc/sites/30/2023/09/SDTJ-TAP-County-Heat.pdf](https://ulidigitalmarketing.blob.core.windows.net/ulidcnc/sites/30/2023/09/SDTJ-TAP-County-Heat.pdf).

<sup>3</sup> "Annex Q Evacuation: Operational Area Emergency Plan," Unified San Diego County Emergency Services Organization and County of San Diego, effective August 30, 2022, [sandiegocounty.gov/content/dam/sdc/oes/emergency\\_management/plans/op-area-plan/2022/EOP2022\\_Annex%20Q.pdf](https://sandiegocounty.gov/content/dam/sdc/oes/emergency_management/plans/op-area-plan/2022/EOP2022_Annex%20Q.pdf).

<sup>4</sup> "Fire Hazard Severity Zones - California - Code of Regulations Title 24 - 2022 California Building Code, Title 24, Part 2 (Volumes 1 & 2)"

<sup>5</sup> "County of San Diego 2023 Consolidated Fire Code," County of San Diego, effective April 13, 2023, [sandiegocounty.gov/pds/docs/cosd-fire-code.pdf](https://sandiegocounty.gov/pds/docs/cosd-fire-code.pdf).

<sup>6</sup> California Building Code, State of California 2022 [California Code of Regulations Title 24 - 2022 California Building Code, Title 24, Part 2 \(Volumes 1 & 2\)](#)

<sup>7</sup> California Wildland-Urban Interface Code, State of California [2025 California Wildland-Urban Interface Code, Title 24, Part 7](#)

The 2025 Regional Plan addresses a number of elements that promote resilience to the risk of wildfire. Road widening projects, such as the Otay Truck Route Widening Project, and SR 67 Improvements Project would add lanes to roadways or widen shoulders for emergency vehicles including fire department access. Integrating infrastructure and services into a smart corridor system that manages multiple modes of transportation will make it possible for traffic to be managed in real time; for first responders to quickly respond to incidents; and for police, fire, and other authorities to effectively coordinate emergency evacuations.

## Heat

High temperatures impact roadway infrastructure and the people who depend on it. For example, high temperatures can increase the susceptibility of roadways to rutting and of rails to buckling and transit users spending time outdoors can be at increased risk of heat-related illness. The County of San Diego's Vulnerability Assessment and Adaptation Report (June 2021) reviews and scores the heat-related vulnerabilities impacting communities during times of extreme heat events and offers adaptation strategies to build resilience.

Incorporating built shade or nature-based solutions to mitigate heat such as increased tree canopy in heat vulnerable areas can help increase safety on extreme heat days. Transit facilities are built to withstand the impacts of flooding and heat waves; and incorporate features such as shade and tree cover. As a result, transportation infrastructure is built to be more resilient to these anticipated impacts.

The 2025 Regional Plan addresses several elements that will increase resilience to extreme heat. Projects to upgrade existing transportation infrastructure, such as those planned at the [San Ysidro Mobility Hub](#) that include the installation of shade structures, will create a more comfortable experience for travelers in the face of high temperatures. SANDAG also provides grant funding for transportation-related infrastructure improvements and planning efforts that support smart growth development through the SGIP. The SANDAG Smart Growth Design Guidelines include several site-design policies that encourage implementation of strategies to address natural hazards, which include project design features that offer shade and weather protection for pedestrians.

## Flooding

Heavy rainfall can lead to flooding of stormwater in roadways and create safety hazards. Stormwater flooding threatens roadway infrastructure, including increased susceptibility to rutting, washout, or other failures. Transportation assets located near streams or rivers are particularly at risk of infrastructure damage or traffic disruption, as the risk of large rain events leads to stormwater flooding in these areas. The heavy rainfall that the region experienced in January 2024 and subsequent flooding was a stark example of this. The storm damaged transportation infrastructure and caused transportation disruptions. For example, trolley lines operated by the San Diego Metropolitan Transit System (MTS) were damaged and saw delays. It also resulted in three deaths and damage or destruction to more than 800 homes in the San Diego region. Over the next several decades, the most damaging events will involve erosion and flooding caused by storm surge and wave run-up that coincide with peak high tides, particularly during El Niño winters. Increasing coastal flooding will worsen these extreme events, causing larger, longer, and more damage to infrastructure and property with longer periods of inundation. Many agencies across the region are working to study, plan for, and adapt to the impacts of flooding and other coastal hazards to ensure reliable transportation routes are available.

The 2025 Regional Plan addresses several elements that will improve resilience to flooding. Coastal hazard assessments will identify feasible design alternatives to combat impacts from flooding and storm surge. Monitoring projects, such as the SANDAG [Regional Shoreline Monitoring Program](#), can help identify areas with significant erosion to inform where to prioritize adaptation efforts. The Regional Shoreline Monitoring Program began in 1996 and performs biannual shoreline surveys to measure beach width and shore zone volume change along with monthly photos along the San Diego beaches and coastline. SANDAG is also collaborating with agencies across the region to identify opportunities for beach replenishment and shoreline monitoring through the Shoreline Preservation Working Group. This working group was created in the 1980s to advise the Board of Directors on strategies, such as beach replenishment, to reduce erosion at the region's beaches.<sup>10</sup> Beach replenishment is an important adaptation tool to preserve the region's beaches and protect vulnerable coastal transportation facilities from erosion and flooding. SANDAG has managed two regional beach sand replenishment projects, which have collectively placed more than 3.6 million cubic yards of sand on the region's sediment-starved beaches.



# Stormwater

## Introduction

Stormwater, or urban runoff, is generated when water flows over impervious surfaces or from properties without percolating into the ground. Precipitation, irrigation, and other non-storm-related discharges of water can also lead to runoff. The impervious surfaces found in the transportation system impact the natural infiltration of water. Stormwater is often considered a nuisance because it contributes to water quality problems in urbanized areas, by carrying pollution to nearby rivers, lakes, and the ocean. Runoff can impact the quality and cost of treatment for potable water held in our reservoirs, which store the majority of water we use in our daily lives. Roads and highways are effective conduits for stormwater runoff because their impervious surfaces allow stormwater to make its way into local water bodies, carrying with it dirt, oil, grease, toxic chemicals, heavy metals, road salts, nitrogen, phosphorus, pathogens, and trash.

## Regional Coordination

In 2009, SANDAG started a regional dialogue to identify the unfunded infrastructure needs in the region; stormwater management was included as one of the focus areas. California Senate Bill 1685 (Kehoe, 2008) authorized the use of tax revenues received by SANDAG through the San Diego Regional Transportation Consolidation Act to include regional water quality improvement and beach sand replenishment projects.<sup>8</sup> In 2022, California Assembly Bill 2367 (Lee, 2024) (AB 2367) expanded on this, and authorizes SANDAG to seek resources and to fund projects identified in the Sustainable Communities Strategy, including habitat conservation projects, water quality improvement projects, and other environmental mitigation projects and to exercise bonding authority to implement the Regional Transportation Plan.<sup>9</sup>

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<sup>8</sup> California “State Water Resources Control Board Office of Legislative Affairs 2007-2008 Legislative Summary,” California Water Boards, effective January 2009, [https://waterboards.ca.gov/publications\\_forms/publications/legislative/summaries/legsum0708.pdf](https://waterboards.ca.gov/publications_forms/publications/legislative/summaries/legsum0708.pdf)

<sup>9</sup> AB 2367 Regional transportation plans: implementation authority: San Diego Association of Governments,” California Legislative Information, last modified July 21, 2022, [leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=202120220AB2367](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB2367)

The impacts of urban runoff are not isolated to an individual city or municipality because runoff travels through the watersheds in the San Diego region toward our reservoirs and ocean. Within the San Diego region, the 11 watersheds are grouped into 1 of 10 Watershed Management Areas for purposes of collaborative stormwater management. The San Diego Regional Water Quality Control Board (the primary entity that regulates stormwater discharge) works with the County of San Diego, 18 incorporated cities, and the special districts of the Port of San Diego and San Diego County Regional Airport Authority (collectively known as co-permittees) who own and operate municipal separate storm sewer systems (MS4s) in the San Diego Region. Caltrans, the North County Transit District (NCTD), and MTS are regulated through separate state-issued stormwater permits. Like many of the topics addressed in the 2025 Regional Plan, stormwater management involves issues, needs, and solutions that cross municipal and jurisdictional boundaries.

To support regional collaboration, Project Clean Water was initiated in July 2000 by the region's MS4 co-permittees to provide a broad and inclusive forum for exploring water quality issues of regional significance.<sup>10</sup> Much of the focus during the first two years was on establishing a visible forum to discuss issues of shared concern, to build consensus on solutions to priority problems, and to characterize baseline conditions in the region's watersheds. Today, Project Clean Water serves as both a countywide initiative dedicated to protecting water quality in San Diego County and the co-permittees' Regional Clearinghouse for regulatory plans and data. The initiative fosters greater awareness of everyday actions people can take to reduce runoff and stormwater pollution. The goal is to support the region's water quality on behalf of healthy communities and thriving ecosystems. Project Clean Water offers a centralized point of access for water quality information and resources and houses all ten of the region's watershed Water Quality Improvement Plans (WQIP). The WQIPs include descriptions of the highest priority pollutants or conditions in a specific watershed, goals and strategies to address those pollutants or conditions, and time schedules associated with those goals and strategies.<sup>11</sup>

SANDAG coordinates with Caltrans District 11 to improve highways in the San Diego region. Caltrans has an integrated stormwater management program designed to protect water quality by installing devices that capture and treat stormwater, incorporating water quality measures into the early planning and design process, and partnering with local jurisdictions to meet water quality goals and regulatory requirements such as Total Maximum Daily Loads for local watersheds. In addition, Caltrans has a comprehensive program for preventing water pollution during construction activities on the state highway system. These include guidance on how to prepare a Storm water Pollution Prevention Plan and Water Pollution Control Program, as well as State Water Resources Control Board approved best management practices for preventing water pollution during construction.

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<sup>10</sup> About Project Clean Water, (Project Clean Water), [projectcleanwater.org/about/](https://projectcleanwater.org/about/).

<sup>11</sup> Water Quality Improvement Plans," (San Diego Regional Water Quality Control Board, last modified May 12, 2023, [waterboards.ca.gov/sandiego/water\\_issues/programs/stormwater/wqip.html](https://waterboards.ca.gov/sandiego/water_issues/programs/stormwater/wqip.html)

Transit projects are subject to similar requirements detailed in the MS4 permits held by MTS and NCTD. For SANDAG active transportation projects and local streets and roads, requirements are governed by the local jurisdiction MS4 permits and can include use of green stormwater infrastructure features such as permeable pavements, bioswales, and rain gardens, that will increase stormwater infiltration on site. Transportation infrastructure development projects also comply with section 404 of the Clean Water Act, which regulates discharge into waters of the U.S.<sup>12</sup>

SANDAG partners with regional transportation infrastructure owners and operators to manage stormwater from roads and highways in the region. SANDAG also provides grant funding for transportation-related infrastructure improvements and planning efforts that support smart growth development through the SGIP. The SANDAG Smart Growth Design Guidelines include a number of site-design policies that encourage adaptation to natural hazard stressors. The guidelines promote project design features such as cisterns and stormwater retention devices that capture, store, and reuse stormwater or minimize runoff into streets.

SANDAG also manages the [TransNet Environmental Mitigation Program](#) (EMP), which purchases, conserves, and restores native habitats in order to mitigate the potential impacts of transportation projects. The program has multiple benefits, including preserving habitat for endangered species, conserving open space for visual and passive recreation, and protecting water quality by restoring and protecting watersheds. Urbanization within natural watersheds pollutes stormwater runoff, accelerates erosion and sedimentation, degrades water supplies, and increases pollutants in aquatic and marine ecosystems. Preserving native plant communities and restoring wetlands can help protect watersheds and provide a wide array of other benefits.

As of January 2024, the EMP has helped acquire more than 9,215 acres of natural open space within the San Diego region. This acreage is about 11 times the size of Central Park in New York City. In addition, the program has created and restored over 200 acres of wetland habitat helping to maintain and enhance flood protection benefiting existing infrastructure and development. Preserving native habitats in a watershed can help strengthen the watershed overall—and functioning watersheds in our region can help better manage stormwater runoff and provide additional environmental benefits.

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<sup>12</sup> Permit Program under CWA Section 404," United State Environmental Protection Agency, last modified April 2024, [epa.gov/cwa-404/permit-program-under-cwa-section-404](https://epa.gov/cwa-404/permit-program-under-cwa-section-404)