Appendix R:

Stormwater and Resilience

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This appendix discusses how past, current, and future work by the San Diego Association of Governments (SANDAG) and other regional partners reduces the impacts that surface transportation has on stormwater runoff and enhances the resilience and reliability of the transportation system and regional connectivity as it confronts the consequences of climate change and natural hazards. Pursuant to 23 CFR 450.306(b)(9), this must be addressed in the metropolitan transportation planning process.

Stormwater

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 lead to runoff. Stormwater is often considered a nuisance because it acts as a conveyance for multiple constituents and can increase pollutants in water bodies. Runoff is the primary source of water quality problems in most urbanized areas, contributing a major source of pollution to 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.

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 Copermittees) who own and operate municipal separate storm sewer systems (MS4s) in the San Diego Region. Caltrans, the North County Transit District (NCTD), and the Metropolitan Transit System (MTS) are regulated through separate state-issued stormwater permits.

Stormwater and Transportation

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. SANDAG partners with regional transportation infrastructure owners and operators to manage stormwater from roads and highways in the region.

SANDAG coordinates with Caltrans District 11 to improve highways in the San Diego region. Caltrans has an integrated stormwater 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. 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 dictated by the local jurisdiction through their MS4 permits.

Beyond transportation projects, SANDAG is assisting the Copermittees in meeting their stormwater permit requirements by identifying areas where regional approaches to stormwater management would promote a holistic and sustainable future.

Stormwater Management

San Diego Forward: The 2021 Regional Plan (2021 Regional Plan) addresses a number of elements that promote a resilient and sustainable future, including providing a healthy environment, transportation, housing, public facilities, and economic prosperity for the San Diego region.

Like many of the issues addressed in the 2021 Regional Plan, stormwater management involves issues, needs, and solutions that cross municipal and jurisdictional boundaries. Even where identified needs are more localized, a regional approach to stormwater management may be more efficient, consistent, and economical than a patchwork of jurisdiction-specific solutions.

There is a lack of available resources at the national and state levels to help finance transportation and other regional and local infrastructure needs. Regions are increasingly being asked to leverage or match state and federal funds with local money or programs that help fill the infrastructure gaps. 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) (SB 1685) expanded the use of tax revenues received by SANDAG through the San Diego Regional Transportation Consolidation Act to assist the region with infrastructure needs to maximize mobility and transportation choices and to conserve and protect natural resources. Specifically, SB 1685 expanded SANDAG authorization to fund watershed management and stormwater conveyance systems improvements to promote water quality through the region.

Regional Stormwater Needs Assessment

In early 2009, SANDAG and the County of San Diego Department of Public Works Watershed Protection Program collaborated to develop an estimate of the funding needed for stormwater quality programs and projects in the region. A broad cross-section of stakeholders from throughout the San Diego region was convened to provide input on necessary stormwater quality infrastructure improvements. This effort resulted in the

2010 Quality of Life Water Quality Needs Assessment (2010 Needs Assessment), which identified a funding need of $24.6 billion for improvements over 40 years.[1]

The County of San Diego has initiated an update of the 2010 Needs Assessment's 40-year water quality cost estimate using more recent water quality planning documents and strategies for achieving regulatory compliance and water quality objectives throughout the region. Since 2010, the Copermittees have worked to formulate Water Quality Improvement Plans (WQIPs) for the region's watersheds, including strategies, planned projects, and schedules to address their respective water quality objectives and compliance needs. The update to the 2010 Needs Assessment is intended to assist in planning and decision making and will draw upon the most recent WQIPs, with a focus on unincorporated areas to develop updated cost information.

Regional Collaboration: Project Clean Water

Project Clean Water was initiated in July 2000 by the region's MS4 Copermittees to provide a broad and inclusive forum for exploring water quality issues of regional significance.[2] 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 Copermittees' Regional Clearinghouse for regulatory plans and data. The initiative fosters greater awareness of everyday actions people can take to reduce runoff and stormwater pollution. Project Clean Water offers a centralized point of access for water quality information and resources. The goal is to support the region's water quality on behalf of healthy communities and thriving ecosystems.

Resilience to Climate Change and Natural Hazards

In addition to engaging with regional partners to address stormwater management, SANDAG is coordinating with other entities in the region to address the impacts of climate change and natural hazards to ensure the resilience and reliability of the transportation system and regional connectivity. The Federal Highway Administration (FHWA) defines resilience as "the ability to prepare for changing conditions and withstand, respond to, and recover rapidly from disruptions" (FHWA Order 5520). This concept can be applied to numerous topics—some of which are discussed in this appendix—that enhance the resilience and reliability of the transportation network and the social resilience of the region.

The San Diego Region Report for California's Fourth Climate Change Assessment (2018) cites increases in temperature and extreme heat events, wetter winters and longer droughts, higher sea levels, an increased rate of sea-level rise, and increased wildfire

[1] "Quality of Life Funding Strategy," Project Clean Water, projectcleanwater.org/quality-of-life-funding-strategy.
[2] Project Clean Water, projectcleanwater.org.

severity compared to historical averages.[3] These climate impacts exacerbate existing natural hazards, and responding to these hazards is a key component of resilience. A broader discussion of the region's climate change impacts is included in the SANDAG Climate Change White Paper (2018), which summarizes completed and ongoing climate resilience efforts managed by SANDAG and regional partners through 2018.[4]

SANDAG's resilience work can be divided into two categories: mitigation and adaptation. Mitigation is a "human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas (GHG) sources and emissions and enhancing GHG sinks." Adaptation is an "adjustment in natural or human systems to a new or changing environment…in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." These definitions are consistent with those included in the Safeguarding California Plan: 2018 Update.[5]

Mitigation

The SANDAG mitigation efforts allow the agency to meet broader federal and other regulatory requirements as they relate to transportation planning efforts. These efforts help mitigate GHG emissions, biological impacts, and other environmental stressors. For example, in 2010 a collaboration between SANDAG and San Diego Gas & Electric (SDG&E) led to the creation of the SANDAG Energy Roadmap Program, which initially provided no-cost energy assessments and energy management plans, or "Roadmaps," to SANDAG member agencies.[6] In 2016, the Energy Roadmap Program was expanded to also provide climate planning support, including Climate Action Plan development,[7] and GHG inventories and projections. The assistance provided via the Energy Roadmap Program's two program areas has helped make municipal facilities more efficient and reduce GHG emissions. The Energy Roadmap Program, which concluded in 2020, was funded primarily by a Local Government Partnership, with SDG&E supporting the energy efficiency–related aspect of GHG emissions–reductions efforts and SANDAG supporting the transportation-related aspects through its own funding.

Although funding for the Energy Roadmap Program has concluded, the SANDAG climate mitigation work through the Climate Resilience Program continues to help mitigate climate impacts through energy and climate planning across the region. For example, SANDAG developed the Regional Climate Action Planning Framework (ReCAP), which identifies best practices and guidance for preparing Climate Action Plans and monitoring

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3 "California's Fourth Climate Change Assessment: San Diego Region Report," (March 21, 2019), energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-009_SanDiego_ADA.pdf.

4 "Climate Change White Paper," (SANDAG, February 23, 2018), sdforward.com/docs/default-source/default-document-library/climate-change-white-paper-march-2-2018.pdf?sfvrsn=c0d4f965_0.

5 "Safeguarding California Plan: 2018 Update: California's Climate Adaptation Strategy," (California Natural Resources Agency, January 2018), resources.ca.gov/CNRALegacyFiles/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf.

6 "Energy Roadmap Program for Local Governments," (SANDAG), sandag.org/index.asp?projectid=373&fuseaction=projects.detail.

7 "Climate Action," (SANDAG), sandag.org/index.asp?classid=17&subclassid=46&projectid=565&fuseaction=projects.detail.

implementation over time, allowing for regionally consistent planning.[8] The methods outlined in ReCAP are used to prepare GHG inventories and monitoring reports, all of which are publicly available in the SANDAG Climate Action Data Portal.[9] SANDAG will continue to prepare local and regional GHG inventories and climate monitoring reports available on the Climate Action Data Portal.

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.[10] The program has multiple benefits, including preserving habitat for endangered species, conserving open space for visual and passive recreation, and protecting water quality by 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 can help protect watersheds and provide a wide array of other benefits, including carbon sequestration. Through a grant from the California Department of Conservation, SANDAG is using the TerraCount[11] tool to estimate the amount of carbon stored in the region's natural and working lands.

As of February 2021, the EMP has helped acquire more than 8,780 acres of natural open space within the San Diego region. This acreage is about 10.5 times the size of Central Park in New York City. 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.

In addition to the mitigation activities summarized above, SANDAG also works with regional partners to adapt to changing conditions. Together, these activities can make it easier for the transportation system to withstand, respond to, and recover rapidly from disruptions, enhancing regional connectivity.

Adaptation

SANDAG began considering the resilience of the region's coastline in the 1980s with the formation of the Shoreline Preservation Committee. This committee was created to advise the SANDAG Board of Directors on strategies to reduce erosion at the region's beaches.[12] Since then, SANDAG has managed two regional beach sand replenishment projects, which have collectively placed more than 3.5 million cubic yards of sand on the region's sediment-starved beaches. Beach replenishment is an important adaptation tool to preserve the region's beaches and protect vulnerable coastal transportation facilities from erosion and sea level rise. To further this work, SANDAG received a Caltrans

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8 "Regional Climate Action Planning Framework," (SANDAG, December 2020), sandag.org/uploads/projectid/projectid_565_28532.zip.

9 Climate Action Data Portal, climatedata.sandag.org.

10 "*TransNet* Environmental Mitigation Program," (SANDAG) sandag.org/index.asp?classid=17&projectid=263&fuseaction=projects.detail.

11 "TerraCount," (California Department of Conservation, 2021), maps.conservation.ca.gov/TerraCount.

12 "SANDAG Info Bits: Got Sand? Why Our Beaches Need TLC," (July 2020), sandag.org/uploads/publicationid/publicationid_4692_27816.pdf.

adaptation planning grant funded by California Senate Bill 1 (Beall, 2017) (SB 1), the Road Repair and Accountability Act of 2017, to prepare the Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance (Adaptation Guidance).[13] Completed in May 2020, the Adaptation Guidance includes a sea level rise vulnerability and risk assessment of regional transportation facilities and an adaptation toolbox with recommendations on policies, projects, and funding sources to address sea level rise impacts. The FHWA's Vulnerability Assessment Scoring Tool[14] was used to perform the risk analysis portion of this project. Building upon this and other local climate vulnerability assessments, SANDAG is working with the U.S. Department of the Navy to analyze the vulnerability of transportation facilities that serve Naval facilities around the San Diego Bay through a grant from the U.S. Department of Defense Office of Local Defense Community Cooperation. It is anticipated that these analyses will encourage the use of green infrastructure projects and adaptive engineering approaches like those that have been incorporated into the design of the North Coast Corridor improvements to bolster the adaptive capacity of coastal transportation facilities in the region.[15]

With a second round of Caltrans SB 1 funding awarded in July 2018, SANDAG developed a Regional Adaptation Needs Assessment (Needs Assessment).[16] With the support of the San Diego Regional Climate Collaborative, SANDAG identified adaptation planning needs and opportunities and facilitated coordination across adaptation projects throughout the San Diego region. The Needs Assessment has increased regional understanding of what is required to move forward with adaptation planning, including research, planning, and/or implementation, and was designed to inform ongoing and future planning efforts. The Needs Assessment focuses on multiple climate impacts (e.g., wildfire, water) and is multidisciplinary.

In May 2019, SANDAG was awarded a third round of Caltrans SB 1 funding for the Holistic Implementation of Adaptation Strategies project (the Project). The previous two Caltrans SB 1 grants identified information gaps regarding existing risks and adaptation needs. Many local governments have adopted Climate Action Plans that include adaptation-focused strategies, and there is a disconnect in knowing how to effectively implement these strategies in conjunction with those in other existing policy and planning documents. The Project, which will conclude in December 2021, aims to provide tangible guidance on how to address these identified risks and needs by holistically implementing projects that link mitigation, adaptation, and equity. An implementation toolkit, economic guidance document, and equity prioritization document will be developed to help local planners with this complex decision making.

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13 "Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance," (SANDAG, May 2020), sandag.org/uploads/projectid/projectid_510_28075.pdf.

14 Federal Highway Administration Vulnerability Assessment Scoring Tool, fhwa.dot.gov/environment/sustainability/resilience/tools.

15 "Appendix D – San Diego Region Coastal Sea Level Rise Analysis: Executive Summary," (Caltrans, 2013), dot.ca.gov/caltrans-near-me/district-11/programs/district-11-environmental/i-5pwp-toc/appd.

16 "Regional Adaption Needs Assessment," (Caltrans), sandag.org/uploads/projectid/projectid_510_28074.pdf.

In addition to the SB 1–funded adaptation projects, SANDAG provides grant funding for transportation-related infrastructure improvements and planning efforts that support smart growth development through the Smart Growth Incentive Program.[17] The goal of this program is to fund comprehensive public infrastructure projects and planning activities that facilitate compact, mixed-use, transit-oriented development and increase housing and transportation choices. One of the prerequisites for applying for funding is having an adopted Climate Action Plan. The SANDAG Smart Growth Design Guidelines[18] include a number of site-design policies that encourage adaptation to climate and natural hazard stressors. These guidelines encourage using trees and shade structures over sidewalks and parking areas to reduce heat and create a more pleasant pedestrian environment; discourage the use of plants that are highly combustible or create large amounts of fuel for fires; and promote design features such as cisterns and stormwater retention features that capture, store, and reuse stormwater or minimize runoff into streets.

Finally, in partnership with Caltrans, SANDAG is preparing 12 Comprehensive Multimodal Corridor Plans (CMCPs).[19] The CMCPs are data-driven plans to reduce congestion, support climate action initiatives, generate transportation choices while preserving community character, and create opportunities for enhancement projects. Corridor enhancement and improvement projects will consider climate resilience and integrate adaptation strategies that to reduce disruptions from climate stressors and contribute to the longevity of multimodal corridor improvements.

Other Local Efforts

In addition to the SANDAG-led efforts, other agencies and organizations in the San Diego region are actively planning for climate resilience. The San Diego region is geographically unique and as such, experiences diverse climate impacts. Along the almost 70 miles of coastline, much work is being done to study, plan for, and adapt to the impacts of sea level rise and other coastal hazards. There are seven coastal jurisdictions in the region, and all of them are preparing, have prepared, or have adopted vulnerability assessments and Local Coastal Program amendments to incorporate best available sea level rise science into their land use planning documents. Other agencies, such as the Port of San Diego, San Diego County Regional Airport Authority, Caltrans, and the U.S. Navy, are also engaged in sea level rise analysis, and they are assessing impacts to the infrastructure and assets that they manage.

A previous effort that has shaped the region's current understanding of sea level rise and its associated impacts is the Resilient Coastlines Project of Greater San Diego, funded by a grant from the National Oceanic and Atmospheric Administration.[20] The project

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17 "*TransNet* Smart Growth Incentive Program and Active Transportation Grant Program," (SANDAG), sandag.org/index.asp?classid=12&projectid=491&fuseaction=projects.detail.

18 "Smart Growth Design Guidelines," (SANDAG), sandag.org/index.asp?projectid=344&fuseaction=projects.detail.

19 "Comprehensive Multimodal Corridor Plan," (SANDAG, Caltrans, July 2021), sandag.org/uploads/publicationid/publicationid_4726_28448.pdf.

20 "Resilient Coastlines Project of Greater San Diego," (Climate Science Alliance, 2021), climatesciencealliance.org/resilient-coastlines-project.

completed an analysis of economic impacts[21] to the San Diego region caused by sea level rise, as well as legal,[22] policy, and planning tools that local agency staff can use. Throughout the project's lifespan (2015–2018), capacity-building and educational opportunities were provided through workshops, working groups, and webinars.

While San Diego's coastal communities are planning for the impacts of rising seas along the region's coastline, the region's inland communities are preparing for extreme heat events and wildfires that also could impact the region's transportation network. The risk for wildfires driven by Santa Ana winds will likely increase as a result of drier, warmer autumn seasons. To address this risk, SDG&E has established a comprehensive wildfire risk mitigation program—including Wildfire Mitigation and Vegetation Management Plans and visual fire detection through a system of cameras, meteorologists, and aviation services—to help protect utility customers, local communities, and transportation infrastructure and improve the region's ability to respond to and recover from wildfires. Collectively this program helps maintain the safety and security of residents, enable access and delivery of critical services, and move people and goods throughout the region.[23]

Likewise, the County of San Diego 2020 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.[24] 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.

The Resource Conservation District of Greater San Diego manages the Fire Safe Council of San Diego County (FSCSDC), which serves as the umbrella organization for the 41 locally formed community Fire Safe Councils. The FSCSDC helps residents protect their families and homes from wildfire through fire prevention programs,[25] public education, and training.

The County of San Diego Office of Emergency Services is responsible for preparing and updating the Multi-Jurisdictional Hazard Mitigation Plan (Hazard Mitigation Plan)[26] for the

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21 Charles Colgan and Fernando DePaolis, "Regional Economic Vulnerability to Sea Level Rise in San Diego County," (San Diego Regional Climate Collaborative, March 2018), digital.sandiego.edu/npi-sdclimate/9.

22 "Legal Risk Analysis for Sea Level Rise Adaptation Strategies in San Diego," (San Diego Regional Climate Collaborative, June 2017), digital.sandiego.edu/npi-sdclimate/10.

23 "Wildfire Safety," (San Diego Gas & Electric), sdge.com/our-commitment-wildfire-safety.

24 "County of San Diego 2020 Consolidated Fire Code," (County of San Diego, March 27, 2020), sandiegocounty.gov/content/dam/sdc/sdcfa/documents/prevention/2020-County-Consolidated-Fire-Code-FINAL.pdf.

25 Fire Safe Council of San Diego County, firesafesdcounty.org.

26 "Multi-Jurisdictional Hazard Mitigation Plan," (Office of Emergency Services), sandiegocounty.gov/oes/emergency_management/oes_jl_mitplan.html.

region in compliance with the federal Disaster Mitigation Act of 2000. The Hazard Mitigation Plan is actively being updated; the 2023 revision will integrate climate-related considerations. SANDAG maintains an extensive data library, which is constantly being updated to ensure that the most current data are being used for various analyses, monitoring, reporting, and forecasts. As such, SANDAG has been engaged in the current revision to the Hazard Mitigation Plan and will continue to reinforce the existing climate planning, adaptation, and resilience efforts that can support overall regional safety while also supplying relevant available data.

Through funding from the Strategic Growth Council, the Connecting Wildlands & Communities (CWC) is a collaboration of the Institute for Ecological Monitoring and Management at San Diego State University and the Climate Science Alliance.[27] The CWC takes a comprehensive planning approach to meet state objectives on protecting rural communities, mitigating wildfire risk, supporting water sustainability, and protecting biodiversity. The goal of this research is to provide an integrated planning and decision-making framework that supports multi-benefit, landscape-scale planning and facilitates science-informed climate adaptation and strategies across the region. The CWC framework is anticipated to be complete in 2021 and will offer comprehensive regional data to better inform program development and project implementation with strong climate resilience considerations for short-, medium-, and long-term regional planning.

Partner agencies in the San Diego region have come together to study and plan for impacts to the water supply under future climate scenarios. The San Diego Basin Study, jointly led by the City of San Diego and Bureau of Reclamation, assesses the region's water supply and demand, and determines the potential climate change impacts.[28] The study also analyzes the region's existing infrastructure and includes adaptation strategies that can help address the uncertainties associated with climate change.

Next Steps

One focus of the 2021 Regional Plan is the resilience of the transportation network to the impacts of climate change and natural hazards. Much of the mitigation and adaptation work that SANDAG has completed and is undertaking informs the projects, policies, and programs in the 2021 Regional Plan. Appendix B includes more information about the SANDAG Climate Action Planning and Climate Adaptation and Resilience program areas and associated implementation actions. Examples of ongoing and future mitigation and adaptation work include:

- Update and maintain ReCAP to include relevant policy and methodology changes.
- Update and maintain the Climate Action Data Portal and ReCAP Snapshots to include more mitigation activity data, as well as adaptation and equity-related datasets.

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[27] "Connecting Wildlands & Communities," (Climate Science Alliance), climatesciencealliance.org/cwc-about.

[28] "San Diego Watershed Basin Study," (Bureau of Reclamation, July 25, 2019), usbr.gov/lc/socal/basinstudies/SDBasin.html.

- Climate resilience technical services to support the work of SANDAG and its member agencies.
- Establish a Nature-Based Climate Solutions Program that could include a Regional Carbon Reduction Program and the use of “soft solutions” or nature-based engineered systems to improve, among other things, water quality and climate vulnerable transportation infrastructure.
- Integration of climate resilience considerations in SANDAG priority projects such as CMCPs, SANDAG Housing Incentive Program, and the Resilient Capital Grants and Innovative Solutions program.
- Increase funding, prioritize, and expedite projects to adapt and/or relocate existing climate vulnerable transportation infrastructure
- Continued participation and coordination with local, regional, state, and federal legislators and agencies to better define the regional role in climate resilience planning and implementation and to ensure that climate resilience considerations are being consistently integrated into plans, policies, and programs.
- Establish a regional forum for consistent and equitable climate resilience planning and implementation to ensure a resilient San Diego region.