

STAFF REPORT

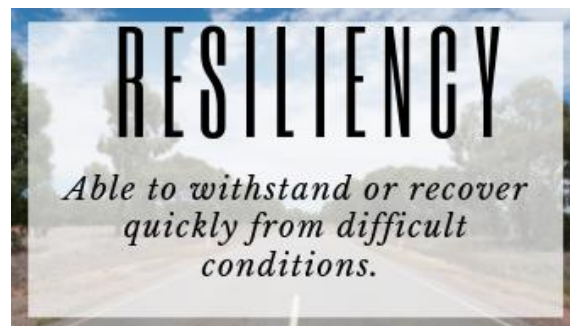
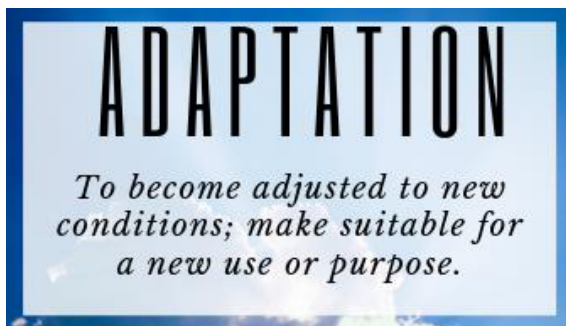
SUBJECT: Transportation Resiliency and Adaptation Defined

RECOMMENDED ACTION: Information

DISCUSSION:

SUMMARY:

Resilient California, also known as SB 379, requires goals, policies and objectives for communities based on vulnerability assessments and implementation measures. Because of this, it is necessary that resiliency and the adaptation of our county is considered to ensure future safety of our communities. Two words in transportation planning that are being used with much frequency are “adaptation” and “resiliency”. At first glance, those words may seem to have similar meaning, but it is crucial to understand the difference especially as they relate to transportation assets:



The rates of extreme weather events are both tangible and highly visible. Recent science shows that temperatures are increasing, rainfall is more erratic, and changing weather patterns are becoming more frequent and intense. Ensuring that our transportation system and infrastructure can withstand these events and even thrive afterwards is more important now than it has ever been and planning in this capacity is crucial to the safety of our San Joaquin County communities. Our county has several assets that are impacted yearly by extreme weather, some of those include our levees, our busses, our roads, and our freeways.

According to Caltrans, benefits of resiliency mitigation and adaptation include lower pollutant emissions, longer service life of transportation assets, reduced costs and need for weather-related maintenance, improved safety, and improved ecosystem resiliency and health. Adaptation and resiliency planning seeks to identify infrastructure that is vulnerable to disruptions due to extreme weather events. In planning for these types of disruptions, it is important to determine the risks and consequences of current weather patterns and trends and propose investment priorities to address the identified risks. SJCOG's Adaptation and Resiliency Study seeks to define these risks and consequences and develop, through both our working group and regional summit, recommendations on the best course of action to address resiliency and adaptation in San Joaquin County.

RECOMMENDATION:

This item is for information; no action is requested at this time.

FISCAL IMPACT:

The budget for the awarded contract is \$68,000. The total project cost of \$80,598 is identified in the Fiscal Year 2018/19 Overall Work Program (OWP). \$71,354 is being provided through a Caltrans Senate Bill 1 Sustainable Transportation Planning Grant. A local in-kind match of \$9,245 in Local Transportation Funds is required. Budgeted amounts above the awarded contract are for SJCOG staff resources also dedicated to the delivery of the study.

BACKGROUND:

As part of the SB-1 planning funding that SJCOG received in the FY17/18, one of the four studies to further the implementation of the 2018 Regional Transportation Plan is the Adaptation and Resiliency

RESILIENCE GOALS

Maintain a multi-modal transportation network to deliver people, goods, and emergency services throughout the county, with a focus on vulnerable populations in floodplains and low-income communities with limited bus services.

Create and maintain redundancy in the transportation system to allow for rerouting during disruptions

Ensure operation of routes supporting evacuation, staging areas, and emergency response.

PROJECT GOALS

A transportation system that is resilient to extreme weather changes

Integration of adaptation into the RTP and transportation investments

Study. SJCOG and our consultant, Eastern Research Group (ERG), began in January of this year to embark on a year-long effort to research and write a transportation resiliency plan for the county. The purpose of this plan is to consider how we can improve the resiliency and reliability of our transportation system in accordance with the most recent RTP guidelines. The study is heavily influenced by local plans and partners, such as the Delta Stewardship Council, Caltrans District 10 and District 4. The objective of this study is to conduct a vulnerability assessment of the transportation system while considering the impacts of extreme weather events (i.e. increased rainfall, high heat, flooding, wildfires, etc.). This study looks at existing plans throughout the county pertaining to evacuation, hazard mitigation, as well as plans by regional and state agencies, cities, and transportation managers. SJCOG, ERG, and our technical working group will then identify planning gaps in the literature and seek to pursue the resilience goals set forth by SJCOG within the resiliency plan. The final step in this study will be to present the findings for further discussion with the public and policy makers in order to outline the next steps as we plan and prepare for the 2022 RTP/SCS.

In addition to the federal requirements, it is important to note that there are several other efforts addressing adaptation and resiliency throughout the state. Along with state efforts, there are also several other local and regional efforts that are either completed or currently under development that are assisting in informing the SJCOG effort. Those studies include the completed Caltrans district 4 Vulnerability Assessment Summary/Technical Report released in 2018, and the not-yet completed Caltrans District 10 Vulnerability Assessment Summary/Technical Report and the Delta Stewardship Council's previous reports, as well as their current and ongoing project which will look at sea-level rise, and inflow data throughout the Delta region zones.

Briefing Schedule:



With the adoption of the most recent RTP in June 2018, SJCOG committed to several studies or analyses intended to not only meet new federal and state planning requirements but to also gain a better understanding of emerging issues for future transportation planning. Largely funded by SJCOG's formula share of SB1 planning funds, six of these studies are currently underway and two more will begin this summer. To keep SJCOG's committees, the Board, and the public aware of the progress of these efforts, staff will be bringing information to the committees and the Board in the form of issue briefings. Besides the direct connection to the on-going studies, the presentations will also be both responsive to previous Board member questions and present new information for discussion. Each briefing and presentation will highlight key information:

- ✚ Why the study is important to the RTP and connection to local planning efforts
- ✚ Relationship to statewide initiatives with effects for local and regional policy making
- ✚ Ways data and deliverables can be leveraged for local planning and decision making
- ✚ Purpose and status of study efforts, next steps, and decision-making points

The intent of the series is to build understanding and dialogue on emerging issues in transportation planning that will help us address new federal and state planning requirements.

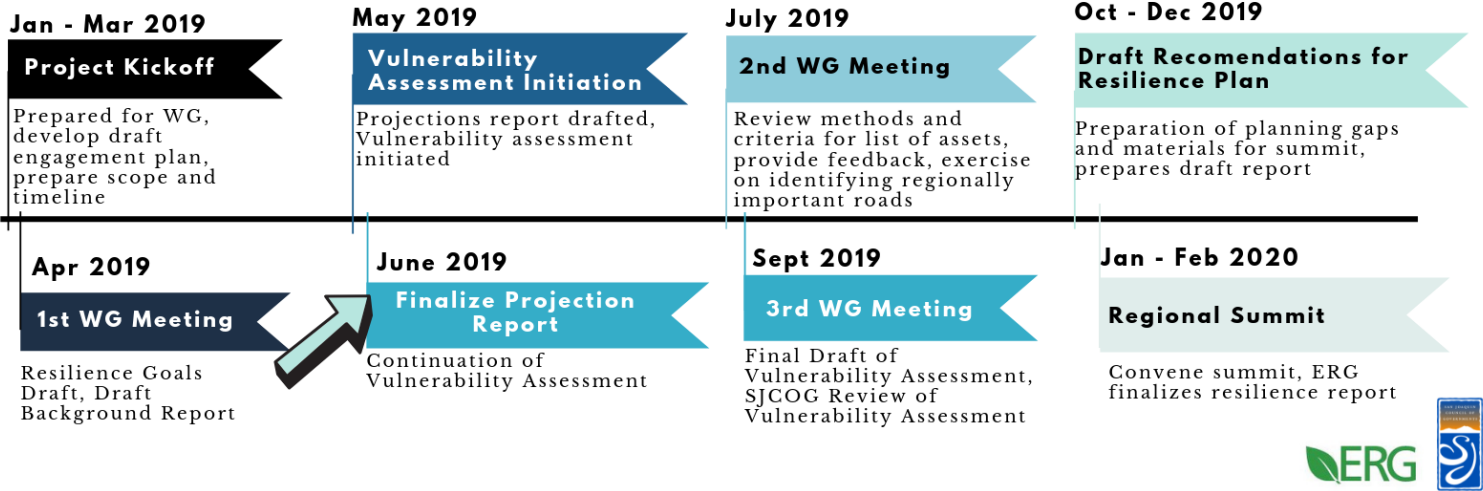
FUTURE BRIEFING SCHEDULE AND NEXT STEPS:

<i>Topic / Study</i>	<i>Tentative Date</i>
Transportation Innovation & Technology Infrastructure for San Joaquin County	May 2019
Transportation System Resiliency Defined	June 2019
Regional Role in Housing Policy	TBD
Economic Modeling for RTP Policy Decisions	TBD
San Joaquin's Sustainable Communities Strategy – Meaningful Policy & Strategy Alternatives for the 2022 RTP	TBD
Advancing the Measurement of Health Benefits from Transportation	TBD
Transportation Investments & Regional Economic Development	TBD

SCHEDULE:

Below is the schedule and timeline overview of our process and what to expect in the coming months regarding this project. After our first working group meeting, the resilience goals were finalized, and we are currently in the assessment phase. In this phase, ERG will be looking at projections of extreme weather events. ERG will be evaluating regional data regarding extreme weather events and trends. From this point, we will continue developing the vulnerability assessment. This report and the draft resilience plan will be available for review around January of 2020.

SB1 Transportation Resiliency Study **TIMELINE OVERVIEW**



Prepared by: Summer Lopez, Assistant Regional Planner



EMERGING PLANNING ISSUE BRIEFING

TRANSPORTATION RESILIENCY DEFINED

JUNE 2019 // PREPARED BY SUMMER LOPEZ, CHRISTINE CORRALES, CAROLINE STYC, KIM ANDERSON, AND ELIZA BERRY (ERG)

Table of Contents

Introduction	4
Terms and Definitions	8
Emerging Policy Environment for Transportation Adaptation and Resiliency Planning	11
California Transportation Plan 2040	11
Executive Order S-13-08	11
Executive Order B-30-15	11
Regional Transportation Plan Guidelines	12
Exploring the Local Impact of Climate Change	14
Climate Stressors in the Delta	14
Vulnerability and the State Highway System	18
Local and Regional Planning Gaps	18
Achieving Adaptation and Resiliency in San Joaquin County	19
Phase One Study Objectives and Deliverables	20
Stakeholder Engagement Plan/Working Group	21
Resilience Goals	22
Review and compile climate data and define climate scenarios	23
Existing Conditions and Vulnerability Assessment	25
Final Plan	27
Regional Summit	27
Timeline	28
Phase Two Study and Deliverables	28
Project Objectives:	29
Deliverables	30
Needs Assessment and Engagement	30
Implementation Priorities	31
Regional Resiliency Implementation Plan and Adaptation Guidance	32
Examples from Other Regions	33
Preparing for Extreme Weather Impacts to Transportation Systems: Adaptation Planning in San Joaquin County	36
Adaptation planning at the county-scale	37
Adaptation planning beyond the County-scale:	39
Adaptation Planning at the City-Level (within San Joaquin County)	40
Adaptation Planning Outside County Boundaries:	45

List of Figures and Tables

Figure 1: Definitions of Adaptation vs. Resiliency	4
Figure 2: Impact Examples from Phase One Scope of Work	6
Figure 3a & 3b: Terms and Definitions	8 & 9
Figure 4: Photo of San Joaquin County Waterway, Mary Hinkle	13
Figure 5: Inundation Risk to Human Populations (Source Delta Stewardship Council)	15
Figure 6: Inundation Risk to Vulnerable People	16
Figure 7: Photo of Escalon Country Road, Susan Platt	18
Figure 8: Photo of Stockton Waterfront, Wayne Giles	21
Figure 9: Photo of Ace Train	22
Figure 10: Prioritization Protocol as established by the Phase Two Scope of Work	28
Figure 11: Example of web-based portal from the California Climate Change website climatechange.ca.gov	29
Figure 12: Caltrans Climate Change Vulnerability Assessment Key Elements	30
Figure 13: Metropolitan Planning Commission, Adapting to Rising Tides Planning Process	32
Figure 14: Photo of Jahant Road, Mary Hinkle	35
Table 1: Example summary table from Vulnerability Assessment Report	23
Table 2: Adaptation and Resiliency Working Group Members	22
Table 3: SJC Plans Review	39

Page left intentionally blank.

Introduction



As part of the SB-1 planning funding that SJCOG received in the FY17/18, one of the four studies to further the implementation of the 2018 Regional Transportation Plan is the Adaptation and Resiliency Study. In January 2019, SJCOG and our consultant, Eastern Research Group (ERG), began a year-long effort to research and write a transportation resiliency plan for the county. This plan considers how we can improve the resiliency and reliability of our transportation system under the most recent RTP guidelines. The study is heavily influenced by local plans and partners, such as the Delta Stewardship Council, Caltrans District 10 and District 4. The objective of this study is to conduct a vulnerability assessment of the transportation system while considering the impacts of extreme weather events (i.e. increased rainfall, high heat, flooding, wildfires, etc.). This study looks at existing plans throughout the county pertaining to evacuation, hazard mitigation, and plans by regional and state agencies, cities, and transportation managers. SJCOG, ERG, and our technical working group will then identify planning gaps in the literature and seek methods to make progress on the resilience goals identified by the technical working group and the consultant team. The final step in this study

will be to present the findings for further discussion with the public and policymakers to outline the next steps as we plan and prepare for the 2022 RTP/SCS.

Besides the federal requirements, there are several other efforts addressing adaptation and resiliency at the state, regional and local level, either completed or under development assisting in informing the SJCOG effort. Those studies include the completed Caltrans district 4 Vulnerability Assessment Summary/Technical Report released in 2018, the not-yet-completed Caltrans District 10 Vulnerability Assessment Summary/Technical Report, and the Delta Stewardship Council's previous, and ongoing projects looking at the sea-level rise and inflow data throughout the Delta region.



Figure 1: Definitions of Adaptation vs. Resiliency, Merriam Webster Dictionary

The rates of extreme weather events are both tangible and highly visible. Temperatures are increasing, rainfall is more erratic, and changes in weather patterns are becoming more frequent and intense. Ensuring that our transportation system and infrastructure can withstand these events and even thrive afterward is more important now than ever and planning in this capacity is crucial to the safety of our San Joaquin County communities. Our county has several assets that are impacted yearly by extreme weather, some of those include our levees, our transit systems, our roads, and our freeways.

According to the [Caltrans Climate Change Branch](#), benefits of resiliency mitigation and adaptation include lower pollutant emissions, the longer service life of transportation assets, reduced costs and need for weather-related maintenance, improved safety, and improved ecosystem resiliency and health.

Adaptation and resiliency planning seeks to identify infrastructure vulnerable to disruptions due to extreme weather events. In planning for these disruptions, it is important to determine the risks and consequences of current weather pattern trends and propose investment priorities to address the identified risks. SJCOG's Adaptation and Resiliency Study seeks to define these risks and consequences and develop, through both our working group and regional summit, recommendations on the best course of action to address resiliency and adaptation in San Joaquin County.

IMPACT EXAMPLES

	Flooding (Extreme precipitation, sea level rise)	Extreme Temperatures	Wildfire	Drought
ROADS	Asphalt stripping, washouts, subbase erosion	Asphalt-concrete cracking	Rutting/softening	Cracking pavement
RAIL	Substructure erosion, inundation, forced delays	Track buckling, forced slower speeds and delays, derailments	Blocked routes, forced delays	
BUSES	Decreased comfort, delays	Transit vehicles overheating, decreased comfort	Route closures, delays	

Figure 2: Impact Examples from Phase One Scope of Work

Terms and Definitions

In navigating the adaptation and resiliency body of literature, there are several key terms and definitions to understand. The following is a list of terms (albeit non-comprehensive) to familiarize readers with the language of adaptation planning.

TERMS & DEFINITIONS

Adaptation: The adjustment of transportation assets to new conditions (environmental changes that impact the functionality and efficiency of assets)

Climate Action Plan: A detailed and strategic framework for measuring, planning, and reducing GHG emissions and related climatic impacts (City of Burlington, Planning)

Disruption: Disturbance or problems which interrupt an event, activity or process (Merriam-Webster Dictionary). In this context, weather events that disturb the functionality of the transportation system

Exposure: The presence of people, livelihoods, species or ecosystems, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by a hazard (The World Bank).

Extreme Weather Events: Unexpected, unusual, unpredictable, severe, or unseasonal weather (i.e. heavy precipitation, drought, extreme heat, riverine flooding) (encyclopedia.com)

Figure 3a: Terms and Definitions

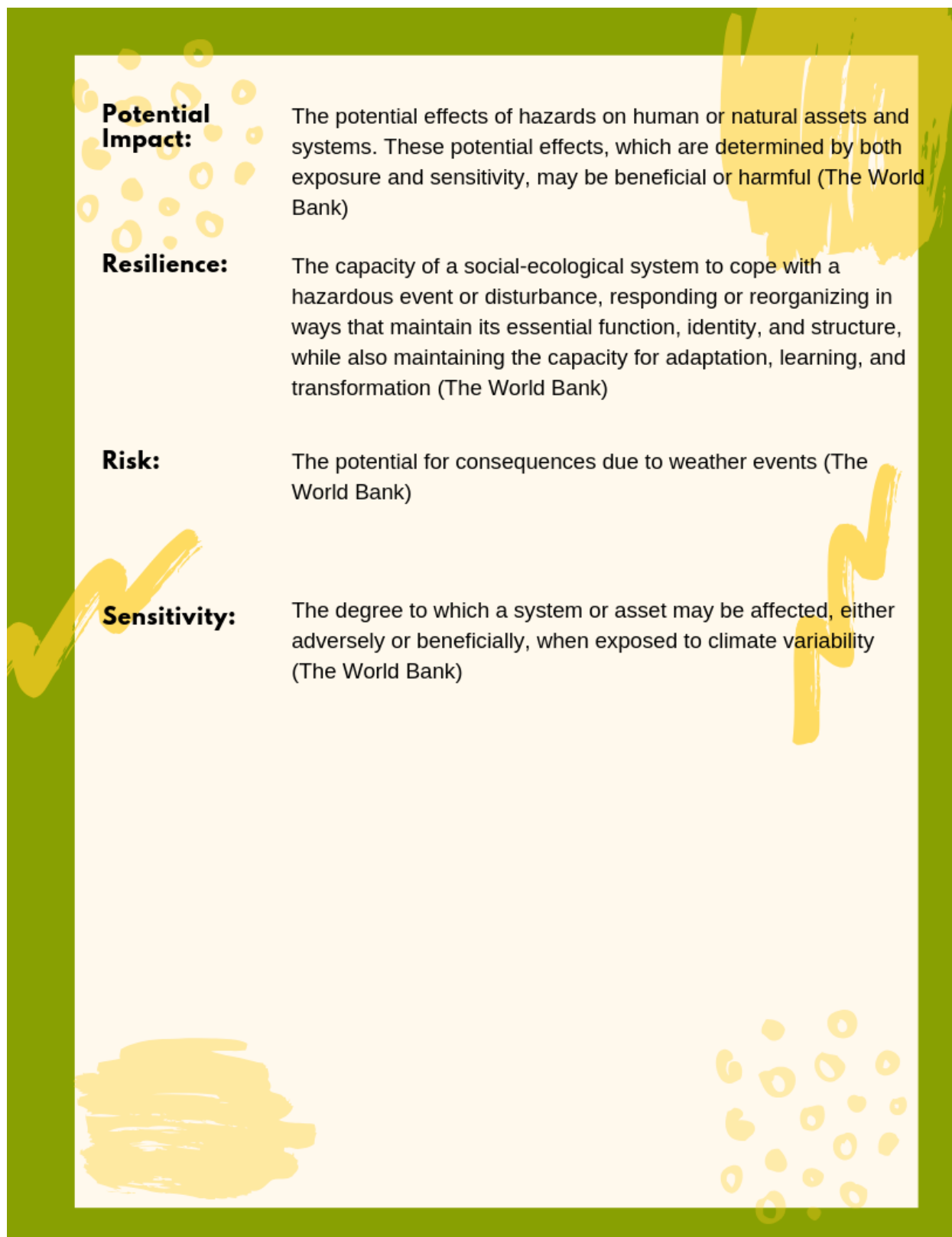
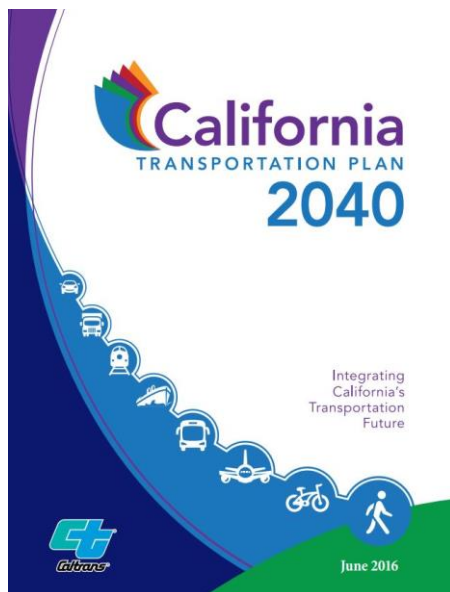


Figure 3b: Terms and Definitions

Emerging Policy Environment for Transportation Adaptation and Resiliency Planning

California is experiencing more frequent and severe extreme events, including storms and wildfires. More change will occur over the coming decades, including increases in temperatures and rising sea levels. Shifting average conditions will be punctuated by more frequent and severe extreme events, including drought, wildfire, and storms. Together, these changes pose risks to California's people, natural resources, and infrastructure.

The state is taking steps to minimize these impacts by leading the way in ensuring California's plans and investments endure and thrive. The following section summarizes key policies, plans, and initiatives driving statewide preparation for a new and changing environment.



California Transportation Plan 2040

The [CTP 2040](#) vision is focused on sustainability: California's transportation system is safe, sustainable, universally accessible, and globally competitive. One of the primary goals of the Plan is to preserve the multimodal transportation system, under which policy calls for adapting the transportation system to reduce impacts from climate change.

Executive Order S-13-08

Executive Order S-13-08 directs state agencies to plan for sea level rise and climate impacts through coordination of the state Climate Adaptation Strategy: Safeguarding California ([California Climate Change Executive Orders](#)).

Executive Order B-30-15

Executive Order B-30-15 specifically addresses the need for the State's planning and investments to consider the exposures and risks from a changing climate. It does this by anticipating current and future impacts and disruptions likely to occur. The order does three things. It establishes a California GHG emissions reduction target of 40 percent below 1990 levels by 2030, directs state government to consider climate change in all planning and investment decisions, and employ full life-cycle cost accounting to evaluate and compare infrastructure investments and alternatives. EO-B-30-15 describes four guiding principles when making planning and investment decisions:

- Priority should be given to actions that both build climate preparedness and reduce GHG emissions
- Where possible, flexible and adaptive approaches should be taken to prepare for uncertain climate impacts
- Actions should protect the state's most vulnerable populations
- Natural infrastructure solutions should be prioritized

The Governor's Office of Planning and Research led a Technical Advisory Group to develop guidance in helping State agency personnel decide when to consider climate change. They make this decision specifically when planning infrastructure and investments and decide how to do so while implementing the four above principles. This includes how to increase social equity and health for vulnerable communities when planning. The Guidance to implement EO-B-30-15 is available here: http://opr.ca.gov/docs/20180313-Building_a_Resilient_CA.pdf

Regional Transportation Plan Guidelines



Section 2.4 (Federal Requirements) in the [RTP Guidelines for MPOs](#) adds two new planning factors to be considered in the RTP. One of these is *“Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation.”*

Chapter 6.30 in the [RTP Guidelines for MPOs](#) focuses on “Adaptation of the Regional Transportation System to Climate Change.” Recently signed state law provides important context for State agencies to collaborate with MPOs in considering climate impacts as they formulate their RTPs:

- AB 1482 directs ongoing updates to the [Safeguarding California Plan](#) and requires future updates to describe the

vulnerabilities from climate change in at least nine specific sectors, and the priority actions needed to reduce climate risks in each sector.

- SB 246 establishes the [Integrated Climate Adaptation and Resilience Program](#) at the Governor's Office of Planning and Research to coordinate regional and local efforts with the state's climate adaptation strategies. It is also meant to establish a climate adaptation clearinghouse that centralizes best scientific evidence, available climate data, and information for planning and implementing state, regional, and local climate adaptation projects. This bill also directs the Office of Emergency Services to update the California Adaptation Planning Guide, within one year of an update to the Safeguarding California Plan, to provide current tools and guidance to regional and local governments and agencies adopting and implementing climate adaptation and community resiliency plans and projects.
- SB 379 requires local hazard mitigation plans to incorporate climate impacts by 2021; through coordination with an update to local jurisdictions' General Plan Safety Element (see OPR's [2017 General Plan Guidelines, Chapter 4: Required Elements, p. 150-158](#)).

Exploring the Local Impact of Climate Change

Across the state, communities are experiencing the effects of extreme weather impacts now through an increase in the frequency and severity of extreme events and their associated significant costs to the government, Californians, and natural resources. What extreme weather events are impacting San Joaquin County now? State, regional, and local partners have explored this question and notable efforts are summarized in this section.

Climate Stressors in the Delta

The Sacramento-San Joaquin Delta includes approximately 500,000 acres of waterways, levees and farmed lands extending over portions of five counties: Contra Costa, Sacramento, San Joaquin, Solano, and Yolo. Significant portions of San Joaquin County lie within the Primary and Secondary Zones of the Delta. A public review draft of [Climate Change and the Delta: A Synthesis \(Delta Stewardship Council, March 2018\)](#) summarizes climate change stressors such as temperature, precipitation, and hydrologic patterns, frequency of extreme events, and sea level rise. These climate change stressors have the potential to affect the ecosystem of the Delta and the Delta's watershed, and consequently nearby communities.

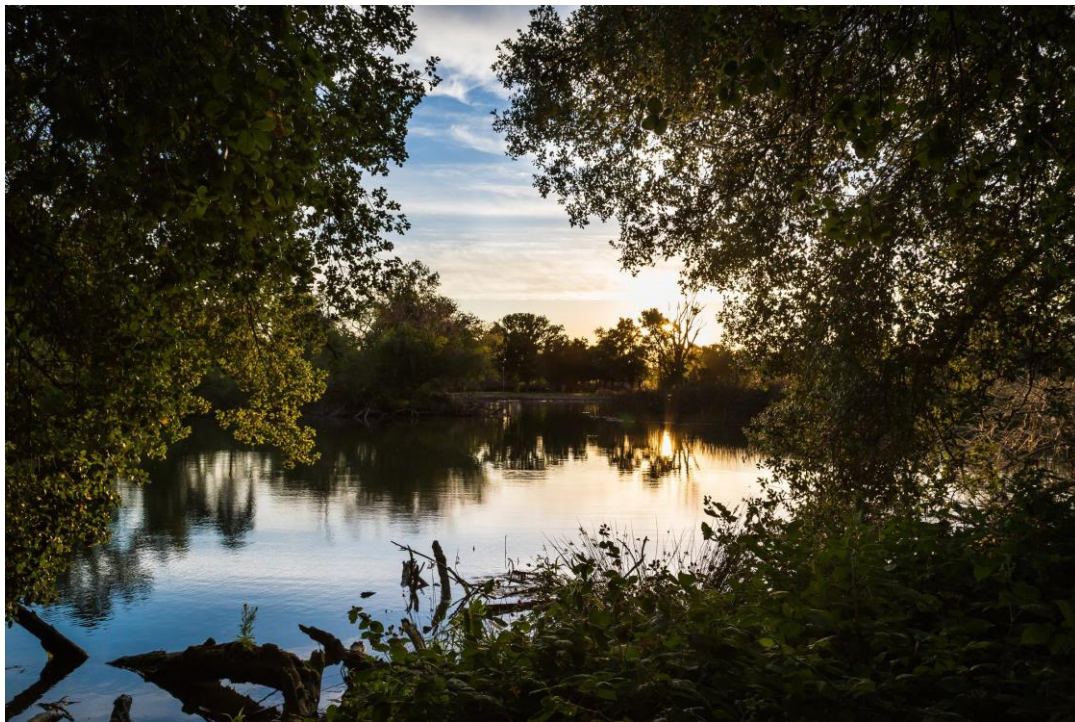
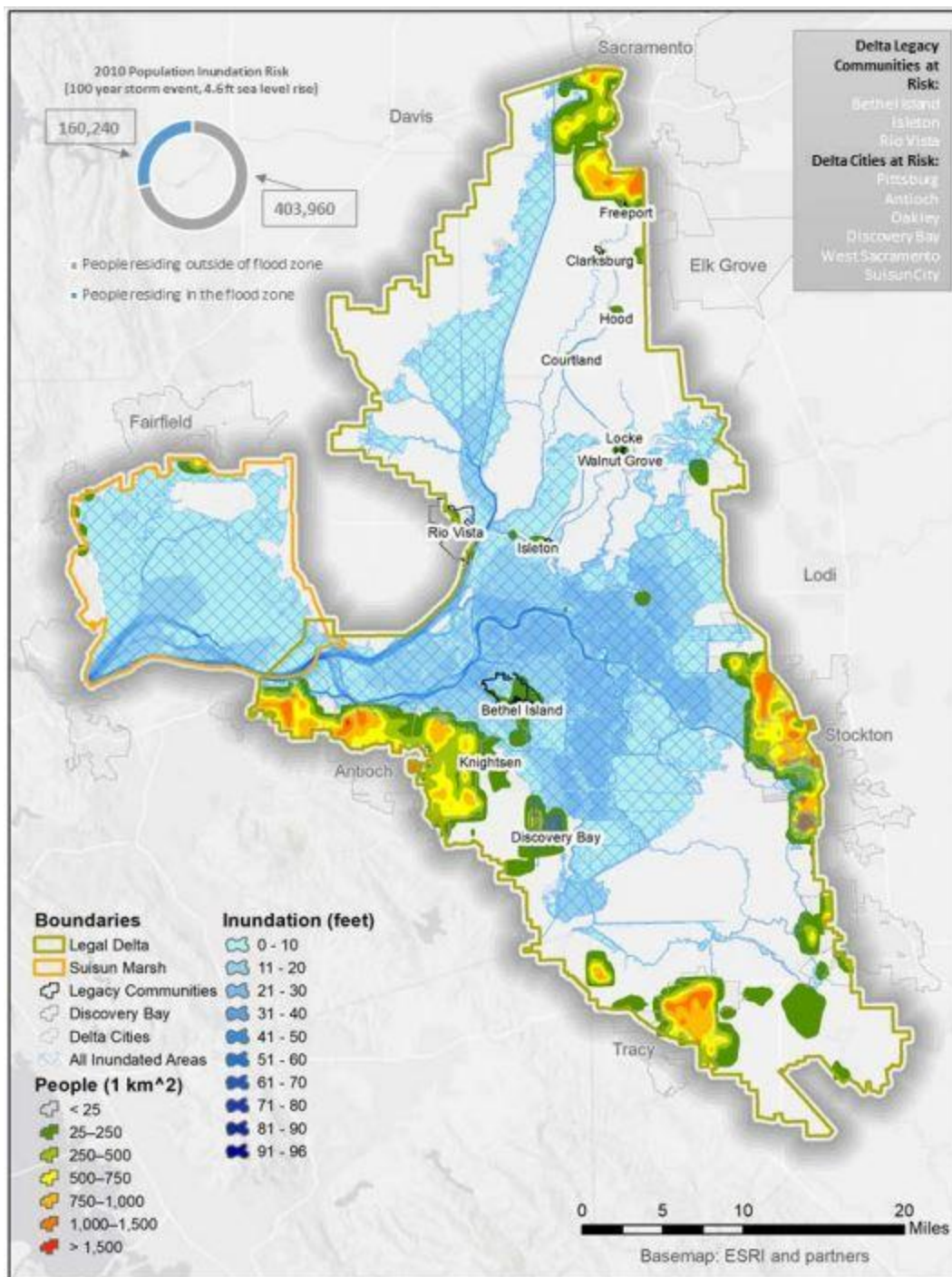


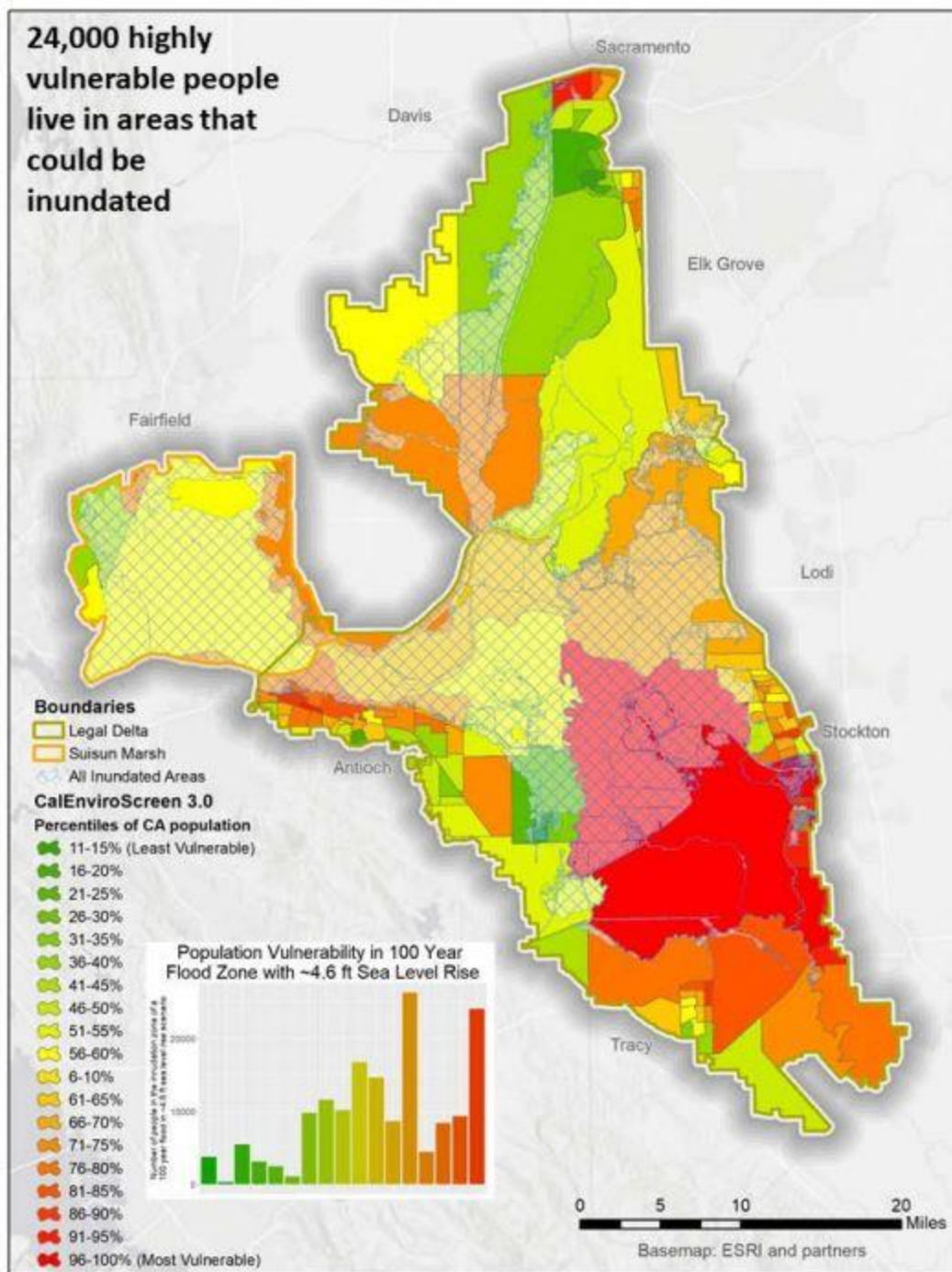
Figure 4: Photo of San Joaquin County Waterway, Mary Hinkle

In the next century, the Delta is likely to experience temperatures higher than those at present and warming is expected to be greater in areas farther from the coast. The temperature change in the San Joaquin Valley itself may drive more extreme weather events, but potential coastal sea level rise, higher water flows through the Delta system, and shifting Sierra Nevada precipitation patterns (decreased snowpack, more rain precipitation) may pose the greatest risks to the region. The potential risk of inundation threatens over 160,000 people Delta-wide based on 2010 populations, with the most vulnerable populations residing in San Joaquin County along the western portions of Stockton and Lodi (Figures 5 and 6) (Climate Change and the Delta: A Synthesis, DSC).



Sources: Radke et al 2017; SEDAC 2010; Delta Reform Act 2009; CalTrans 2015; Delta Plan 2013.
Disclaimer: This map reflects a risk-based approach of where inundation could impact human populations currently in the Delta and Suisun Marsh and does not incorporate population growth.

Figure 5: Inundation Risk to Human Populations (Source: Delta Stewardship Council)



Sources: Radtke et al 2017; CalEnviroScreen 3.0.

Disclaimer: This map reflects a risk-based approach of where inundation could impact vulnerable human populations currently in the Delta and Suisun Marsh and does not incorporate any demographic shifts.

Figure 6: Inundation Risk to Vulnerable People (Source: Delta Stewardship Council)

Vulnerability and the State Highway System

Additional data from the ongoing Caltrans District 10 Vulnerability Assessment will also inform regional understanding of climate change impacts to the state highway system. Caltrans is preparing this study concurrently with SJCOG's Phase One Adaptation Study. It is expected that state highway system risks and adaptation strategies will resemble those identified in the 2018 District 4 Vulnerability Assessment, which identifies the need for pavement able to withstand higher temperatures to diminish deterioration, increased ground saturation affecting retaining walls, infrastructure deterioration due to wildfire damage, and disruption to transit routes during these emergencies.

Local and Regional Planning Gaps

These climate change impacts will influence both the local transportation system and regional and local planning efforts (local Climate Action Plans, General Plan updates, and in-advance planning for the SJCOG 2022 RTP/SCS). Many local jurisdictions are studying the effects climate change may have on their communities and local transportation systems, and how to increase resiliency or adapt. While some have tackled climate action planning and have updated General Plans, others have either not done so, have outdated plans, or are updating now. This project will assist local jurisdictions through data sharing, technical assistance, and planning guides and tools -- all designed with their input and guidance -- to aid their efforts.

No comprehensive climate adaptation assessment for the region currently exists, and without such climate resiliency preparations, climate-related hazards would impede the state's overarching goals of assisting already several disadvantaged communities, especially San Joaquin County communities that lie within the threatened Delta region. This project would provide the tools, research, and implementation strategies local jurisdictions and regional entities need to accelerate current ongoing adaptation planning efforts. This vital implementation planning will inform local, regional, and statewide adaptation needs at the nexus of transportation and other priorities. These efforts, in close collaboration with statewide and local progress, will ensure that the San Joaquin region continues its push for transportation resiliency against extreme climate events. As San Joaquin County's regional planning agency, SJCOG can best coordinate existing local efforts, provide a conduit between local and state agencies, and continue its work with neighboring regions. With this project, SJCOG will leverage the regional partnership and provide jurisdictions and agencies input, results, and lessons learned as they work through adaptation planning efforts. Additionally, this funding would coordinate regional transportation planning and adaptation projects across jurisdictions through neighboring regions. Data gathering is crucial, but data and planning documents without robust technical tools, implementation guides, and leadership for action, cannot succeed.

Achieving Adaptation and Resiliency in San Joaquin County



Figure 7: Photo of Escalon Country Road, Susan Platt

According to SB 379, all cities and counties are required by the state to integrate climate adaptation and resiliency strategies into the safety element of their General Plan upon next revision. Because of this requirement, research efforts are happening now - looking at new tools and data for assessing sea-level rise, flood risk analyses, melting snowpack, excess rainfall, and other stressors. In summation, the plans around our county mostly regard the impacts these extreme weather events have on our levee and dam systems. SJCOG will be addressing these efforts and developing recommendations to ensure system-wide resiliency.

Assessing vulnerability to extreme weather changes is important for defining the risks posed by these events and provides information for identifying measures to adapt to the impacts. It enables practitioners and decision makers to identify the most vulnerable areas and assets. This means that adaptation options targeted at specified assets can be developed and implemented. Part of this project's context is built by relying on others throughout the region and the state that have already implemented measures to begin the adaptation process. We turn to the experts invited to join our working group to help us define this study and come up with resilience goals, and eventually recommendations to achieve resiliency in our transportation system.

Phase One is the first step in SJCOG’s commitment to addressing federal requirements and planning factors in the most recent RTP guidelines related to the improvement of the resiliency and reliability of the transportation system. A follow-up Phase Two study will be conducted after this Phase One study is finished. This Phase Two study will be an adaptation implementation plan that seeks to further the actionable recommendations of adaptation strategies that come out of the Phase One study. This Phase Two is the critical second step to achieving transportation resiliency in San Joaquin County

Phase One Study Objectives and Deliverables

The Climate Adaptation and Resiliency Study is a climate vulnerability assessment of the transportation system, considering impacts of changing precipitation patterns, flooding, high heat events, and wildfires on transportation infrastructure and subsequent consequences for communities and the region. The top five vulnerable transportation assets will be identified. In addition, the project team has carried out a survey of existing climate action and adaptation plans across the region (many by local governments) which documents the status of these plans and identifies resilience planning gaps for the region.

Work will culminate in recommendations for integrating and prioritizing resilience projects into the next RTP and capital improvement plans. Project findings and recommendations will be shared in a Climate Adaptation Report and Climate Summit that will occur around January of 2020.

PROJECT GOALS



In the first step of this study, ERG clarified project objectives, determined the geographic scope, assets, and possible climate impacts to be addressed within this project. The plan for stakeholder engagement was also set. Before the working group meeting and development of the stakeholder engagement plan, the project goals were defined and established. The goals establish a framework for the study and define the relationship between the Phase One study and the Regional Transportation Plan.

Stakeholder Engagement Plan/Working Group

For this study, SJCOG is relying on a diverse group of stakeholders for project support. Along with our consultant, we have developed a project Working Group (see Table 2) of government experts and key partners in transportation and climate adaptation who vet project methods, data sources, and interim deliverables. At the close of the project, a Regional Climate Change Summit will be organized with a broader group of people active in the adaptation “space” to provide feedback on the Climate Adaptation Report and offer recommendations for moving resilience forward.

What we have heard within our working group is there is a need to make sure solutions identified specifically address the transit dependent communities throughout our county. These communities are the ones that are most impacted by extreme weather events. SJCOG and ERG are using data related to environmental justice and Title VI analysis from the Regional Transportation Plan / Sustainable Communities Strategy (RTP/SCS) for both context and direction.

Table 2: Adaptation and Resiliency Study Working Group Members

Name	Title	Agency
Andrew Schwarz	Supervising Water Resources Engineer	Delta Stewardship Council
Darryl Rutherford	Executive Director	Reinvent South Stockton Coalition
David Kwong	Community Development Director	City of Stockton
Ed Lovell	Management Analyst II	City of Tracy
George Lorente	Grants Manager	San Joaquin Regional Transit District
Greg Showerman	Community Development Director	City of Manteca
Jasmine Leek	Founder and Director	Third City Coalition
Kate Anderson	Senior Environmental Planner	Delta Stewardship Council
Michael Robinson	Associate Transportation Planner	Caltrans
Sarah Rasheed	Executive and Legislative Coordinator	Altamont Corridor Express
Steve Larson	Grants Administration	Port of Stockton
Tammy Alcantor	City Manager	City of Escalon
Kris Balaji	Director	San Joaquin County Public Works
Glenn Gebhardt	City Engineer	City of Lathrop
Megan Aguierre	Senior Planner	San Joaquin County
Ron Elliott	Deputy Director	Stockton Metropolitan Airport
Lynn O'Connor	Chief, Office of System Planning	DOT (Caltrans District 10)
Juan Villanueva	Development and Planning Manager	Port of Stockton
Ken Zuidervart	Planning director	City of Ripon
Vince Hobbs	SJC Citizen	Retired from Fire Department
Paul Herman	Associate Planner	Altamont Corridor Express
Julia Tyack	Transportation Planner	City of Lodi

Resilience Goals

RESILIENCE GOALS

Maintain a multi-modal transportation network to deliver people, goods, and emergency services throughout the county, with a focus on vulnerable populations in floodplains and low-income communities with limited bus services.

Create and maintain redundancy in the transportation system to allow for rerouting during disruptions

Ensure operation of routes supporting evacuation, staging areas, and emergency response.

The project and resilience goals guide the foundation of the study. These goals were developed through feedback received based on priorities at the first working group meeting that occurred in April of this year. Some agencies around the table assisting us with this project include Caltrans, Delta Stewardship Council, SJRTD, representatives of jurisdictions, Third City Coalition, Reinvent South Stockton and several others. The group largely brought to our attention the severe need for system resiliency especially in rural neighborhoods and communities, but also the need for evacuation and emergency response availability. SJCOG and ERG are aiming for an overarching theme of system-wide transportation resiliency throughout San Joaquin County with these goals.

The resilience goals are the framework guiding the study. Once the study is finished, the response to these goals can be used in decision making and leveraged for local planning efforts.

Review and compile climate data and define climate scenarios

After initial data collection, ERG will move into a more comprehensive data collection and vetting process, leveraging the expertise of the working group members and their networks. Having identified the climate impacts and data of interest, ERG will define climate scenarios of interest for the final report and adaptation strategy based on the goals and scope identified by the working group. Best available science will be used, considering a range of potential future conditions.

The scenarios will impact recommendations for the final plan, and the selection needs to consider the interplay between short-term needs and long-term goals, and how timeframes can affect the planning process. To facilitate collaboration with stakeholders, ERG will produce short climate scenario statements that outline selected scenarios, justify their selection, and (simply) describe how the scenarios are built into the exposure analysis. Technical information on the scenarios and threats will be presented graphically. Visuals such as GIS, with well-known

reference points and landmarks, will depict impacts to the transportation system in ways that the public can easily understand.



Figure 8: Photo of Stockton Waterfront, Wayne Giles

Existing Conditions and Vulnerability Assessment



Figure 9: (Photo above) Photo of Ace Train

The Vulnerability Assessment is the most important piece of the study as it defines the top five transportation assets that are most affected by extreme weather changes. To prepare for this assessment, an existing conditions report is underway that assesses the baseline information and gaps in exposure of transportation assets to extreme weather impacts. In review for the existing conditions report, ERG will be looking for information that may support the assessment of the transportation system vulnerability, including:

- *Transportation assets in San Joaquin County that have already undergone a climate change vulnerability assessment.* For previously conducted assessments, the aim is to understand which climate impacts the plans did and did not include, and to what extent asset conditions were considered, as well as functions, and governance questions. This will be to pull in existing findings.
- *Climate data applied or referenced.* ERG will ensure that we are aware of the latest, highest-resolution and highest-quality data.
- *Transportation assets already identified as vulnerable.* If a plan labels a transportation asset as vulnerable and uses a county- or region-wide dataset to support that categorization, we will try to track down the data (e.g., culvert health throughout Caltrans District 10). If the asset is identified as vulnerable due to the asset manager's firsthand experience or similarly qualitative knowledge, we will also flag it for integration in our vulnerability assessment.

The transportation vulnerability assessment report will be organized by transportation category—for example, highways, rail (freight and passenger), ports. It will also describe extreme weather impacts on each transportation category and identify existing characteristics of the transportation system that make some segments more vulnerable to climate stressors than others. The draft report will call out specific assets that are highly vulnerable and could result in severe consequences to the region and communities if disrupted.

ERG will seek to identify important trends, such as increased transportation system vulnerability in certain parts of the county or increased impacts on public transit versus roads serving personal vehicles. The report will also provide tables that summarize vulnerability findings by asset and help readers understand which assets face the greatest risks. Table 1 provides an example of what such a report summary table could look like.

Asset Group	Specific Asset	Exposure	Sensitivity	Timing of Exposure	Regional Consequence	Asset Group Overall Vulnerability
Highways	Highway 1	HIGH (precip)	HIGH (precip)	Mid	HIGH	HIGH
	Highway 2	MEDIUM (precip)	HIGH (precip)	Near	HIGH	
	Highway 3	HIGH (fire, heat)	HIGH (fire, heat)	Mid	HIGH	
Trains	Train A	MEDIUM (heat)	LOW (heat)	Mid	MEDIUM	MEDIUM
	Train B	LOW (sea level rise, precip)	MEDIUM (sea level rise, precip)	Mid	MEDIUM	

Table 1: Example summary table from Vulnerability Assessment Report

Final Plan

After receiving feedback on the draft Vulnerability Assessment at the working group meeting, ERG will shift their approach from a transportation vulnerability assessment to a broader community dialogue on forming a regional resilience plan. Together we will identify gaps in current planning and develop recommendations to achieve regional and state adaptation and resiliency goals. We will address key planning gaps such as:

- What areas of the region have not had adequate climate adaptation planning efforts?
- What climate impacts have not been adequately studied to date?
- What transportation assets have not been assessed?

The gaps will be summarized and ranked in terms of their importance to the transportation system's overall integrity. For example, we will rank gaps affecting transportation nodes with high disruption consequences higher than those for transportation nodes that have readily available disruption avoidance options or less serious socioeconomic impacts. Gaps that prevent the region from reaching resilience goals will also be ranked higher than those that do not significantly impact goals.

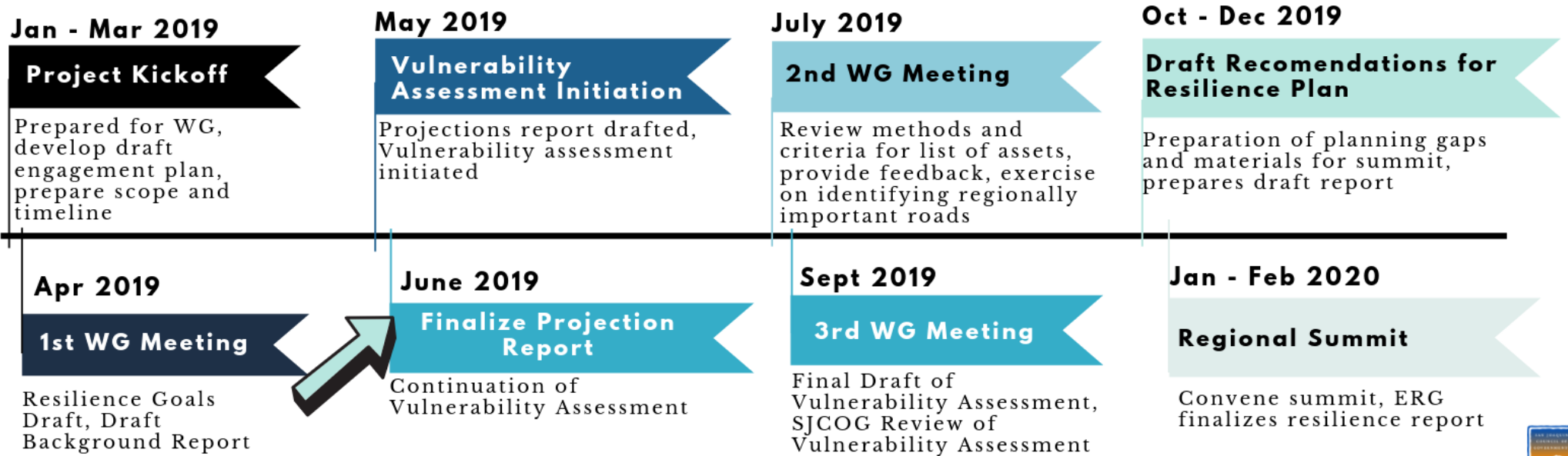
ERG will develop recommendations to fill these gaps and help achieve regional and state climate goals. Both a gap analysis and suggested recommendation summary will be provided in handouts at the regional summit.

Regional Summit

Following the steps outlined in the stakeholder engagement plan, ERG has prepared an initial invitee list (to include all working group members) and outlined a draft agenda for the regional climate change summit. ERG will revisit the summit plans with SJCOG and the working group giving thought to additional groups that may have valuable input given the nature of the planning gaps discussed at the summit.

At the summit, ERG will present a summary of its vulnerability assessment, an overview of predicted changes in climate stressors, and findings on adaptation planning gaps. The summit will serve as a soft-launch of the adaptation and resiliency report and its recommendations for adaptation planning in the county. ERG will frame the findings to be broader than just transportation and will highlight those that point to networked effects and extreme weather impacts to other sectors. We will also discuss needs to similarly assess other major sectors in the county and describe how future assessments will be more doable now that a methodology is in place. Following introductory information, the summit will be organized around engagement exercises that ask participants to provide feedback on a strawman proposal for the Phase Two Regional Resiliency Implementation Plan and Adaptation Guidance and how to move it forward. Finally, ERG will ask participants for input on proposed performance metrics for the plan. Incorporating any comments received at the summit, the report will be finalized.

SB1 Transportation Resiliency Study **TIMELINE OVERVIEW**



Phase Two Study and Deliverables

Based on the Phase One results and recommendations, SJCOG will create a Regional Resiliency Implementation Plan and Adaptation Guidance. The comprehensive regional implementation plan will preserve San Joaquin County's vital transportation assets from extreme weather events such as increased precipitation patterns, flooding, wildfire, extreme heat events, and sea level rise. This implementation plan will also address the unique risks and vulnerabilities identified by the Phase one study and other regional vulnerability assessments. The plan will strengthen cross-sectional partnerships, including transportation partners (cities, Port of Stockton, Stockton Metropolitan airport, transit providers) and community stakeholder groups. Additionally, the plan will focus on the region's disadvantaged and vulnerable populations' specific needs. Plan deliverables include risk assessment tools and an implementation guide to inform future policy. These deliverables will fully integrate resiliency and adaptation into SJCOG's planning and programming activities. The Phase Two study will be delivered through a recently awarded \$200,000 Caltrans competitive Adaptation Planning grant.

Project Objectives

The objective of the Regional Resiliency Implementation Plan and Adaptation Guidance is to take the data and recommendations from the Phase One Climate Adaptation and Resiliency study and develop a plan that will provide the framework and tools to address the previously identified asset vulnerabilities, planning gaps, and any functional or governance hindrances to advancing projects and programs to increase climate resiliency in the county. The final deliverables will include data evaluation tools and an adaptation planning implementation guide. This planning guide will prioritize policy statements and specific implementation actions to be taken based on an overall level and timing of risk, cost of implementation, and the likelihood of successful implementation. Specific project objectives are:

- Carry forward the data, vulnerability assessment, and implementation recommendations of SJCOG's on-going Phase One study to create a shared understanding between local, regional, and state agencies of adaptation planning needs in San Joaquin County
- Provide a focus on disadvantaged communities to ensure their needs are met and prioritized
- Provide a variety of tools for local and regional adaptation efforts to both ensure consistent approaches and methods for project development, but also recognize that communities will have different needs and capacity
- Strengthen existing collaboration and partnerships around climate impacts – and bring in new state and community partners as appropriate

- Expand SJCOG's role as a source of technical assistance and up-to-date information, guidance, and leadership for county-wide integration of resilience for member agencies, stakeholders, and the public
- Ensure local jurisdictions and other partners have the technical tools needed to consider expected climate impacts on transportation infrastructure

Deliverables

Needs Assessment and Engagement

The Vulnerability Assessment from SJCOG's Phase One study, applicable outcomes from the on-going Caltrans District 10 Vulnerability Assessment, and outcomes from the Delta Stewardship Council's Vulnerability Assessment for San Joaquin's Delta region will be synthesized in this needs assessment. The deliverables reflect a more in-depth look at the data and solutions for implementation. SJCOG and working group members will participate together in a workshop to develop the outcomes and objectives for the Regional Resiliency Implementation Plan and Adaptation Guidance. This includes assessing the outcomes and actionable items from the Phase One study. Together, we will identify missing and critical information needed from jurisdictions, regional transportation asset managers, and stakeholders.

Once we have identified the objectives and outcomes, SJCOG and the selected consultant will then develop a needs assessment protocol (Figure 10) that will help us better understand any local barriers to moving regional adaptation and resiliency planning forward. The needs could range among additional research, data, staff capacity, case studies or evaluation tools. The needs assessment will assist us in identifying gaps that could impede our ability to respond to climate stressors and will help to inform local, regional, and statewide planning efforts (e.g. mitigation plan updates, climate action plans, General Plan updates, or regional planning documents).

This study will have a focus on engagement with both local and regional partners and community residents. SJCOG and the selected consultant will engage with the community and collect surveys regarding their priorities. SJCOG and the selected consultant will conduct focused interviews with regional asset managers, jurisdictional staff and other stakeholders to understand the potential co-benefits of local needs and to help identify local resources and case studies. The answers and responses from these interviews will comprise a survey for the community engagement where we will collect the priorities of San Joaquin County residents.

Once we've received the input from both the community residents and local and regional stakeholders, a Regional Needs Assessment Report will be written that captures the adaptation planning needs of San Joaquin County. This report may also include research relevant to future studies or planning activities that will support local decision-making and policy changes.

Implementation Priorities

SJCOG will work with the selected consultant to develop a prioritization protocol which will allow each option to be evaluated through a list of pre-determined priorities.

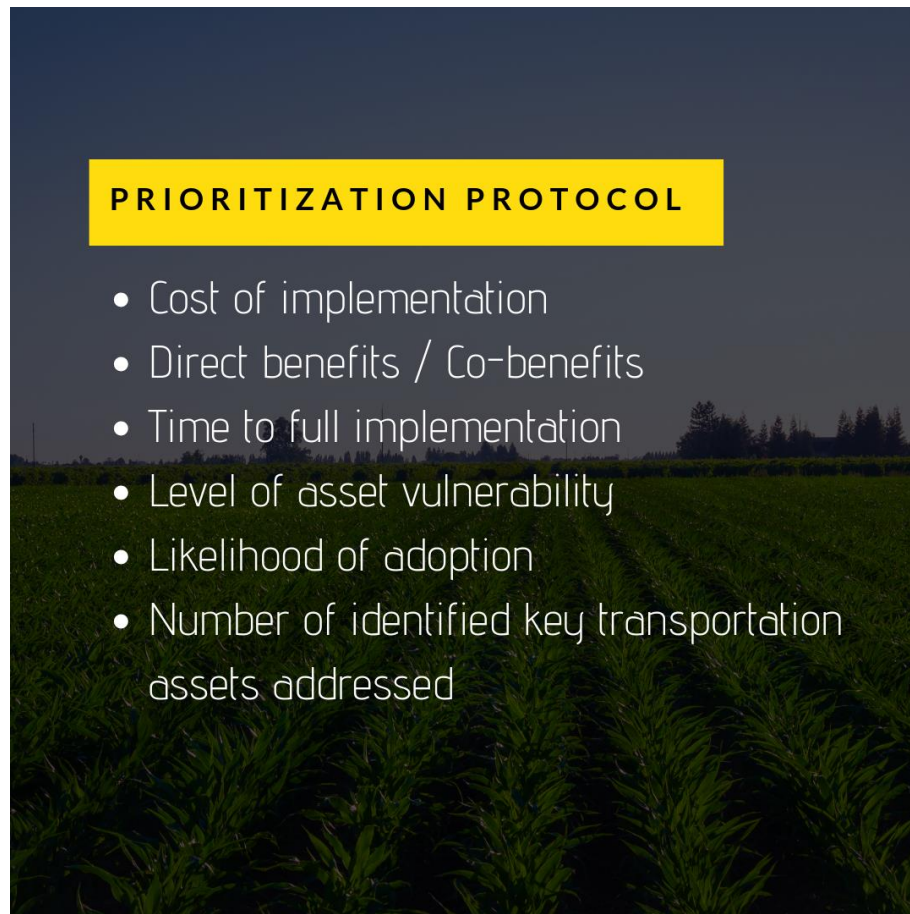


Figure 10: Prioritization Protocol as established by the Phase Two Scope of Work

Once the protocol is established, SJCOG will host a workshop to receive feedback on the list of resiliency solutions and prioritization. We will ask the attendees about their own planning gaps, barriers, and projects that will advance resiliency implementation in San Joaquin County. We will then develop a finalized prioritization protocol matrix (Figure 10) with implementation actions and a technical report describing the priorities in resiliency implementation.

Regional Resiliency Implementation Plan and Adaptation Guidance

Finally, the Regional Resiliency Implementation Plan and Adaptation Guidance will be composed based on the final list of strategies and actions for inclusion. The contents of the draft may change, but is set to be the following:

- Introduction to include a summary of previous work completed and the purpose of the plan
- A summary of the process of the plan development
- A description of each strategy or action, the time from implementation, expected co-benefits, and implementation level (state, local, regional) - cross-referenced by transportation asset type and climate vulnerability addressed.

We will take the draft document to our working group members and stakeholders for another workshop and will discuss the needs of an online toolkit or web-based data portal. We will also discuss next steps and strategies for implementation tracking.

Along with the document, a web-based data portal (Figure 11) will be developed that is meant for tracking adaptation and implementation. This data portal is expected to have the final plan and data downloads, and best practices examples for projects and programs.

California Climate Strategy

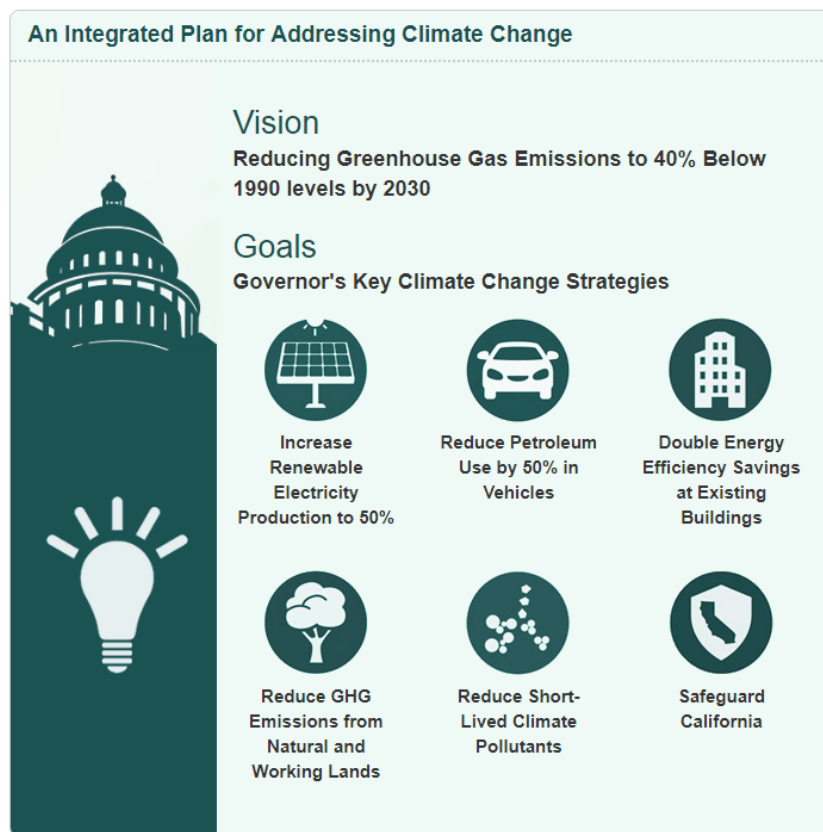


Figure 11: Example of web-based portal from the California Climate Change website climatechange.ca.gov

Examples from Other Regions

To meet new requirements and ensure future resiliency, many MPOs and regional planning agencies across the nation have begun plans to adapt their transportation systems and make them resilient to future environmental changes. Adaptation and resilience, although commonly used in partnership with one another in transportation planning, have different implications during planning and implementation processes. In practice, adaptation is the adjustment of transportation assets to new conditions. In this scenario, those new conditions are environmental changes that impact the functionality and efficiency of assets. While making these adaptations, it is essential that assets are made to be resilient: able to withstand and recover quickly from difficult conditions. When predictable or unpredictable future events impact transportation assets, they can quickly be restored to provide their intended services. Resilient transportation systems provide a foundation for a resilient community, empowering many activities of modern society. And although there are many potential future climate scenarios, some more impactful than others, all are likely to require some degree of adaptation.

Many state agencies—such as the California Coastal Commission (CCC), the California Energy Commission (CEC), and the California Department of Water Resources (DWR)—have developed approaches for understanding and assessing the potential impacts of a changing climate on California’s built environment. In California, there are a few general climate trends expected that evoke the need for transportation adaptation: rising sea levels, coastal erosions, increased temperatures, and more frequent heat waves as well as more severe wildfire seasons (Caltrans Climate Change Vulnerability Assessments: District 4 Technical Report). In response, Caltrans has planned, initiated or completed Climate Change Vulnerability Assessments across all 12 districts (Figure 12). The assessments identify and define the elements and locations of the highway system that may be exposed to changing environmental conditions and estimate the timing of these expected impacts, so they can be properly planned for and prioritized.



Figure 12: Caltrans Climate Change Vulnerability Assessment Key Elements

For example, the District 4 assessment found that an evaluation of US Route 101 near Corte Madera Creek in Marin County suggests that a sea level rise of 1.0 meter coupled with storm surges will frequently inundate portions of the roadway and flood the creek and Corte Madera Creek Bridge. Causing damage to the bridge in multiple ways (Caltrans Climate Change Vulnerability Assessment Summary Report: District 4). This finding indicates the need for a

vulnerability review by engineers of the current bridge and may lead to adaptation changes that are prioritized to be completed before this environmental change is estimated to occur.

The Sacramento Area Council of Governments (SACOG) completed a Regional Transportation Climate Action Plan in 2015 that takes previously studied climate change possibilities and applies their assumed impacts on the current transportation system. Using a Technical Advisory Committee (TAC), stakeholders were engaged to identify the most critical transportation assets and the potential damage done by potential climate risks. Transportation assets are categorized into nine areas: roadways, railways, bridges, walking and biking, drainage, traffic flow, public transit, buildings and facilities, and traffic controls. Focusing on four climate risk areas: extreme temperatures, precipitation, wildfire, and landslides; their consequences on the different assets are categorized into one of four damage classifications ranging from high likelihood of damage to low likelihood or no consequence.

After assessing the potential damage done under the four climate risk areas on these transportation assets, adaptation plans for each asset were created. Adaptation strategies fall into one of four categories. First, maintain and manage, enhancing policies and emergency response plans to improve severe event preparedness. Second, strengthen and protect; retrofit existing infrastructure and build new structures that better withstand extreme climate events. Or third, enhancing redundancy: creating alternatives to vulnerable transportation routes using alternative means of transportation. Or finally, retreat: relocate or abandon infrastructure located in highly vulnerable areas. Creating an adaptation framework for all vulnerable transportation assets that can then be included in any future policy, funding, or long-range planning decisions. Helping to ensure that Sacramento's transportation assets are resilient to any future climate consequences.

The Metropolitan Transportation Commission (MTC) has completed a series of projects to understand the vulnerability of sea level rise inundation and storm event flooding on their transportation infrastructure. The region has been dealing with the current challenge of upgrading and seismically retrofitting aging infrastructure but MTC also recognizes that these systems were not designed to be resilient to changes to precipitation, temperature, and increased flooding due to sea level rise. Called Adapting to Rising Tides (ART), their methods will be implemented throughout SJCOG's Climate Adaptation and Resiliency Study.

The ART process emphasizes convening and closely collaborating with a stakeholder working group representing the diverse values, viewpoints, and responsibilities relevant to the vulnerable asset assessment. The assets they reviewed were interstates and highways, passenger and cargo rail, BART, walking and biking trails, and transit services as well as priority development areas, and priority conservation areas. They also included community members with characteristics that make them more vulnerable to flooding in the assessment process.



Figure 13: Metropolitan Planning Commission, Adapting to Rising Tides Planning Process

After completing an inventory of all their assets, the climate impacts study details the flooding inundation map and overtopping analysis of their previously identified assets. The subsequent risk assessment identifies the vulnerability of assets to different levels of sea level rise and flooding. Adaptation measures are then created with the use of risk profiles: ranking the assets level of prioritization based on its level of exposure to climate forces, sensitivity to climate stressors, adaptation capacity, the consequences if it is permanently or temporarily out of use, and two other measurements specific to ocean shore changes. Suitable adaptation measures that reduce the risk of inundation from sea level rise combined with the risk profiles will then facilitate the prioritization of projects. The ART project recognizes that adaptation will come from multiple areas, whether they be asset specific, region-wide or policy-oriented and those collaborative partnerships will be vital in achieving adaptation and resilience.

Outside of MPO's, private entities are also investing funding in creating resilient communities. The [100 Resilient Cities](#) project supports the adoption and incorporation of resilience that includes not just shocks—earthquakes, fires, floods, etc.—but also the stressors that weaken the fabric of a city on a day to day or cyclical basis. By funding positions in local government that focus on building resilient efforts, collaboration between many partners is utilized to improve responses to future challenges. Better responding to adverse events and better able to deliver basic functions in both good times and bad, to all populations.

In their urban resilience framework, infrastructure and environment are a key part of the community system. Man-made and natural systems provide critical services, protect, and connect urban assets enabling the flow of goods, services, and knowledge. Therefore, the maintenance of these assets so they can ensure continuity of critical services and provide reliable mobility and communication are essential. To aid in achieving resilience, 100 Resilient

Cities partners and employees work to integrate resilience and adaptation frameworks into planning, development and funding decisions made by local governments.

Preparing for Extreme Weather Impacts to Transportation Systems: Adaptation Planning in San Joaquin County

The following summarizes adaptation planning directly and indirectly targeted at transportation infrastructure in San Joaquin County. The research includes a review of adaptation plans by the county, regional and state agencies, cities, and transportation managers. In cities where climate change adaptation planning has been limited, this section also summarizes hazard mitigation plans, General Plan safety elements, and related plans given that adaptation planning and hazard mitigation are closely linked.

Adaptation planning at the county-scale

1. [San Joaquin County Climate Change and Health Profile Report](#) (2017): This report, produced by the CA Department of Public Health and UC Davis, considers health impacts of climate change in the county and evaluates specific subgroups that expected to be most vulnerable (e.g. very young, very old). While it does not evaluate risks to specific transportation assets, the report highlights that climate-related extreme weather events can damage roads and impede access by emergency responders and health care personnel.
2. [San Joaquin County Emergency Operation Plan](#) (2019): The goal of this plan is to create an incident management structure and flexible platform for planning and responding to all hazards, incidents, events, and emergencies. Climate change is identified as one hazard facing the County. The plan identifies flood/levee break/dam failure, drought, excessive heat, and climate change as among about a dozen threats and hazards most likely to occur. Regarding climate change specifically, the plan discusses how changing patterns of melting snowpack and rainfall could stress the levee system and dams around the County.

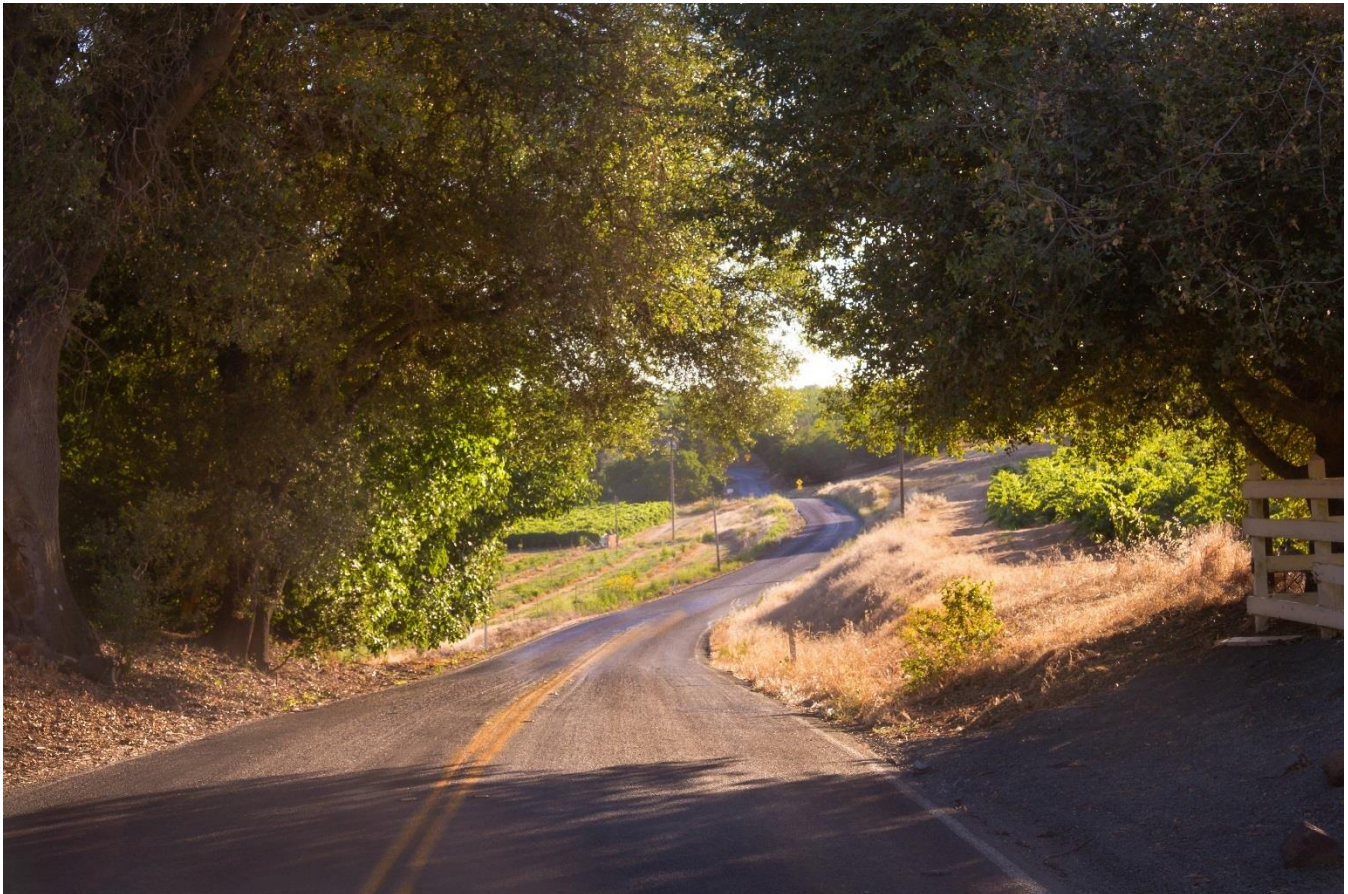
The plan calls out the need to provide services to transit-dependent populations before, during, and after an incident. It describes County Office of Emergency Services (primary) and Public Works (secondary) responsibilities for monitoring, identifying alternative routes, and coordinating recovery of transportation assets and providers should transportation systems be damaged. The plan identifies Interstate 5, 205, 580 and Highways 99, 12, 88, 4, 120, 132, and 26 as possible evacuation routes.

Several of the subject-specific annexes to the plan are still being finalized. The following hazard annexes are currently available:

- a. **Extreme Heat (2018):** Identifies actions and division of responsibility for ensuring vulnerable populations have transportation access to Cooling Centers. It also highlights potential impacts of extreme heat on the transportation system and utilities.
- b. **Flood and Dam Failure Hazard Annex (2019):** The annex is focused on how agencies will coordinate in the event of a flood. Flood zones are defined by the FEMA 100-yr and 500-yr flood plains, noting that high-use highways and roadways are included in the flood plain. The FEMA defined floodplains do not include future climate change projections.

3. [San Joaquin County General Plan](#) (2016): The Public Health and Safety element of the General Plan describes emergency response to natural hazard risks, including flooding, earthquakes, and liquefaction. The Public Health and Safety element of the General Plan aims to maintain efficient emergency response in the face of disasters and protect the County from potential effects of climate change. Four County communities (Bellota, Clements, Linden, and Lockeford) are identified as communities at risk for wildland fire. The Plan includes an Appendix focused on Sustainability Policies and Programs. Besides GHG reduction programs, the appendix calls for a range of climate adaptation programs. For example, the appendix calls for creation of a County program to monitor climate impacts and implement adaptive management strategies as well as a range of plans related to levee maintenance, multi-purpose flood control projects, and emergency flood response.
4. [Regional Transportation Plan/Sustainable Communities Strategies \(RTP/SCS\)](#) (2018). The RTP/SCS identifies transportation infrastructure durability and resiliency as a priority and indicates that SJCOG will be partnering with local jurisdictions to ensure that the region is prepared for climate change impacts and other natural hazards. The plan notes that regional resiliency to climate impacts will be achieved not only through resilient transportation investment, but also through increasing affordable housing availability, encouraging sustainable land use planning to reduce farmland loss, and investing in sustainable transportation modes. The RTP/SCS explains that local agency climate action plans are instrumental in these activities. The RTP/SCS will push forward adaptation planning efforts in the region by supporting a series of studies including the SJCOG Climate Adaptation and Resiliency Study.

Figure 14: Photo of Jahant Road, Mary Hinkle



Adaptation planning beyond the County-scale:

1. **Delta Regional Climate Change Vulnerability Assessment and Adaptation Strategy** (in progress): The Strategy will provide critical support to the Council to improve understanding of regionally specific climate change risks and address how Sacramento-San Joaquin Delta communities, infrastructure, and the ecosystem can adapt to future conditions. Phase One is focused on assessing vulnerability of Delta assets to climate impacts including changing precipitation and runoff patterns, air and water temperature, and sea level rise. In the adaptation phase (Phase Two), the project will evaluate alternative responses that could be implemented in the Delta region or elsewhere. For each recommended strategy, the project will include a general assessment of costs and benefits, governance, and opportunities for Council action and leadership
2. [**Central Valley Flood Protection Plan \(CVFPP\)**](#) (2017): This update to the original 2012 plan refines the overall near-term and long-term investment needs and includes recommendations on policies and financing to support comprehensive flood risk management actions locally, regionally, and system-wide. Key updates to the plan include significant State investment in levees and other flood risk reduction improvements to protect major urban areas and levee improvements and non-structural flood control improvements for small communities. Changes for rural areas include construction of all-weather access roads on top of rural levees and repair of identified weak spots in the levees. Other changes focus on improving operations and maintenance of the flood control system and better-coordinating releases from large reservoirs. The plan works toward 200-year flood protection for urban areas. In identifying flood risk and required upgrades to levees and reservoirs, the plan draws on models of the systems under projected climate change given changing hydrology and sea level rise.
3. **Caltrans District 10 Vulnerability Assessment (in progress)**: The assessment identifies potential exposure of the District 10 California State Highway System and other Caltrans assets to future changes in climate. Caltrans will use the vulnerability assessment to inform a subsequent adaptation plan.

Summary: Several existing County plans call out the need for the County to adapt to a changing climate and protect transportation infrastructure from natural hazards and climate stressors. The importance of maintaining transportation systems for emergency operations is repeatedly stressed though only the Emergency Operations Plan calls out specific routes to be prioritized: interstate 5, 205, 580 and highways 99, 12, 88, 4, 120, 132, and 26 as possible evacuation routes. To date, several County plans have looked closely at flood risk in the county, with the CVFPP going into great depth. The Delta Regional Climate Change Vulnerability Assessment and Caltrans District 10 Vulnerability Assessment (in progress) will be the first at the County scale (or beyond) to look at exposure to a range of climate change impacts.

Adaptation Planning at the City-Level (within San Joaquin County)

Cities in San Joaquin County have undertaken limited planning work to assess their vulnerability to the full range of climate impacts and comprehensively integrate adaptation into their General Plan, climate action or resiliency plan, or similar documents. That said, the City of Stockton has committed to a comprehensive climate change vulnerability assessment and adaptation planning process in the future. The cities and county have already undertaken a considerable effort to understand their flood risk, especially under 200-year flood conditions in urban areas to meet requirements of SB 5 (City of Stockton, Community Development). As shown in Table 3, 200-year flood protection is being integrated into General Plan amendments. In addition, cities, the County, and reclamation districts are collaborating to address the 200-year flood protection requirement in reclamation districts (RD) of overlapping authority. For example, the County and cities of Stockton, Lathrop, and Manteca have entered a Memorandum of Understanding to collaborate on levee improvements in RD 17. Though the 200-year flood protection requirement does not require modeling of climate change impacts, DWR recommends this. See Table 3 for context.

*Note for Table 3: The natural hazards described in these plans are likely directly or indirectly connected to climate change (i.e., change in magnitude/frequency). However, they are identified separately if the plan does not make a connection to climate change, nor does it anticipate how these hazards may change over time.

Page left intentionally blank.

Table 3: SJC Plans Review

City	Plan	Climate Change Impacts Explicitly Identified and Considered?	Current Natural Hazards Addressed (though not assessed in terms of climate change) *	Key transportation adaptation projects highlighted? Implemented?	Additional Notes
Escalon	General Plan (2005, updated 2010)	Plan calls on City to coordinate with regional agencies on transportation and climate change impact projects.	Wildfire, flooding, seismic hazards	Plans calls for city to establish a network of streets to improve emergency vehicle access.	
Lathrop	Comprehensive General Plan (2004)	No	Flooding, seismic hazards Detailed descriptions of flood control and levee improvement plans with a focus on meeting FEMA 100-year flood protection.	Discussion of locating the ACE train at Stewart Tract	

Lathrop	General Plan Amendment of 2015: SB 5 200-Year Flood Protection	To some extent. Calls out actions to consider climate change in planning, design, and maintenance of levees and flood control. Climate impacts are not quantified in this document.	N/A		This amendment addressed new “Urban Level of Flood Protection” requirements (200-year protection in urban areas) that were established since the last General Plan Update.
Lodi	Climate Action Plan (2014)	No	No. Plan is focused on GHG emissions reduction.	Calls for more telecommuting (intended to reduce GHGs)—this has the co-benefit of helping the community adapt if transport is interrupted.	Strong focus on expanded transit.
Manteca	Climate Action Plan (2013)	Yes, explains need to plan for wildfire and flood risk given climate impacts.	N/A	N/A	The plan states that at time of publication, there were no studies indicating increased flood risk in Manteca due to climate change (though plan notes that the science could change).

Manteca	General Plan (2010)	No	Flooding, seismic hazards	N/A	SR120/McKinley Avenue Interchange Project begins construction this year
Ripon	General Plan (2004)	No	Wildfire, flooding	N/A	
Stockton	General Plan: Envision Stockton 2040 (2018)	To some extent. Calls for a comprehensive climate change vulnerability assessment upon next revision of the City's Local Hazard Mitigation Plan to inform development of adaptation and resilience policies.	Wildfire, seismic, flooding.		Includes plans to provide "Urban Level of Flood Protection" (200-year protection in urban areas)
Stockton	Climate Action Plan (2014)	No.	No.	N/A	Strong focus on expanded transit.
Tracy	Sustainability Action Plan (2011)	No.	No.	N/A	26 actions to encourage transit and walking and reduce vehicle miles traveled.

Tracy	Tracy Local Hazard Mitigation Plan (update in process)	No.	Flooding, wildfires, drought, extreme heat, seismic hazards.	N/A	Calls for improvements to specific levees. Identifies an area southwest of the city with high fire risk (due to a history of fires).
-------	--	-----	--	-----	--

Adaptation Planning Outside-County Boundaries:

1. [BART Sustainability Action Plan](#) (2017): Assesses the BART system's vulnerability to extreme weather and future climate impacts and outlines strategies to address these vulnerabilities across the system.
2. [BART Sea Level Rise and Flooding Resiliency Study](#) (ongoing): This study provides a more detailed assessment of sea level rise and flood vulnerability of a set of BART assets already flagged as facing higher flood risk. The study will cause plans and strategies to address these vulnerabilities.
3. [Capital Corridor Alviso Wetland Railroad Adaptation Alternatives Study](#) (in progress): This study evaluates sea level rise adaptation alternatives for railroad tracks in the Alviso wetland to improve resilience of railroad infrastructure, enhance habitat restoration, and ensure that such infrastructure can support plans for increased train capacity.
4. [Sacramento Regional Transportation Climate Adaptation Plan](#) (2015): This work started with a high-level climate change vulnerability assessment and led to an adaptation plan for the region's transportation infrastructure (also high-level). The plan is a framework to guide future adaptation work and inform planning for transportation investments.
5. [Sacramento Transportation Project-Level Climate Adaptation Strategies for the Sacramento Region](#) (in progress): Building on the 2015 plan, this work will conduct a more detailed climate change vulnerability assessment for the transportation system and specific adaptation strategies. Outcomes from this project will include policies in SACOG's MTP/SCS that specifically address climate impacts to the transportation network and strategies to ensure its resiliency. Outcomes will also include the integration of climate adaptation-related selection criteria into SACOG's biennial transportation funding programs.
6. [Caltrans District 4 Vulnerability Assessment \(2018\)](#): The assessment identifies potential exposure of the District 4 California State Highway System (San Francisco Bay Area) and other Caltrans assets to future changes in climate. The assessment considers sea level rise, storm surge, extreme precipitation, temperature change, and wildfires. Caltrans will use the vulnerability assessment to inform a subsequent adaptation plan. This work resulted in a public-facing summary document and a technical background report.

In neighboring counties, there are examples of detailed studies of transportation system vulnerability and adaptation planning, with some of these studies complete and other ongoing. These neighboring projects can serve as a source of lessons learned for designing, carrying out, and building momentum for this work.

Sources

100 Resilient Cities. <http://www.100resilientcities.org/>

Caltrans Climate Change Branch. <http://www.dot.ca.gov/transplanning/ocp/climate-change.html>

Caltrans. *Climate Change Vulnerability Assessment: District 4 Technical Report*
http://www.dot.ca.gov/transplanning/ocp/docs/rCT_D4_Technical_Report_VerAL.pdf

Caltrans. *Climate Change Vulnerability Assessment: District 4 Summary Report*
http://www.dot.ca.gov/transplanning/ocp/docs/D4_Caltrans_Vulnerability_Assessment_v49.pdf

City of Burlington. *What is a Climate Action Plan?* 2014
<https://www.burlingtonvt.gov/Sustainability/CAP>

City of Stockton. *State Flood Information*. 2018.
<http://www.stocktongov.com/government/departments/communityDevelop/cdBuildState.html>

Delta Stewardship Council. *Climate Change and the Delta: A Synthesis*. 2018.
<http://deltacouncil.ca.gov/sites/default/files/2018/04/2018-03-23-Climate-Change-and-the-Delta-Public-Draft.pdf>

Encyclopedia.com. *Extreme Weather*. 2008. <https://www.encyclopedia.com/environment/energy-government-and-defense-magazines/extreme-weather>

Metropolitan Planning Commission, *Adapting to Rising Tides: Transportation Vulnerability and Risk Assessment Briefing Report* http://www.adaptingtorisingtides.org/wp-content/uploads/2015/04/RisingTides_BriefingBook_sm.pdf

Resilient California, *Transportation Project-Level Climate Adaptation Strategies for the Sacramento Region* <https://resilientca.org/case-studies/transportation-project-level-climate-adaptation/>

Sacramento Area Council of Governments, *Sacramento Region Transportation Climate Action Plan*
<https://www.sacog.org/sites/main/files/file-attachments/fullplanwithappendices.pdf>

World Bank, The. *Climate & Disaster Risk Screening Tools: Key Terms*. 2019.
<https://climatescreeningtools.worldbank.org/content/key-terms-0>