SACRAMENTO COUNTY

2016 Sacramento Countywide Local Hazard Mitigation Plan Update

Public Review Draft

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Executive Summary

Sacramento County prepared this Local Hazard Mitigation Plan (LHMP) to guide hazard mitigation planning to better protect the people and property of the County and participating jurisdictions from the effects of natural disasters and hazard events. This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed in order for the County and participating jurisdictions to be eligible for certain federal disaster assistance, specifically, the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) Program, and the Flood Mitigation Assistance (FMA) Program.

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated. The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards

The Sacramento County LHMP is a multi-jurisdictional plan that geographically covers the entire area within Sacramento County's jurisdictional boundaries (hereinafter referred to as the planning area). While many more local jurisdictions participated in the development of this LHMP, the following jurisdictions participated in the planning process and are seeking approval of this LHMP plan:

- Sacramento County*
- Brannan Andrus Levee Maintenance District (RDs 317, 407, 2067)
- City of Citrus Heights*
- City of Elk Grove*
- City of Folsom*
- City of Galt*
- City of Isleton
- City of Rancho Cordova*
- City of Sacramento*
- Cosumnes Community Services District Fire Department*
- Los Rios Community College*
- Reclamation District 3
- Reclamation District 341*
- Reclamation District 369
- Reclamation District 551
- Reclamation District 554
- Reclamation District 556
- Reclamation District 563
- Reclamation District 744
- Reclamation District 755
- Reclamation District 800*
- Reclamation District 813

- Reclamation District 1000*
- Reclamation District 1002
- Reclamation District 1601
- Reclamation District 2110
- Reclamation District 2111
- Sacramento Area Sewer District
- Sacramento Metro Fire District
- Sacramento Regional County Sanitation District*
- Southgate Recreation and Park District*
- Twin Rivers School District*

* Participated in 2010 Plan

LHMP Plan Development Process

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This plan documents the hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the County and participating jurisdictions will use to decrease vulnerability and increase resiliency and sustainability in the community.

This LHMP was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. The County and participating jurisdictions followed a planning process prescribed by FEMA as detailed in Table ES-1.

Table ES-1 Local Hazard Mitigation Planning Process

DMA Process	Modified CRS Process
1) Organize Resources	
201.6(c)(1)	1) Organize the Planning Effort
201.6(b)(1)	2) Involve the Public
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies
2) Assess Risks	
201.6(c)(2)(i)	4) Identify the Hazards
201.6(c)(2)(ii)	5) Assess the Risks
3) Develop the Mitigation Plan	
201.6(c)(3)(i)	6) Set Goals
201.6(c)(3)(ii)	7) Review Possible Activities
201.6(c)(3)(iii)	8) Draft an Action Plan
4) Implement the Plan and Monitor Progress	
201.6(c)(5)	9) Adopt the Plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan

The planning process began with the organizational phase to establish the hazard mitigation planning committee (HMPC) comprised of key County and City representatives, and other local and regional stakeholders; to involve the public; and to coordinate with other departments and agencies. A detailed risk assessment was then conducted followed by the development of a focused mitigation strategy for the Sacramento County planning area. Once approved by Cal OES and FEMA, this plan will be adopted and implemented by Sacramento County and the participating jurisdictions over the next five years.

Risk Assessment

The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to the Sacramento County planning area, assessed the vulnerability of the planning area to these hazards, and examined the existing capabilities to mitigate them.

The County is vulnerable to numerous hazards that are identified, profiled, and analyzed in this plan. Floods, levee failures, drought, wildfires, and other severe weather events are among the hazards that can have a significant impact on the Sacramento County planning area. Table ES-2 details the hazards identified for the Sacramento County LHMP.

Table ES-2 Sacramento County Hazard Identification Assessment

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Agricultural Hazards	Significant	Highly Likely	Critical	Medium	Medium
Bird Strike	Limited	Highly Likely	Critical	Medium	Low
Climate Change	Extensive	Highly Likely	Critical	High	–
Dam Failure	Significant	Unlikely	Catastrophic	Medium	High
Drought and Water Shortage	Extensive	Likely	Limited	High	High
Earthquake	Limited	Occasional	Critical	Medium	None
Earthquake: Liquefaction	Significant	Occasional	Limited	Medium	None
Flood: 100/200/500-year	Significant	Occasional/Unlikely	Catastrophic	High	High
Flood: Localized Stormwater Flooding	Limited	Highly Likely	Limited	Medium	High
Landslides	Limited	Unlikely	Negligible	Low	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	High
River/Stream/Creek Bank Erosion	Limited	Highly Likely	Limited	Medium	High
Severe Weather: Extreme Temperatures – Cold/Freeze	Extensive	Likely	Limited	Low	High
Severe Weather: Extreme Temperatures – Heat	Extensive	Highly Likely	Critical	High	High
Severe Weather: Fog	Extensive	Highly Likely	Limited	Low	Medium
Severe Weather: Heavy Rains and Storms (Thunderstorms, Hail, and Lightning)	Extensive	Highly Likely	Critical	Medium	High
Severe Weather: Wind and Tornadoes	Limited	Highly Likely	Limited	Low	Medium
Subsidence	Significant	Highly Likely	Limited	Low	Medium
Volcano	Limited	Unlikely	Limited	Low	None
Wildfire:(Burn Area/Smoke)	Significant	Highly Likely	Limited	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Probability of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Mitigation Strategy

Based on the results of the risk assessment, the HMPC developed a mitigation strategy for reducing the Sacramento County planning area's risk and vulnerability to hazards. The resulting Mitigation Strategy for the Sacramento County planning area is comprised of LHMP goals and objectives and a mitigation action plan which includes a series of mitigation action projects and implementation measures.

The goals and objectives of this Sacramento County LHMP are:

Mission Statement: This LHMP assesses natural hazards of concern to the Sacramento community; evaluates risk to life safety, public health, property, and the environment; and evaluates mitigation measures to reduce these risks and vulnerabilities, minimize losses, and increase community resilience.

GOAL 1: Minimize risk and vulnerability of the Sacramento County community to the impacts of natural hazards and protect lives and reduce damages and losses to property, public health, economy, and the environment.

Objectives:

- Protect, preserve, and promote public health and safety, livability, and the environment
- Assure long term protection and resiliency of existing and future development (including infill areas) from natural hazards
- Protect critical facilities from natural hazards and minimize interruption of essential infrastructure, utilities, and services
- Protect natural resources; Protect and enhance water quality and supply, critical aquatic resources and habitat for beneficial uses.
- Maintain/enhance the flood mitigation program to provide 100/200/500 year flood protection
- Minimize risk of levee breach, overtopping or other failures
- Mitigate Repetitive Loss Properties
- Continued enhancement of CRS programs
- Address localized drainage issues
- Reduce the potential of wildfire in Sacramento County and protect the community
- from adverse effects of wildfire, including secondary impacts such as air quality
- Protect vulnerable populations from the threat of natural hazards
- Address climate change influence in project design and development
- Promote hazard mitigation as an integrated public policy and as a standard business practice

GOAL 2: Improve public outreach, awareness, education, and preparedness for all hazards to minimize hazard related losses

Objectives:

- Increase outreach, communication and awareness of natural hazards and reduce exposure to all hazard related losses, including climate change
- Improve the communities' understanding of natural hazards and how to effectively be prepared and take action to mitigate the impacts of hazard events
- Develop and target outreach and education for each hazard type and risk area

- Increase access to natural hazard information via enhanced web and mobile applications before, during, and after a disaster
- Enhance public outreach programs to target all vulnerable populations, including multi-language communications and multi-mode delivery
- Continued promotion of flood insurance

GOAL 3: Improve the capabilities of the community to mitigate losses and to be prepared for, respond to, and recover from a disaster event

Objectives:

- Promote interagency coordination of mitigation planning and implementation efforts
- Minimize hazard-related damage in order to maintain current service levels
- Continued enhancements to emergency services capabilities, integrating new technologies to reduce losses and save lives
- Promote intergovernmental and interagency coordination, planning, training, exercising and communication to ensure effective community preparedness, response, and recover
- Increase the use of coordinated, shared resources between agencies
- Promote public/private partnerships in hazard mitigation and preparedness programs
- Identify, coordinate, and implement countywide evacuation and shelter in place planning for all populations and increase community awareness of these activities

GOAL 4: Assure conformance to Federal and State Hazard Mitigation Initiatives and Maximize Potential for Mitigation Implementation

Objectives:

- Maintain FEMA Eligibility/Position Jurisdictions for Grant Funding
- Maintain good standing with FEMA and State hazard mitigation programs, regulations and requirements
- Develop an overall mitigation funding strategy to prioritize and pursue mitigation projects in an equitable manner to benefit all populations
- Maximize funding opportunities through identification and tracking of all types of Federal and state grant programs to implement identified mitigation projects

Actions to support these goals are shown on Table ES-1.

Table ES-3 Sacramento County Planning Area Mitigation Actions

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Sacramento County						
Multi-Hazard Actions						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan		2011 Action	X	X	X	
Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness		2011 Action	X	X		
Increase pedestrian and bicycle evacuation routes by constructing regional bike/pedestrian trail infrastructure, and expanding connection to neighborhoods (particularly in vulnerable areas)		New Action	X	X		
Community Rating System (CRS) Program for Public Information (PPI)	1, 2, 3, 4	2011 Action	X	X	X	
Flood Insurance Assessment, Awareness, and Promotion	1, 2, 3, 4	New Action	X	X	X	
Public Outreach Mailers	1, 2, 3, 4	2011 Action	X	X	X	
Public Outreach Mailers	1, 2, 3, 4	2011 Action	X	X	X	
Community Rating System (CRS) Program for Public Information (PPI)	1, 2, 3, 4	New Action	X	X	X	
Flood Insurance Assessment, Awareness, and Promotion	1, 2, 3, 4	New Action	X	X	X	
Climate Change Actions						
Increase average fuel efficiency and reduce GHG emissions from the County Fleet and Fuels		New action	X	X		
Reduce Sacramento County's vulnerability to Climate Change by reducing GHG emissions in the commercial and residential sectors by making energy efficiency a priority through building code improvements		New action	X	X		

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Mitigate Climate Change impacts by integrating climate change research and adaptation planning into County operations and services		New action	X	X		
Reduce Sacramento County's vulnerability to extreme heat events and associated hazards by Increase tree planting/canopy preservation/enhancement		New action	X	X		
Flood and Localized Flood Actions						
Keep the PPI current		New action	X	X	X	
Alder Creek flood control		New action	X	X	X	
Alder Creek flood mitigation (dam)		New action	X	X	X	
Alder Creek miners reservoir, property owned by the City of Folsom		New action	X	X	X	
Delta Small Communities flood protection - structural and nonstructural mitigation		New action	X	X	X	
Gum Ranch flood control - joint use basin		New action	X	X	X	
Implement Storm Drain CIP		New action	X	X	X	
Implement Water Supply CIP		New action	X	X	X	
Laguna Creek at Triangle Aggregate flood control -joint use basins		New action	X	X	X	
Laguna Creek mitigate flood hazard south of Jackson Highway		New action	X	X	X	
Model Sacramento River levee breach (LAMP) south of Freeport		New action	X	X	X	
Morrison Creek Miners Reach Flood Insurance Study		New action	X	X	X	
Morrison Creek miners reach levee improvements		New action	X	X	X	
Outreach stormwatch guide (ALERT, Stormready, weather radio)		New action	X	X	X	
Peak flow floodplain mitigation Arcade Creek near Auburn Blvd		New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Risk Map (flood frequency, depth, velocity)		New action	X	X	X	
Elevation & Acquisition Projects (to Mitigate Flood Risk)		2011 Action	X	X	X	
Repetitive Loss Properties (to Mitigate Flood Risk)		2011 action	X	X	X	
Five-Year Capital Improvement Plan – Drainage Projects		New action	X	X	X	
Arcade Creek Corridor Plan		New action	X	X	X	
Elevate Homes on Long Island (Grand Island Road, Sacramento River)		New action	X	X	X	
Repetitive Loss Church Building on Dry Creek		New action	X	X	X	
South Branch Arcade Creek – Gum Ranch Basin (with Fair Oaks Park District) and Kenneth Avenue Bridge Improvements (with Sacramento County Department of Transportation)		New action	X	X	X	
Dry Creek Flood Hazard Mitigation Acquisitions with County Regional Park Department		New action	X	X	X	
Arcade Creek at Evergreen Estates Floodwall Improvements		New action	X	X	X	
Linda Creek Peak Flow Mitigation		New action	X	X	X	
Flood Preparation in the American River Parkway		New action	X	X	X	
Improve County ALERT (Automated Local Evaluation in Real Time) System of Stream and Rain Gauges		2011 Action	X	X	X	
Update County Hydrology Standards		New action	X	X	X	
Woodside Condominiums Repetitive Flood Loss Property		New action	X	X	X	
Bridge Replacement on Elk Grove Florin Road at Elder Creek	1, 2, 3, 4	New action	X	X	X	
Michigan Bar Bridge Replacement at the Cosumnes River	1, 2, 3, 4	New action	X	X	X	
El Camino Avenue Phase 2 Road Improvements	1, 2, 3, 4	New action	X	X	X	
Levee Failure Actions						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Improve Flood Protection and/or Evacuation Planning for Mobile Home/RV Park at Manzanita/Auburn. Alternatively, the Park Should Establish Flood Warning and evacuation procedures.		New action	X	X	X	
Hydromodification and Stormwater Quality Countywide		2011 action	X	X	X	
Wildfire Actions						
Wildfire Suppression		New Action	X	X		Property Protection
Wildfire Fighting - Support		New Action	X	X		
Wildfire Suppression – Regional Parks and Open Space (urban interface)		New Action	X	X		
City of Citrus Heights						
City of Elk Grove						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan, as well as other Local Planning Efforts	1, 2, 3, 4	2011 Action	X	X	X	
Mutual Aid Agreements	1, 2, 3, 4	New action	X	X		
Elk Grove Green Street Project: Repurposing Urban Runoff with Green Instructure Technologies	1, 2, 3	New action	X	X		
Hazard Education and Risk Awareness	1, 2, 3, 4	New action	X	X	X	
City of Elk Grove's Storm Drainage Master Plan (SDMP)	1, 2, 3, 4	New action	X	X	X	
City of Folsom						
City of Galt						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
City of Isleton*						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	1, 2, 3, 4	New Action	X	X		
Storm Water Runoff Rehabilitation Project	1, 2, 3, 4	New Action	X	X	X	
Wastewater Treatment Plant Pond Levee Elevation Raise to 200-year Flood Standard	1, 2, 3, 4	New Action	X	X	X	
City of Rancho Cordova						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	1, 2, 3, 4	2011 Action	X	X	X	
Sunrise Boulevard Widening Kiefer to Jackson	1, 2, 3	2011 Action	X	X		
City of Rancho Cordova Disaster Debris Management Plan	1, 2, 3, 4	New Action	X	X		
Transportation Interconnectivity	1, 2, 3, 4	New Action	X	X		
Intergovernmental Agreement between the County of Sacramento and the City of Rancho Cordova	1, 2, 3	New Action	X	X		
Land Use (Long range)	1, 2, 3, 4	New Action	X	X		
Post disaster training for staff	1, 2, 3, 4	New Action	X	X		
Update/Maintain Emergency Operation Plans (EOPs)	1, 2, 3, 4	New Action	X	X		
Increase Everbridge Enrollment	1, 2, 3, 4	New Action	X	X		
Developing and maintaining a database to track community vulnerability.	1, 2, 3, 4	New Action	X	X		
City Website HMP and City Website, Press Notification, and Social Media Emergency Information	1, 2, 3	New Action	X	X		
Building & Safety Division Disaster Inspector Training	1, 2, 3, 4	New Action	X	X		
Landscape and Irrigation Requirements/Retro	1, 2, 3, 4	New Action	X	X		
Landscape Ordinance	1, 2, 3	New Action	X	X		
Impervious surface	1, 3, 4	New Action	X	X		
Porous pavement and vegetative buffers	1, 3, 4	New Action	X	X		

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Storm Water Pump Station Infrastructure Upgrades	1, 2, 3, 4	New Action	X	X	X	
SB-5 Urban Level of Flood Protection	1, 2, 3, 4	New Action	X	X	X	
Channel Vegetation Management and Erosion Control	1, 2, 3, 4	New Action	X	X	X	
Floodplain Manager Certification	1, 2, 3, 4	New Action	X	X	X	
Adoption of Hydromodification and Low Impact Development (LID) Standards	1, 2, 3, 4	New Action	X	X	X	
Stormwater Capital Improvement Program Master Plan	1, 2, 3, 4	New Action	X	X	X	
Sunrise Blvd. & Monier Circle Drainage Improvements	1, 2, 3, 4	New Action	X	X	X	
Roundabouts	1, 2, 3, 4	New Action	X	X	X	
City of Sacramento						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	1, 2, 3, 4	2011 action	X	X	X	
Coordination with Relevant Organizations and Agencies to Consider the Impacts of Urbanization and Climate Change on Long-Term Natural Hazard Safety	1, 2, 3, 4	New action	X	X		
Maintain and Identify Changes in Critical Facilities GIS Layer to Support Emergency Management Efforts	1, 2, 3, 4	New action	X	X	X	
Community Outreach on Multi-Hazard Preparation & Pre-mitigation	1, 2, 3, 4	New action	X	X	X	
Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas	1, 2, 3, 4	2011 Action	X	X	X	
Retrofit of Repetitive Loss Properties	1, 2, 3, 4	2011 Action	X	X	X	
Safeguard Essential Communication Services	1, 2, 3, 4	New action	X	X		
Multi-lingual Disaster Education	1, 2, 3, 4	New action	X	X		
Cal OES Safety Assessment Program Evaluators	1, 2, 3, 4	New action	X	X		
National Flood Insurance Program & Community Rating System Continuation	1, 2, 3, 4	New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Coordinate with Sacramento Area Flood Control Agency on Completion of South Sacramento Streams Group Projects	1, 2, 3, 4	New action	X	X	X	
Develop a Master Generation Plan for Pump Stations	1, 2, 3, 4	New action	X	X	X	
Develop a Disaster Housing Plan	1, 2, 3, 4	New action	X	X	X	
Disaster Resistant Business Program	1, 2, 3, 4	New action	X	X	X	
Develop Enhanced Emergency Planning for Special Needs Populations in the City of Sacramento Emergency Operations Plan and Other Planning Documents	1, 2, 3, 4	New action	X	X	X	
Establish a Post-Disaster Action Plan	1, 2, 3, 4	New action	X	X	X	
Flood Recovery Plan	1, 2, 3, 4	New action	X	X	X	
Public Information Flood Response Plan	1, 2, 3, 4	New action	X	X	X	
Construction of a new Emergency Operation Center (EOC)	1, 2, 3, 4	New action	X	X	X	
Protection of Transportation Infrastructure	1, 2, 3, 4	New action	X	X	X	
Public Education Campaign for Everbridge System	1, 2, 3, 4	New action	X	X	X	
Regional Emergency and Disaster Preparedness Exercises to Test Operational & Emergency Plans	1, 2, 3, 4	New action	X	X	X	
Special Needs and Critical Facilities Database and Advanced Warning System	1, 2, 3, 4	New action	X	X	X	
Multi-Jurisdictional Modeling for Drainage Watersheds Greater Than 10 Square Miles	1, 2, 3, 4	New action	X	X	X	
Map and Assess Vulnerability to Sea Level Rise	1, 2, 3, 4	New action	X	X	X	
Aquifer Storage	1, 2, 3, 4	New action	X	X	X	
Perform a Groundwater Recharge Feasibility Study	1, 2, 3, 4	New action	X	X	X	
Map and Assess Community Vulnerability to Earthquakes	1, 2, 3, 4	New action	X	X	X	
Seismic Vulnerability Assessment on Sacramento Levees, Infrastructure & Buildings	1, 2, 3, 4	New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Heating Centers in High Priority Locations	1, 2, 3, 4	New action	X	X	X	
Cooling Centers in High Priority Locations	1, 2, 3, 4	New action	X	X	X	
Extreme Weather Outreach Strategy	1, 2, 3, 4	New action	X	X	X	
Coordinate with Stakeholder on Proposed Flood Control Project on Magpie Creek	1, 2, 3, 4	New action	X	X	X	
Adopt Additional Floodplain Development Standards	1, 2, 3, 4	2011 action	X	X	X	
Drainage Projects for Repetitive Loss Properties	1, 2, 3, 4	2011 Action	X	X	X	
Preferred Risk policy (PRP) Outreach Campaign	1, 2, 3, 4	2011 Action	X	X	X	
Emergency Notification and Evacuation Planning	1, 2, 3, 4	2011 Action	X	X	X	
Historic Magpie Creek	1, 2, 3, 4	2011 Action	X	X	X	
Natomas Internal Drainage Canals/Levees	1, 2, 3, 4	New action	X	X	X	
Drainage Projects from the City's Priority Drainage Project List	1, 2, 3, 4	2011 Action	X	X	X	
Tree Trimming & Debris Removal	1, 2, 3, 4	New action	X	X		
Upgrading Overhead Utility Lines & Burying Critical Power Lines	1, 2, 3, 4	New action	X	X		
Stabilization of Erosion Hazard Areas	1, 2, 3, 4	New action	X	X		
Implement a Fire Education and Information Program	1, 2, 3, 4	New action	X	X		
Cosumnes Community Services District						
Los Rios Community College						
District Wide Roofing Renovations	1, 2, 3	2011 Action	X	X		
ARC Drainage at Arcade Creek	1, 2, 3	New Action	X	X		
Protect District Property	1, 2, 3	New Action	X	X		
Metro Fire District						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Relocate the essential facilities in the 200-year flood plain	1, 2, 3, 4	New Action	X	X	X	
Perform seismic study of all district facilities and identify those facilities at greatest risk for earthquake damage.	1, 3, 4	New Action	X	X		
Implement a Wildland Urban Interface (WUI) Building/Fire Code	1, 3, 4	New Action	X	X		
Develop and Implement a comprehensive WUI fuels management program.	1, 2, 3, 4	New Action	X	X		
Deploy 2 remote automated weather stations (RAWS) in Metro Fire jurisdiction	1, 2, 3, 4	New Action	X	X		
Defensible space ordinance	1, 2, 3, 4	New Action	X	X		
Brannan Andrus Levee Maintenance Disrict						
Implement Bioengineered Bank Stabilization techniques	1, 2, 3, 4	New Action	X	X		
Development of Dredge Stockpile Site	1, 2, 3, 4	New Action	X	X		
Georgiana Slough Waterside Erosion Repair	1, 2, 3, 4	New Action	X	X		
Hydrographic surveys and data collection	1, 2, 3, 4	New Action	X	X		
Mokelumne River Crown Raising	1, 2, 3, 4	New Action	X	X		
San Joaquin River Waterside Erosion Repair	1, 2, 3, 4	New Action	X	X		
Sevenmile Slough French Drain and Seepage Berm	1, 2, 3, 4	New Action	X	X		
Reclamation District #3*						
Reclamation District #341*						
Reclamation District #554*						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Apply for a Letter of Map Revision (LOMR) to bring the District back into Zone X.	1, 2, 3, 4	New Action	X	X	X	
Fill Abandoned Slough	1, 2, 3, 4	New Action	X	X		
Geotechnical Investigation	1, 2, 3, 4	New Action	X	X		
Snodgrass Slough Levee Improvements	1, 2, 3, 4	New Action	X	X	X	
Reclamation District #556*						
Flood Response Activities, Georgiana Slough Weir	1, 2, 3, 4	New Action	X	X	X	
Georgiana Slough Vegetation Management	1, 2, 3	New Action	X	X		
Georgiana Slough Waterside Erosion Repair	1, 2, 3, 4	New Action	X	X	X	
Topographic and Hydrographic Surveys and Data Collection	1, 2, 3, 4	New Action	X	X	X	
Reclamation District #563*						
Rock Slope Protection Project	1, 3	New action	X	X		Property Protection Structural projects Natural resource protection
HMP and PL-8499 Levee Improvement Projects	1, 3	New action	X	X	X	Property Protection Structural projects Natural resource protection
Reclamation District #800						
Reclamation District #1000						
2014 Capital Improvement Plan	1, 2, 3, 4	New action	X	X		
Implement Supervisory Control and Acquisition Data system (SCADA) on District canals and pump stations	1, 2, 3	New Action	X	X	X	
Public Outreach and Education	1, 2, 3, 4	New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Stockpile and pre-stage flood emergency response materials	1, 2, 3, 4	New action	X	X		
Emergency response improvements including radios for communications	1, 2, 3, 4	New action	X	X		
Emergency Back-up Generator for pump stations	1, 2, 3, 4	New action	X	X		
Reclamation District #1002*						
Geotechnical Investigation	1, 2, 3	New Action	X	X		
Snodgrass Slough Levee Improvements	1, 2, 3	New Action	X	X	X	
Snodgrass Slough Vegetation Management	1, 2, 3	New Action	X	X		
Reclamation District #1601*						
Levee Improvement Project	1, 3	New action	X	X	X	Property Protection Structural projects Natural resource protection
Reclamation District #2111*						
Rock Slope Protection Project	1, 2, 3, 4	New action	X	X	X	
HMP and PL-8499 Levee Improvement Projects	1, 2, 3, 4	New action	X	X	X	
Sacramento Regional County Sanitation District						
South River Pump Station Flood Protection Project	1, 2, 3, 4	New action	X	X		
Sacramento Area Sewer District						
MOU for Dedicated Cell Phone Tower and Cell Phone Pack	1, 2, 3	New Action	X	X		
Southgate Recreation and Park District						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Twin Rivers School District						

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Chapter 1 Introduction

1.1 Purpose

Sacramento County and 24 other jurisdictions prepared this Local Hazard Mitigation Plan (LHMP) update to the 2011 Federal Emergency Management Agency (FEMA) approved Sacramento County Local Hazard Mitigation Plan. The purpose of this Plan Update is to guide hazard mitigation planning to better protect the people and property of the County from the effects of hazard events. This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed, among other things, to ensure Sacramento County and participating jurisdictions' continued eligibility for certain federal disaster assistance: specifically, the FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). Completion also earns credits for the National Flood Insurance Program's Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.

1.2 Background and Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses incurred by insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This plan documents Sacramento County's hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the County and participating jurisdictions will use to decrease vulnerability and increase resiliency and sustainability in the community.

The Sacramento County Local Hazard Mitigation Plan (LHMP) update is a multi-jurisdictional plan that geographically covers the entire area within Sacramento County's jurisdictional boundaries (hereinafter referred to as the planning area). The following jurisdictions participated in the planning process and are seeking approval of the LHMP plan update:

- Sacramento County*
- Brannan Andrus Levee Maintenance District (RDs 317, 407, 2067)
- City of Citrus Heights*
- City of Elk Grove*
- City of Folsom*
- City of Galt*
- City of Isleton
- City of Rancho Cordova*
- City of Sacramento*
- Cosumnes Community Services District Fire Department*
- Los Rios Community College*
- Reclamation District 3
- Reclamation District 341*
- Reclamation District 369
- Reclamation District 551
- Reclamation District 554
- Reclamation District 556
- Reclamation District 563
- Reclamation District 744
- Reclamation District 755
- Reclamation District 800*
- Reclamation District 813
- Reclamation District 1000*
- Reclamation District 1002
- Reclamation District 1601
- Reclamation District 2110
- Reclamation District 2111
- Sacramento Area Sewer District
- Sacramento Metro Fire District
- Sacramento Regional County Sanitation District*
- Southgate Recreation and Park District*
- Twin Rivers School District*

* Participated in 2010 Plan

3 jurisdictions that were approved for the 2011 LHMP, but are not seeking approval for this plan update include:

- Arcade Creek Recreation and Park District
- Fair Oaks Recreation and Park District
- SAFCA

This plan update was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA) or DMA 2000.) While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

This planning effort also follows FEMA's 2008 Plan Preparation Guidance. Because the Sacramento County Planning Area is subject to many kinds of hazards, access to these programs is vital.

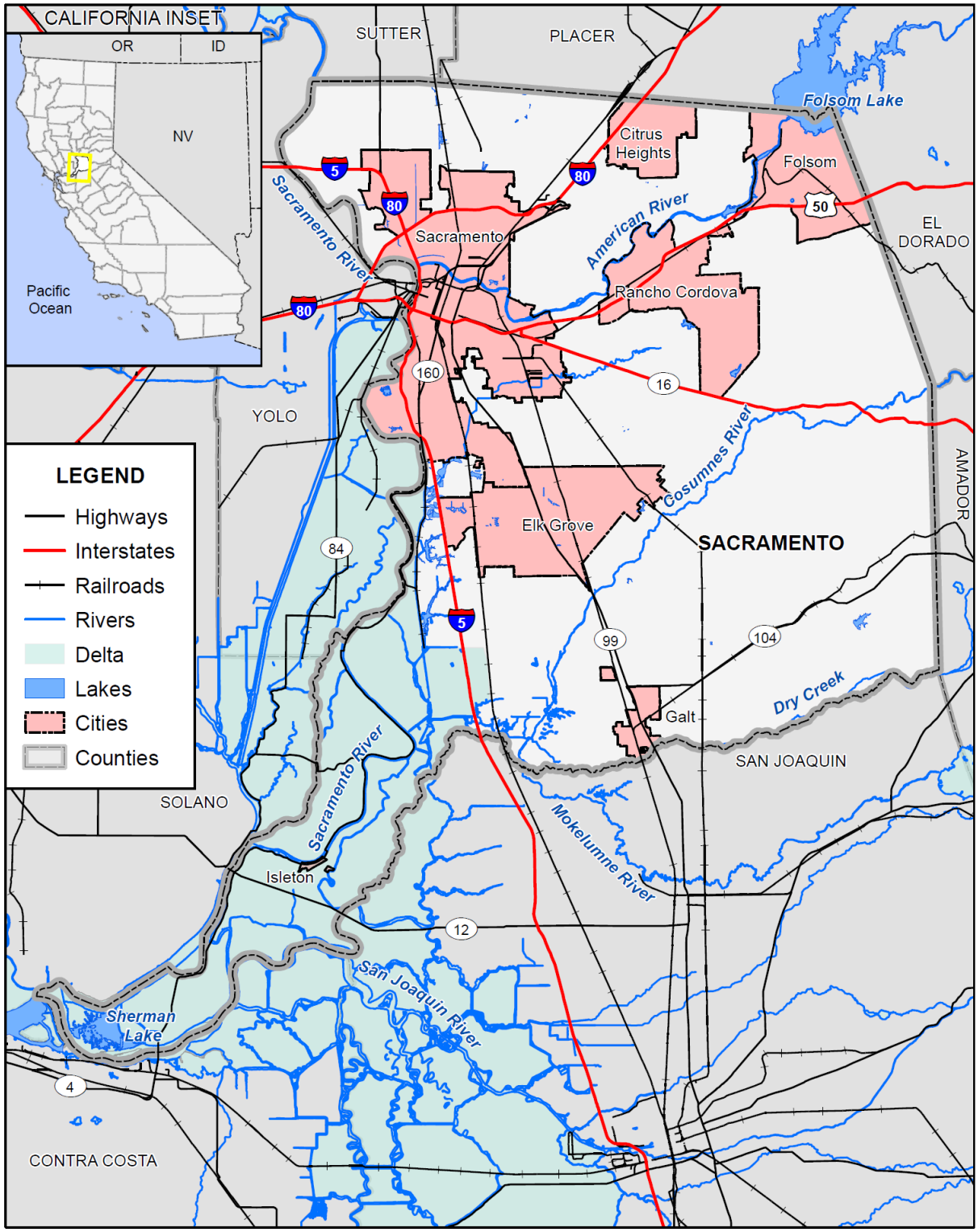
Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The planning area has been affected by hazards in the past and is thus committed to reducing future impacts from hazard events and maintaining eligibility for mitigation-related federal funding.

1.3 Community Profile

Sacramento County lies within the Central Valley of California, and is the County seat of the state capitol of Sacramento. The County has a history as a center of government, trade, transportation and agriculture, and as a consequence the City of Sacramento is a major transportation hub. Interstates 80 and 5; U.S. Highway 50; and State Highways 99, 16 and 160 all extend from the outer edges of the County and converge in downtown Sacramento. Similarly, all of the rail lines in the County converge in Sacramento at the site of the old Sacramento Rail Yard. Airports include Sacramento International, Sacramento Executive, Mather Air Force Base, McClellan Air Force Base and other smaller airports. Each of these major transportation corridors or locations impacts the land uses in the vicinity.

The County is divided into 25 community areas, seven of which are incorporated cities. Most of these communities are in the urbanized core in the western, northwestern or northern portion of the County. The southwestern, eastern and southern portions of the County are more agricultural and rural residential. Many portions of the developed County are within the historic floodplains of the three major rivers (Sacramento, American, and Cosumnes Rivers) and are protected by a system of levees. A map of the County is shown in Figure 1.1.

Figure 1-1 Sacramento County



Data Source: Sacramento County GIS, Cal-Atlas; Map Date: 05/2016.

1.3.1. History

Early Spanish explorers and the Franciscan and Jesuit missionaries who followed them were the first Europeans to reach northern California. The interior of the Sacramento Valley, away from the easily defended and more accessible chain of coastal missions and pueblos, was left largely untouched by the Spanish and "Californios." Established settlement of the Sacramento area did not begin until the late 1830s and early 1840s, when resourceful and independent individuals such as Sutter and Jared Sheldon obtained land grants from the Mexican government, usually in exchange for an agreement to protect Mexican interest in these remote interior regions.

With the initial Euro-American settlement of Sacramento County by John Sutter in 1839 at what would become Sutter's Fort, the established outpost brought with it an increase in Euro-American trappers, hunters and settlers to the area. After the arrival of Sutter, several individuals obtained large Mexican Land Grants in the area. As a result of the Mexican War (1847-1848), California became part of the territory of the United States. In 1848, gold was discovered at Sutter's Mill in Coloma. With the discovery of gold in 1848, a torrent of settlers from the east flooded into the Sacramento region. As the population increased and easily found gold decreased, newcomers who decided to stay turned to alternative vocations, particularly agriculture. Many found land comparatively plentiful and cheap. Raising grain, livestock, and produce to sell to the thousands of miners heading to the gold fields proved a profitable venture. These combined events hastened the settlement of the area and the development of Sacramento as an economic and transportation center. The designation of Sacramento as the state capital, in 1854, also resulted in the area's increase in socio-political importance.

The County is the major component of the Sacramento Metropolitan Statistical Area (SMSA) which includes Sacramento, El Dorado and Placer Counties. The County Charter was established in 1933 and is still used today. The official County Seal was adopted by the Board of Supervisors on January 18, 1961, following a contest for an appropriate design.

1.3.2. Geography and Climate

Sacramento County lies just north of the center of California's Central Valley. The confluence of two of the state's major rivers, the Sacramento and the American, occurs within the County. The southwestern panhandle of the county extends far into the Sacramento-San Joaquin Delta, to the point just north of Antioch, where nearly all waters of the Central Valley converge. To the south, San Joaquin County is primarily agricultural. The wooded foothills of the Sierra Nevada rise to the east in Amador and El Dorado Counties. On the north, Placer County has experienced dramatic growth over the past decade, and much of the grasslands adjacent to the northern Sacramento County boundary have been converted to residential uses. Yolo and Sutter Counties to the northwest and west have experienced growth as well, though agricultural uses remain.

1.3.3. Population

The California Department of Finance 2015 estimates for population of the County and its jurisdictions are shown in Table 1-1.

Table 1-1 Sacramento County Population by Jurisdiction

Jurisdiction	Total Population
Citrus Heights	85,147
Elk Grove	162,899
Folsom	74,909
Galt	24,607
Isleton	820
Rancho Cordova	69,112
Sacramento	480,105
Unincorporated County	573,313
Total	**1,470,912**

Source: California Department of Finance, 2015 E-1 Report

1.4 Economy and Tax Base

Sacramento County has a diverse economy. US Census estimate show economic characteristics for the County. These are shown in Table 1-2.

Table 1-2 Sacramento County Civilian Employed Population 16 years and Over

Industry	Estimated Employment	Percent
Agriculture, forestry, fishing and hunting, and mining	4,858	0.8%
Construction	39,046	6.3%
Manufacturing	34,750	5.6%
Wholesale trade	15,725	2.5%
Retail trade	70,392	11.4%
Transportation and warehousing, and utilities	28,369	4.6%
Information	13,453	2.2%
Finance and insurance, and real estate and rental and leasing	45,950	7.4%
Professional, scientific, and management, and administrative and waste management services	71,867	11.6%
Educational services, and health care and social assistance	136,652	22.1%
Arts, entertainment, and recreation, and accommodation and food services	56,996	9.2%
Other services, except public administration	32,546	5.3%
Public administration	68,442	11.1%

Source: US Census Bureau American Community Survey 2010-2014 Estimates

Fortunately for Sacramento County, many large industries are located in Sacramento County. Major employers in the County are shown in Table 1-3. In addition, the County is home to the Port of Sacramento, which allows for agricultural commodities to be shipped worldwide.

Table 1-3 Major Employers in Sacramento County

Employer Name	Location	Industry
Aerojet-Rocketdyne Holdings	Rancho Cordova	Aerospace Industries (Mfrs)
Air Resources Board	Sacramento	State Government-Environmental Programs
AMPAC Fine Chemicals LLC	Rancho Cordova	Chemicals-Manufacturers
California Prison Industry Authority	Folsom	State Govt-Correctional Institutions
California State University	Sacramento	Schools-Universities & Colleges Academic
Corrections Dept	Sacramento	State Govt-Correctional Institutions
Delta Dental	Rancho Cordova	Insurance
Disabled American Veterans	Sacramento	Veterans' & Military Organizations
Employment Development Dept	Sacramento	Government-Job Training/Voc Rehab Svcs
Environmental Protection Agcy	Sacramento	State Government-Environmental Programs
Exposition & Fair	Sacramento	Government Offices - State
Intel Corp	Folsom	Computer & Equipment Dealers
Mercy General Hospital	Sacramento	Hospitals
Mercy San Juan Medical Ctr	Carmichael	Hospitals
Municipal Services Agency	Sacramento	Grading Contractors
Sacramento Bee	Sacramento	Newspapers (Publishers/Mfrs)
Sacramento Regional Transit	Sacramento	Bus Lines
Sacramento State	Sacramento	Schools-Universities & Colleges Academic
SMUD Customer Service Center	Sacramento	Electric Companies
Sutter Memorial Hospital	Sacramento	Hospitals
UC Davis Medical Center	Sacramento	Hospitals
Water Resource Dept	Sacramento	State Government-Environmental Programs

Source: America's Labor Market Information System (ALMIS) Employer Database, 2016 1st Edition.

The County has a wide and varied tax base. Tax base information is tracked and maintained by the Sacramento County Assessor's Office. The following tables show the tax base for the County as well as for the incorporated jurisdictions. Table 1-4 shows the secured real property value by property type for the entire County. Table 1-5 shows the secured real property value by jurisdiction. Table 1-6 breaks out the jurisdictions by land use.

Table 1-4 2016-2017 Sacramento County Planning Area Distribution of Value by Property Type

Property Type	Assessments	2015-16 Value ($)	2016-2017 Value ($)	Ratio of Total Value to Prior Value
Single Family Residential	380,907	85,511,262,266	90, 146,646,411	1.054
Mobile Homes	7,856	372,879,553	380,928,297	1.028
Multi-Family Residential	21,209	12,544,846,078	12,938,650,086	1.037
Vacant Residential Land	15,035	1,348,538,827	1,555,324,881	1.301
Commercial	13,026	22,075, 156,589	24,043,815,805	1.092
Vacant Commercial Land	2,062	612,388, 949	677,822,995	1.183
Industrial	4,619	5,283,794, 161	5,549,247,547	1.066
Vacant Industrial Land	1,415	364,217,201	318,917,406	0.993
Vacant and Improved Rural	5,680	1,867,233,067	1,956,212,388	1.053
Unrestricted Rural	1,209	712, 115,252	712,712,592	1.042
Restricted Rural	1,444	583,934,662	610,240,481	1.075
Oil, Gas, Mineral Rights	139	92,623,784	61,557,947	0.665
Other*	21,306	1,174,140,141	1,214,259,905	1.040
Totals**	**475,907**	**132,543,130,530**	**140,166,336,741**	**1.062**

Source: Sacramento County Assessor's Office

*Churches, miscellaneous vacant land

**Gross totals, before Exemptions, less Secured Fixtures and Personal Property

Table 1-5 Local Assessment Roll Totals by Jurisdiction

Jurisdiction	2015-16 Value ($)	2016-17 Value ($)	Current Year Change	Percent of Current Roll*
Citrus Heights	6,172,005,395	6,451, 760,362	4%	4
Elk Grove	17,412,867,028	18,541,918,216	6%	13
Folsom	11,973,366,059	12,576,166,745	5%	9
Galt	1,738,795,750	1,855,626,958	6%	1
Isleton	50,114,828	50,790,458	1%	0
Rancho Cordova	7,313,825,493	7,793,218,613	6%	5
Sacramento City	44,417,867,548 2	47,118,444,96	6%	32
Unincorporated Area	51,612,441,745	53,664,479,099	4%	36
Total Value (Gross)	**140,691,283,846**	**148,052,405,413**	**5%**	**100**

Source: Sacramento County Assessor's Office

*Percentages rounded to the nearest whole number

Table 1-6 Summary of Property Types by Jurisdiction

Jurisdiction	Single Family with HEX*	Single Family Without HEX*	Multi-Family Residential	Vacant Land	Commercial	Agricultural	Mobile Homes	Other	Total
Citrus Heights	12,849	9,741	1,428	472	622	0	1,918	355	27,835
Elk Grove	27, 135	20,779	349	2,743	984	28	248	735	53,001
Folsom	13,296	7,792	317	1,744	755	17	854	574	25,349
Galt	3,661	2,884:	193	527	204	3	361	128	7,961
Isleton	82	143	19	155	83	1	44	39	566
Rancho Cordova	9,113	8,036	921	1,539	1,324	25	1,350	329	22,637
Sacramento City	61,522	59,451	8,548	8,961	7,217	8	3,230	4,449	153,386
Unincorporated Area	85,078	64,852	7,482	7,966	6,015	2,571	7,801	3,857	185,622
Total Value (Gross)	**212,736**	**173,678**	**19,257**	**24,107**	**17,204**	**2,653**	**15,806**	**10,466**	**475,907**

Source: Sacramento County Assessor's Office
*Homeowners' Exemption

1.5 Plan Organization

This Sacramento County 2016 LHMP update is a multi-jurisdictional plan that geographically covers the entire area within Sacramento County's jurisdictional boundaries (i.e., the planning area). Participating jurisdictions within the Sacramento County Planning Area include: Unincorporated Sacramento County, the seven incorporated communities, and 17 special districts.

- Chapter 2: What's New
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption
- Chapter 7: Plan Implementation and Maintenance
- Jurisdictional Annexes
- Appendices

The Sacramento County Local Hazard Mitigation Plan update is organized as follows:

The **Base Plan** provides the overall framework for this multi-jurisdictional LHMP. It is the umbrella document that includes the planning process, methodologies, and procedural requirements for all participating jurisdictions (i.e., unincorporated County and all Jurisdictional Annexes). As such, Chapters 1-7 of the Base Plan apply to the unincorporated County, the seven incorporated communities and all 17 special districts as participants to this LHMP update seeking FEMA approval of the plan. Because this is a multi-jurisdictional plan, the Base Plan addresses the LHMP hazard mitigation planning elements for all participating jurisdictions and includes data, information, and analysis specific to: The Sacramento County

Planning Area (which includes all participating jurisdictions and the entire geographic boundary of Sacramento County) and Unincorporated Sacramento County.

The **Jurisdictional Annexes** detail the hazard mitigation planning elements specific to each participating jurisdiction to this 2016 Sacramento County LHMP Update. Each Annex is not intended to be a standalone document, but appends to, supplements, and incorporates by reference the information contained in the Base Plan document. As such, all Chapters 1-7 of the Base Plan, including the planning process and other procedural requirements and planning elements apply to and were met by each participating jurisdiction. The Annexes provide additional information specific to each participating jurisdiction, with a focus on providing additional details on the risk assessment and mitigation strategy.

As part of these Jurisdictional Annexes, a **Delta Annex** was created which provides an umbrella base document specific to the Delta Area, which then contains the Annexes (or Chapters) for the participating jurisdictions (City of Isleton and Delta Reclamation Districts) located within the Delta Region.

The **Appendices** provide additional information, data, and planning process documentation that applies to all participating jurisdictions (i.e., unincorporated County and all Jurisdictional Annexes) to this Sacramento County 2016 LHMP Update.

Chapter 2 What's New

Requirements §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

The 2011 Sacramento County Local Hazard Mitigation Plan contained a detailed description of the planning process, a risk assessment of identified hazards for the Sacramento County Planning Area and an overall mitigation strategy for reducing the risk and vulnerability from these hazards. Since approval of the plan by FEMA, much progress has been made by Sacramento County and all participating communities on implementation of the mitigation strategy. As part of this 2016 LHMP Update, a thorough review and update of the 2011 plan was conducted to ensure that this update reflects current community conditions and priorities in order to realign the overall mitigation strategy for the next five-year planning period. This section of the plan includes the following:

- **What's New in the Plan Update**. This section provides an overview of the approach to updating the plan and identifies new analyses, data and information included in this plan update to reflect current community conditions This includes a summary of new hazard and risk assessment data as it relates to the Sacramento County Planning Area as well as information on current and future development trends affecting community vulnerability and related issues. The actual updated data, discussions, and associated analyses are contained in their respected sections within this 2016 LHMP Update.
- **Summary of Significant Changes to Current Conditions and Hazard Mitigation Program Priorities**. This provides a summary of significant changes in current conditions and any resulting modifications to the community's mitigation program priorities.
- **2011 Mitigation Strategy Status and Successes**. This section provides a description of the status of mitigation actions from the 2011 plan and also indicates whether a project is no longer relevant or is recommended for inclusion in the updated 2016 mitigation strategy. This section also highlights key mitigation success stories of the County and participating jurisdictions since the 2011 LHMP.

This What's New section provides documentation of Sacramento County Planning Area's progress or changes in their risk and vulnerability to hazards and their overall hazard mitigation program. Completion of this 2016 LHMP Update further provides documentation of the Sacramento County community's continued commitment and engagement in the mitigation planning process

2.1 What's New in the Plan Update

This LHMP update involved a comprehensive review and update of each section of the 2011 plan and includes an assessment of the success of the participating communities in evaluating, monitoring, and implementing the mitigation strategy outlined in the initial plan. Only the information and data still valid from the 2011 plan was carried forward as applicable into this LHMP update. In fact, based in part on the issuance of new planning guidance, this 2016 plan has been significantly updated and rewritten.

Also to be noted, Chapter 7 Implementation and Maintenance of this plan update identifies key requirements for updating future plans:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to inventories; and
- Incorporate new action recommendations or changes in action prioritization.

These requirements and others as detailed throughout this plan were addressed during this plan update process.

As part of its comprehensive review and update of each section of the plan, Sacramento County and participating jurisdictions recognized that updated data, if available, would enhance the analysis presented in the risk assessment and utilized in the development of the updated mitigation strategy. Highlights of new data used for this Plan Update is identified below in this Section and is also sourced in context within Chapter 4, Risk Assessment. Specific data used is sources throughout this plan document. This new data and associated analysis provided valuable input for the development of the mitigation strategy presented in Chapter 5 of this plan.

Highlights of new information and analyses contained in this plan update includes the following:

- A new assessment of updated hazards affecting the Sacramento County Planning Area was completed. No existing hazards were eliminated from this update.
- The agriculture hazard was expanded upon to better capture the weather related impacts to this industry in addition to the impacts associated with insects and pests.
- The drought hazard was expanded to include water shortage impacts to the County, to better align with the State of California Hazard Mitigation Plan and to reflect the significant issues related to drought conditions resulting from the current and ongoing drought within the County and State of California.
- The wind hazard was separated out from the heavy rains and storms hazard and included with the tornado hazard to better reflect those high wind events that occur outside of thunderstorm events.
- Climate Change has been addressed both as a standalone hazard and within the hazard profiles of each identified hazard to assist the County in considering climate change issues when identifying future mitigation actions for the Planning Area.
- An entire rework of the risk assessment for each identified hazard. This included reworking the hazard profile and adding new hazard event occurrences; redoing the entire vulnerability analysis to add items identified below and updating the vulnerability assessment based on more recent hazard data as well as using the most current parcel and assessor data for the existing built environment.
- An update of the flood hazard analysis to include an updated analysis of the 100-year flood, an analysis of the 500-year and 200-year flood events and an enhanced analysis of the localized/stormwater flooding problems affecting the Planning Area, including the use the new DFIRMs (Preliminary DFIRMs dated June 16, 2015) developed by FEMA for the County, the Best Available Maps (BAM) compiled by the state, and input from the County. An analysis of flooded acres in the Planning Area based on new DFIRMs was also conducted.

- New dam data provided by Cal OES was used for the Dam inventory and analysis. This data included an updated hazard classification for identified dams.
- An analysis of the Repetitive Loss (RL) properties within the planning area was completed for this update based on updated Repetitive Loss Area Analysis (RLAA) reports developed by the County and City of Sacramento.
- Utilizing updated critical facility GIS mapping for the City of Sacramento, combined with the critical facility data developed for the 2011 plan, to provide an updated inventory of critical facilities by jurisdiction and a GIS analysis of critical facilities vulnerable to priority hazards.
- An enhanced vulnerability assessment which added an updated GIS analysis of future development areas in the Planning Area and specific to each of the mapped hazards.
- Incorporation and analysis of the new 2010 Census data was utilized for this LHMP update.
- Also, as required by current FEMA planning guidance, an analysis of each jurisdictions' ongoing and continued compliance with the NFIP.
- For the CRS communities of Sacramento County and the City of Sacramento, this plan was developed to maximize CRS credits for CRS Activity 510, Floodplain Management Planning.
- As part of the CRS Activity 510 requirements, a greater emphasis was placed on public involvement and outreach of this LHMP Update as well as Agency coordination and input.

ADD TO THIS SECTION

2.2 Summary of Significant Changes to Current Conditions, Planning Area Vulnerability, and Hazard Mitigation Priorities

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Agricultural Hazards			X

- Recent drought conditions stressed crops making them more susceptible to insect infestation
- Reduced water supply resulted in land being left out of production reducing overall crop yields
- Noxious weeds are more drought tolerant – better able to compete for water over local crops
- Drought increased the tree mortality in the County further impacting the wildfire hazard.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Bird Strike		X	

-
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Climate Change			

-
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Dam Failure	X		

- Folsom Dam Improvement projects are near completion that will allow releases at a lower flood stage so the Dam can hold more water for enhanced flood control. This decreases the overall vulnerability in the Folsom Dam inundation areas.
- Jurisdictional dams generally have no change in vulnerability as they are highly regulated. However, with more people moving into dam inundation areas, the vulnerability increases due to an increase in potentially affected population, but not due to an increased risk of dam failure.
- Non-jurisdictional dams pose the biggest risk and, over time with little regular maintenance and often located in remote areas with little security, result in an increase in vulnerability to Sacramento.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Drought and Water Shortage			X

- Since the 2011 planning process, current drought conditions, including water supply issues, have had a significant impact on the Sacramento County planning area and California. As a result the drought hazard has become a significant priority for mitigation planning.
- As previously mentioned, the drought has contributed to an increase in vulnerability of the County due to increase tree mortality issues and general increase in wildfire conditions.
- Water Supply?
- Over the last few years, the drought has had a significant economic impact on recreation in the County, with rivers running substantially lower, less people have been vacationing and undertaking water dependent recreational activities, such as boating.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Earthquakes		X	

- The primary factor that might change the earthquake vulnerability, is additional development and more people moving to the area.
- Recently Lake County had a 5.2 earthquake on a previously unknown fault. There is the potential for effects from earthquakes and volcanic activity in the adjacent and nearby counties

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Earthquake Liquefaction			

-
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Floods:100-/200-/500-year		X	

- With the issuing of new FEMA flood maps (2015 DFRIMs), flood depths have been established in some areas and the regulatory Special Flood Hazard Area has changed. With these changes, flood mitigation projects, including flood insurance promotion and continued participation in the NFIP's CRS program, is a priority.
- Although the FEMA mapped floodplains have changed based on new data, the risk and vulnerability of 100/200/500 year flooding events ???. Effective land use planning and requirements for development in identified floodplains have minimized additional exposure to this hazard in the County.
- All new development in the floodplain has been completed in accordance with current and applicable codes and standards, thus these new development areas should be protected from future flooding.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Floods: Localized Flooding		X	

- Increased development in unmapped flood hazard areas could result in a net increase in vulnerability should these areas experience increased stormwater/localized flooding. However, development requirements that require mitigation of stormwater runoff effectively mitigates this hazard.
- Climate change issues may result in more localized flooding as the climate warms and the wetter storms create more runoff.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Landslide and Debris Flows			X

- Over the last couple of years, with the severe drought, much of the vegetation along slopes areas is failing to thrive, thus there is a lack of vegetation to hold soil contributing to the landslide/mudslide potential.
- Post fire conditions, such as the King Fire, have left areas more susceptible to landslides and debris flows, especially with the heavy storms associated with the current El Nino winter.

- Even outside of post-fire areas, recent wet storms have increased the incidents of landslides and road closures.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Landslides			

-
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Levee Failure			

-
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
River/Stream/Creek Bank Erosion			X

- Drought conditions have increase the occurrence of stream bank erosion, with soils drying out and becoming more friable, they tend to slough off the banks causing increased areas of erosion.
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Severe Weather: Extreme Temperatures - Heat			X

- Climate change issues create the potential for additional heat related impacts in the future
-

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Severe Weather: Extreme Temperatures- Cold and Freeze			

- Over the last five years of mild winters, there has been a notable decrease in vulnerability of Sacramento County to freeze and severe winter storms.

➢

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Severe Weather: Fog		X	

➢ This low priority hazard has not changed over the last five years.
➢

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Severe Weather: Heavy Rains and Storms	X		

➢ Over the last five years of mild winters, there has been a notable decrease in vulnerability of Sacramento County to heavy rains and storms. However, climate change bring renewed concern moving forward for heavy rains, storms and associated issues to the County.
➢

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Winds and Tornadoes			

➢

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Subsidence			

➢ Drought conditions have contributed to increased subsidence statewide. In Sacramento County, this is likely more of a Delta issue where subsidence concerns have actually decreased with the implementation of better farming practices over the years.
➢

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Volcano		X	

➢ This low priority hazard has not changed over the last five years.
➢

2016 LHMP Update Hazards	Decrease in Vulnerability	No Change in Vulnerability	Increase in Vulnerability
Wildfire			X

- Compounded by current drought conditions, the wildfire hazard has substantially increased and is no longer just a seasonal issue. The wildfire season, including the potential for a catastrophic wildfire, is now a year around concern.
- The vulnerability of Sacramento County to increased occurrence of a devastating wildfire has increased as exacerbated by the recent drought, increases in tree mortality, and overall increase in wildfire conditions.
- The increased development in WUI areas within the County also contributes to an increase in vulnerability.
-

Multi-hazard Considerations

- With new areas of development identified within the County and within the incorporated communities, requirements for new development will consider various hazard constraints and mitigation measures to govern ultimate development and buildout of these areas. Changes in development that have occurred in hazard prone areas and have increased or decreased the vulnerability of the Planning Area, development planned or under the consideration of the participating jurisdictions, and other conditions that may affect the risks and vulnerabilities of the Planning Area such as climate change variables are documented and considered in this Plan Update.

INSERT UPDATED INFORMATION ABOVE DEVELOPED FROM HMPC #5 HERE WHEN DONE

2.3 2011 LHMP Mitigation Strategy Successes and Status

Sacramento County and its various communities have been very successful in implementing actions identified in the 2011 LHMP Mitigation Strategy, thus, working diligently towards meeting their 2011 goals and objectives of:

Goal 1: Minimize the loss of life, injury, and property damage from natural hazards (reduce the risk and vulnerability of the community to hazards through mitigation efforts)

- Objective 1.1 Assure long term protection of existing and future development from natural hazards
- Objective 1.2 Protect critical facilities from natural hazards
- Objective 1.3 Protect the environment from natural hazards
  - ✓ 1.3.1 Protect and enhance water quality, critical aquatic resources and habitat for beneficial uses.
- Objective 1.4 Maintain/enhance the flood mitigation program to provide 100/200/500 year flood protection
  - ✓ 1.4.1 Protect, create, and restore flood control facilities and waterways to convey flood waters and to provide flood control services to surrounding areas.
  - ✓ 1.4.2 Mitigate Repetitive Loss Properties.

- ✓ 1.4.3 Flood mitigation efforts should include considerations for protecting water supply from contamination.
- ➢ Objective 1.5 Minimize risk of levee breach, overtopping or other failures
  - ✓ 1.5.1Maintain levees to standards described by state and federal regulations suitable for risk reduction.
  - ✓ 1.5.2 Address levee seepage and erosion issues on a proactive, ongoing basis.
  - ✓ 1.5.3 Obtain funding for identified levee improvement projects.
- ➢ Objective 1.6 Reduce the potential of wildfire incidents next to developed communities
  - ✓ 1.6.1 Fuels reduction and maintenance of defensible space in the High and Very High Fire Hazard Severity Zones, including the Rollingwood, American River Parkway, Fair Oaks, and Orangevale areas.
  - ✓ 1.6.2 Secure funding for staffing Fire Station #33 during red flag conditions.

GOAL 2: Enhance public awareness of the affects of natural hazards and public understanding of disaster preparedness

- ➢ Objective 2.1 Reduce exposure to hazard related losses
  - ✓ 2.1.1 Fire fuel reduction and defensible space
  - ✓ 2.1.2 Flood hazard awareness and mitigation
  - ✓ 2.1.3 Insurance is the last but certain defense
- ➢ Objective 2.2 Implement outreach/education programs pre- and post-disaster
  - ✓ 2.2.1 Target outreach and education for each hazard type and risk area.
- ➢ Objective 2.3 Develop, enhance, and integrate disaster response planning and training
  - ✓ 2.3.1 Encourage at risk populations to develop and practice emergency plans, including procedures for evacuation and shelter-in-place.
    - 2.3.1.1 Consider utilizing a neighborhood approach to evacuation planning and disaster response to assist first responders.

GOAL 3: Improve the capabilities of the community to mitigate or reduce losses from natural hazards

- ➢ Objective 3.1 Minimize hazard-related damage in order to maintain current service levels
- ➢ Objective 3.2 Maximize resources to provide mitigation from natural hazards
  - ✓ 3.2.1 Coordinate jurisdictional responsibilities to various hazards through City and Community Disaster/Emergency Response Plans and Exercises.
- ➢ Objective 3.3 Increase the use of shared resources between agencies
  - ✓ 3.3.1 GIS, Lidar, DFIRM
  - ✓ 3.3.2 Water Supply
- ➢ Objective 3.4 Strengthen Intergovernmental and Interagency partnerships
  - ✓ 3.4.1 Transportation, waste disposal, fire districts
- ➢ Objective 3.5 Promote public/private partnerships in hazard mitigation and education programs
- ➢ Objective 3.6 Increase coordination and communication among federal, state and local agencies
  - ✓ 3.6.1 Identify and implement mitigation projects that are mutually beneficial

GOAL 4: Position Jurisdictions for Federal and State Grant Funding

- Objective 4.1 Maintain good standing with FEMA and State hazard mitigation programs, regulations and requirements
- Objective 4.2 Maximize funding opportunities through identification and tracking of all types of Federal and state grant programs
  - ✓ 4.2.1 Monitor and communicate to all communities: available grant programs, timelines, and processes

Where possible, Sacramento County and the participating jurisdictions used existing plans and programs to implement the 2011 mitigation strategy. Examples include implementation of wildfire mitigation actions through Fire Safe Alliances and existing community wildfire protection plans (CWPPs), implementation of flood mitigation actions through the County and PCFCWCD programs including existing plans, studies, and projects, and implementation of a variety of projects through the County's Capital Improvement Program.

2.3.1. Success Stories

INSERT

2.3.2. 2011 Mitigation Strategy Update

The 2011 mitigation strategy contained 158 separate mitigation actions benefiting one or more communities within the Sacramento County Planning Area. Of these 158 actions, 16 have been completed, 5 are completed but are still ongoing, 64 are ongoing, 14 are ongoing but not yet started, and 14 have not been started. Because many of these projects, such as the various fuels management projects, are implemented on an annual or other continuous basis and some of the projects have yet to be funded or have otherwise not been initiated, 80 2011 projects have been identified for inclusion in this plan update. Another 34 were determined not to be viable projects due to a variety of reasons, including funding availability, resulting in a lack of priority.

Table 2-1 provides a status summary of the mitigation action projects from the 2011 LHMP. Following the table is a description of the status of each project.

Table 2-1 Sacramento County's 2011 LHMP Update: Mitigation Action Status Summary

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Multi-Hazard Mitigation Actions					
Enhance Public Awareness of the Affects of Natural Hazards and Public Understanding of Disaster Preparedness	Sacramento County		X		
CRS Public Information Pilot Program	Sacramento County, City of Sacramento	X (City)	X (County)		

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	Sacramento County City of Citrus Heights City of Elk Grove City of Folsom City of Galt City of Rancho Cordova City of Sacramento	X (Sacramento County) X (City of Galt) X (City of Sacramento)	X (City of Rancho Cordova)		Y
Flood Insurance Promotion	Sacramento County		X		
Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas	Sacramento County		X (Sacramento County) X (City of Sacramento)		
Finalize and Implement the Actions of the South Sacrament Habitat Conservation Plan	Sacramento County City of Elk Grove City of Galt City of Rancho Cordova Sacramento Regional County Sanitation District Sacramento County Water Agency Southeastern Connector	X			
SAFELY OUT™ Evacuation Preparedness	Sacramento County Citizen Voice			X	
Public Education Program	City of Elk Grove		X		
Alerts and Warning System	City of Elk Grove		X		
Emergency Operation Center (EOC)	City of Elk Grove		X		
Critical Facilities Database Development and Data Maintenance Processes	City of Elk Grove		X		
Increase Redundancy/ Functionality of Water Wells and Sewer Lift Stations	City of Galt				
Increase Data Capacity of Emergency Frequencies	City of Galt				
Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas	City of Sacramento		X		
Data Center Disaster Recovery Improvement	Los Rios Community College District	X			N
Community Emergency Response Training (CERT)	Los Rios Community College District			X	N

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Update the critical facilities identified during this DMA planning effort with the City's GIS technical group to support emergency management efforts.	City of Sacramento	X			
Bird Strike Mitigation Actions					
Wildlife Hazard Management Plan	Sacramento County Airport System	X			
Dam Failure Mitigation Actions					
Mather Dam Improvements	Sacramento County		X		
Alder Creek Miners Dam	Sacramento County			X	
Improved Flood Inundation and Evacuation Plan for Probable maximum flow from New Spillway at Folsom Dam	Sacramento County		X		
Folsom Dam Joint Federal Project	SAFCA				
Folsom Dam Raise	SAFCA				
Drought Mitigation Actions					
Drought Contingency Plan	Southgate Park & Recreation District				
Earthquake Mitigation Actions					
Hughes Stadium Renovation at Sacramento City College	Los Rios Community College District	X			N
Flood Mitigation Actions					
Improve County ALERT (Automated Local Evaluation in Real Time) system of stream and rain gages	Sacramento County		X		
Elevation Projects to Mitigate Flood Risk	Sacramento County		X		
Arcade Creek Corridor Plan	Sacramento County		X		
Elevate up to Three Homes on Long Island (Grand Island Road, Sacramento River)	Sacramento County		X		
Mitigation Projects for Repetitive Loss Structures/Areas	Sacramento County		X		
Improve Strawberry Creek Basins at East Stockton Blvd	Sacramento County	X	X		
Triangle Detention Basin	Sacramento County		X		
Unionhouse Detention Basin Upstream of East Stockton Blvd Partnering with Park District and SAFCA	Sacramento County		X		

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Unionhouse Creek Joint Use Detention Basins – Park Active or Passive Joint Use	Sacramento County		X		
South Sacramento Stream Group Detention Basins	Sacramento County		X		
Elder and Gerber Creek	Sacramento County		X		
Florin Creek Basins –Florin Vineyard Drainage Master Plan	Sacramento County		X		
Joint Use Detention-Park Basins on Laguna Creek	Sacramento County	X	X		
Pasa Robles Drive - Concrete Channel Lining Rehabilitation	Sacramento County			X	
Chicken Ranch Slough - Concrete Channel Lining Rehabilitation	Sacramento County		X		
Morrison Creek - Concrete Channel Lining Rehabilitation	Sacramento County			X	
Mayhew Slough - Concrete Channel Lining Rehabilitation	Sacramento County			X	
Strong Ranch Slough - Concrete Channel Lining Rehabilitation	Sacramento County			X	
Keep Watershed Management Plan Current CRS Activity 450 (county and cities)	Sacramento County		X		
Woodside Condominiums Repetitive Flood Loss Property	Sacramento County			X	
Conversion to NAVD88 vertical datum (from NGVD29)	Sacramento County		X		
Mitigation projects to reduce flood risk to critical facilities.	Sacramento County		X		
Hydrologic and Hydraulic Modeling in Compliance with 2012 Central Valley Flood Protection Plan	Sacramento County		X		
Delta Area Fire Station Needs to be Elevated or Flood Proofed to Protect Against Levee Breach Flooding to Assure Function in that Disaster Event.	Sacramento County			X	
Update and Adopt Floodplain Management Ordinance in Light of Levee De-accreditation	Sacramento County	X	X		
Mitigate Peak Flow on Dry Creek and Tributaries (including Sacramento County and City of Roseville)	Sacramento County		X		

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Repetitive Loss Church Building on Dry Creek	Sacramento County		X		
Determine Cause and Mitigate Mercury and Methyl Mercury Coming from Tributaries of American River	Sacramento County		X		
Pump Stations	Sacramento County	X	X		
Public Outreach Mailers	Sacramento County		X		X
Drainage improvements to reduce flooding on key evacuation routes	Sacramento County		X		
South Branch Arcade Creek – Gum Ranch Basin (with Fair Oaks Park District)	Sacramento County			X	
Dry Creek Flood Hazard Mitigation Acquisitions with County Park Dept	Sacramento County			X	
Arcade Creek at Evergreen Estates Floodwall improvements	Sacramento County		X		
Linda Creek Peak Flow Mitigation	Sacramento County		X		
Improve flood protection and/or Evacuation Planning for Mobile Home/RV Park at Manzanita/Auburn. Alternatively, the park Should Establish Flood Warning and Evacuation Procedures.	Sacramento County		X	X	
Capital Improvement Projects – Pipelines (2012-13)	Sacramento County	X	X		
Capital Improvement Projects – Pipelines (2014-15)	Sacramento County	X	X		
New City Sump 90 Operation Plan	Sacramento County		X	X	
Land Acquisition	Southgate Park & Recreation District				
Conservation Easements	Southgate Park & Recreation District				
Multi-jurisdictional Cooperation within Watersheds	Southgate Park & Recreation District				
South Sacramento Streams Group	SAFCA				
American River Common Features	SAFCA				
CVFPP - Flood Emergency Plan	City of Sacramento		X		
Adopt Additional Floodplain Development Standards	City of Sacramento		X		X
Update the General Plan to include the requirements of the CVFPP	City of Sacramento	X			
Historic Magpie Creek Study	City of Sacramento	X	X		X

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
South Sacramento Streams Project: Union Pacific Railroad Flood Wall	City of Sacramento	X			
Natomas Levee Improvement Project (NLIP)	City of Sacramento	X	X		X
Retrofit of Repetitive Loss Properties	City of Sacramento	X	X		X
Preferred Risk Policy (PRP) Outreach Campaign	City of Sacramento		X		
Drainage Projects for Repetitive Loss Properties	City of Sacramento	X	X		X
Unionhouse Creek Existing Conditions LOMR and Channel Improvements	City of Sacramento	X			
Emergency Notification and Evacuation Planning	City of Sacramento	X			X
Drainage Projects from the City's Priority Drainage Project List	City of Sacramento	X	X		X
Riconada Flood Wall	City of Citrus Heights		X		
Storm Debris Removal	City of Elk Grove		X		
Drainage and Flood Control Programs	City of Elk Grove		X		
LID Rain Garden Plaza	City of Elk Grove	X	X		
School Street Alley Drainage Improvements	City of Elk Grove	X			
Elk Grove Creek Outfalls	City of Elk Grove	X			
Elk Grove Creek Restoration	City of Elk Grove	X			
Waterman Road Culvert Repair and Replacement	City of Elk Grove	X			
Waterman Road Culvert Replacement	City of Elk Grove	X			
Elk Grove Creek Flood Protection and Clean Water	City of Elk Grove		X		
Elk Grove Watershed Recommended Improvements	City of Elk Grove	X			
Multi-Functional Drainage Corridor for Shed C	City of Elk Grove		X		
9816 Sheldon Road – Enlarge Culverts	City of Elk Grove	X			
Sheldon Road Drainage Project	City of Elk Grove	X			
Sleepy Hollow Detention Basin Retrofit	City of Elk Grove		X		

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Sleepy Hollow Lane Drainage Improvements	City of Elk Grove			X	
East Elk Grove Area/ Rural Region Improvements	City of Elk Grove			X	
Sheldon Road Ditch Improvements and Multi-Use Trails	City of Elk Grove			X	
Laguna Creek Watershed Improvements (New Pipeline and Enlarge Existing Pipelines)	City of Elk Grove	X			
Deer Creek Watershed Improvements (New Detention Basins)	City of Elk Grove			X	
SCADA System for the Stormwater Pump Stations	City of Elk Grove		X		
Dry Well Installation at Kent Street and St. Anthony Court	City of Elk Grove	X			
Elk Crest Drive Pipes	City of Elk Grove	X			
Strawberry Creek Detention Basin Retrofit	City of Elk Grove		X		
Laguna Creek and Whitehouse Creek Multi-Functional Corridor Enhancement	City of Elk Grove		X		
Whitehouse Creek Watershed Improvements	City of Elk Grove		X		
Grant Line Channel Improvements (Pump Station and Enlarge Pipes)	City of Elk Grove			X	
Alder Creek Watershed Council	City of Folsom				
Redevelopment Area Drainage Improvements	City of Folsom				
Drainage System Maintenance Tax Assessment	City of Folsom				
Floodplain Mapping	City of Folsom				
Drain Inlet Retrofit Capital Improvement Plan (CIP)	City of Galt				
Creek/Streams Vegetation Management Plan	City of Galt				
Sunrise Boulevard Widening Kiefer to Jackson	City of Rancho Cordova		X		Y
Flood Response Equipment	Cosumnes Community Services District Fire Department				

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Flood Response Training	Cosumnes Community Services District Fire Department				
Coordinate with SAFCA, CA-DWR, USACE, and Sacramento County on Proposed Flood Control projects on Magpie Creek	City of Sacramento			X	
Storm Water Management Practices - Implement Storm Water Management Practices as identified in Stormwater Quality Design Manual	Southgate Park & Recreation District				
Main Drainage Canal Bank Stabilization and Sediment Removal	Reclamation District #1000			X	
Security of District Facilities	Reclamation District #1000		X		X
South River Pump Station Flood Protection Project	Sacramento Regional County Sanitation District				
SRCSD Critical Facilities Flood Study (Planning)	Sacramento Regional County Sanitation District				
Levee Failure Mitigation Actions					
Hydromodification and Stormwater Quality countywide	Sacramento County			X	
Ring Levees to Protect Delta Historic Villages	Sacramento County			X	
Levee Breach Scenario, Inundation, Evacuation, and Recovery Planning for Rural Areas South of Freeport	Sacramento County		X		
Improved Flood Inundation and Evacuation Plan for Structural Flood Control System Failure Scenarios in Urban Areas	Sacramento County		X		
Human Vertical Evacuation Structures in Areas of Widespread Flood Hazard	Sacramento County		X		
Livestock Vertical Evacuation Mounds in Areas of Widespread Flood Hazard	Sacramento County		X	X	
Implement the Recommended Actions of the Sherman Island Five Year Plan	Reclamation District #341		X		
Highway 16 Levee Rehabilitation Project	Reclamation District #800			X	

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Bank and Levee erosion	Reclamation District #1000		X		X
Severe Weather: Heavy Rains and Storms Mitigation Actions					
Public Education/Outreach Extreme Weather	City of Folsom				
Heating and Cooling Centers for Extreme Weather	City of Folsom				
District Wide Roofing Renovations	Los Rios Community College District		X		Y
Tree Management	Southgate Park & Recreation District				
Wildfire Mitigation Actions					
Fuels Reduction in the American River Parkway	City of Sacramento/Sacramento Metropolitan Fire District	X	X		
Coordinate with the County and State to Create defensible space to protect vital infrastructure located in the American River Parkway from wildfires (from 2005 Plan)	City of Sacramento		X		
Fuel Reduction and Modification	City of Folsom				
Wildfire Prevention Outreach	City of Folsom				
Wildfire Hazard Identification	City of Folsom				
Arson Prevention & Control Outreach	City of Folsom				
Ignition Resistant Building Construction Upgrades	City of Folsom				
Reduction of Fire Hazard SRCSD Bufferlands	Sacramento Regional County Sanitation District				
Twin Rivers School District Annex*					
Reduce Risk to Flooding of Northern Area Schools	Twin Rivers School District				
New drainage plans to sites within the flood areas including, site drainage, storm drain upgrades and re-grading fields to shed water (on-site) away from buildings	Twin Rivers School District				

Mitigation Action	Lead Jurisdiction	Complete	Ongoing	Not Started	Project in 2016 Update
Work with City/County/Water departments to create defensible spaces at sites where nearby creeks are prone to flooding. Build-up earthen berms (off-site) to shed water away from critically located schools.	Twin Rivers School District				
Update the Emergency Preparedness Plan and the Emergency Operations Plan so that in event of emergency or disastrous event, personnel and procedures are in place and streamlined. This will include purchase of new equipment not reliant on typical system power; including communications equipment, emergency housing and supplies.	Twin Rivers School District				
Working with the Department of the State Architect (DSA) on Earthquake Retrofit Plan on all sites.	Twin Rivers School District				
Revise and update district-wide Storm Water Prevention Plan	Twin Rivers School District				
Create email notification system for families for emergency situations.	Twin Rivers School District				
Incorporate new rules for M&O department to keep drains clear, trees trimmed and vegetation removed to minimize impact during heavy rains.	Twin Rivers School District				
Create defensible perimeter space – for fire areas. Trees trimmed and vegetation removed to minimize impact during fire season.	Twin Rivers School District				
Updating Evacuation Plans.	Twin Rivers School District				
Updating District Policy for new Construction.	Twin Rivers School District				
Updating Evacuation Plans for Excessive Heat	Twin Rivers School District				
Updating Evacuation Plans for Streambank Erosion	Twin Rivers School District				
Updating Evacuation Plans for Fog	Twin Rivers School District				

*The Twin Rivers School District was a participant in the 2011 Plan Update after the fact. As such, their mitigation actions were arranged in their 2011 annex in this order, and not by hazard.

Multi-Hazard Mitigation Actions

Enhance Public Awareness of the Effects of Natural Hazards and Public Understanding of Disaster Preparedness

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Cal OES has developed a website for multi-agency initiatives and projects such as California Flood Preparedness Week; County Water Resources will include the link on its website and in its outreach campaigns. A multi-agency committee has been established to plan, develop and manage an annual campaign to educate California residents about their flood risk and how to prepare for potential flooding. The outreach components include:

- Preparing brochures and flyers to be handed out to the public at events,
- Developing consistent messages for individual agency websites
- Preparing radio messages for earned media and paid advertising utilizing a variety of social media tools to reach various populations including people with disabilities and those with access and functional needs

The County continues to develop methods to communicate with the community including Internet, direct mail, traditional media, and social media. Every year Water Resources works with public information professionals to improve messaging in the hope of helping County residents understand the risk of natural hazards, particularly flood, but also drought conditions.

CRS Public Information Pilot Program

Lead jurisdiction: Sacramento County, City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

- City of Sacramento – The City completed a Program for Public Information (PPI) in February 2015 as part of the Comprehensive Flood Management Plan. The City Council will be adopting the PPI in the fall of 2015.
- Sacramento County – This is no longer a pilot program. The Program for Public Information is now within the 2013 Coordinator's Manual for the CRS program in Activity 330. County Water Resources continues and improves its outreach efforts and will be looking to develop the Program for Public Information in the coming year. Working with the County office of emergency services and the levee maintaining agencies, there will be additional outreach efforts as required under the flood emergency action planning activity. The County is encouraged by Central Valley flood protection laws and by the NFIP Community Rating System to outreach levee and dam breach disaster scenario information to the potentially affected public. The County with the City of Sacramento and the levee maintaining agencies is establishing updated flood emergency action protocols and will outreach information to the public over coming months.

Integrate Local Hazard Mitigation Plan into Safety Element of General Plan

Lead jurisdiction: Sacramento County, City of Citrus Heights, City of Elk Grove, City of Folsom, City of Galt, City of Rancho Cordova, City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

- City of Elk Grove – Language integrating the LHMP into the Safety Element of the General Plan is expected to be completed during the General Plan update anticipated to be completed by the summer of 2017.
- City of Galt – The LHMP was incorporated into our Safety Element of the City's General Plan in 2011. It will remain in the General Plan when it is revised.
- City of Rancho Cordova - LHMP will be incorporated in next GP update.
- City of Sacramento – The LHMP was incorporated into our Safety Element of the City's General Plan in 2007. It will remain in the General Plan in future revisions.
- Sacramento County – Complete. References to the Local Hazard Mitigation Plan (aka Multi-Hazard Mitigation Plan) were incorporated into the Safety Element of the General Plan amendment adopted on November 9, 2011. In addition to references on pages 3 and 10, the Multi-Hazard Mitigation Plan is the topic of Policy SA-32, in the Section on "Emergency Response": "SA-32 The County will implement the Multi-Hazard Mitigation Plan in the planning and operations of the County to achieve the goals, objectives, and actions of the County's Multi-Hazard Mitigation Plan." The Multi-Hazard Mitigation Plan was adopted by the Board independent of the General Plan. It would seem that compliance with the requirement is fully met, even though the Hazard Mitigation Plan is not "adopted" in the Safety Element.

Flood Insurance Promotion

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This is an on-going activity that is approached in several ways throughout the year. Extensive flood insurance outreach was conducted in conjunction with the digital flood insurance rate map (DFIRM) program and the levee decertification in the south Sacramento county Delta areas. Several public meetings helped to inform residents of the importance of obtaining flood insurance. Direct mail newsletters were sent out to all residents impacted by a map change. Newsletters were posted in public areas and flood insurance rate maps and flood insurance materials were placed in public libraries.

In light of the National Flood Insurance Program (NFIP) reform eliminating subsidies and grandfathering rule that were enjoyed by many County property owners, there will be much effort to outreach to the public in the coming months.

It will become increasingly important for owners of buildings that were constructed prior to Mach 15, 1979 (enjoying 'pre-FIRM' subsidized flood insurance rates) to obtain elevation certificates. Several private engineers and surveyors are equipped to perform this service and the County Department of Water Resources offers this service for a fee.

Water Resources keeps apprised of news related to NFIP reform and will work on effective messaging to the public. Nothing new to report, we continue to outreach to the public pursuant to Activity 300 of the CRS program. Status: The flood insurance reform act of 2012 was revised in 2014 and subsequently FEMA has been working to understand the requirements moving forward. In that light, Water Resources floodplain management staff has been working to outreach the message to the public. For example, it was recently learned that there is great potential penalty to those property owners who do not carry flood insurance in areas recently mapped from Zone X to Zone AE. The deadline to acquire insurance is March 2016, if one is to enjoy the so-called grandfathering clause in the 2014 legislation. Further, if property is sold or transferred the new owner must take over the existing flood insurance policy in order to be considered grandfathered into the Zone X rate (ref. WYO Bulletin 14053). As the details of the 2014 NFIP reform are fleshed out, it is important to communicate with our public.

Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

- City of Sacramento – Much work has been accomplished to map critical facilities and to assess risks in the LHMP. Further analysis of critical facilities was accomplished in early 2014 with the CRS reverification process. The list is currently being updated again as part of the City's new Emergency Action Plan.
- Sacramento County – Sacramento City, American River Flood Protection District, Reclamation District 1000 and Sacramento County are developing a Comprehensive Flood Plan for the American and Sacramento Rivers, Develop a standardized Emergency Safety Plan (ESP) for all four jurisdictions, Sacramento City and County are installing up to date river flow gauges on both rivers. Sacramento Metropolitan Fire District is developing an emergency rescue response plan for the American River utilizing the up dated river data. These actions will unify the response to possible flooding and or levee emergencies so that we have a common language and common operational plan for the two rivers. The County received grants from the CA Dept of Water Resources to help levee maintaining agencies, the City and County to develop levee breach flood evacuation and emergency action plans. This work is scheduled to be completed in 2016.

Finalize and Implement the Actions of the South Sacrament Habitat Conservation Plan

Lead jurisdiction: Sacramento County, City of Elk Grove, City of Galt, City of Rancho Cordova, Sacramento Regional County Sanitation District, Sacramento County Water Agency, Southeastern Connector

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The bulk of Sacramento County's work on the SSHCP comes from staffing by Rich Radmacher (Water Resources) with management representation by Leighann Moffitt (Planning and Environmental Review). The South Sacramento Habitat Conservation Plan and Aquatic Resources Plan documents were competed in the summer of 2015. Final adoption of the SSHCP is expected in Summer/Fall of 2016.

SAFELY OUT™ Evacuation Preparedness

Lead jurisdiction: Sacramento County, Citizen Voice

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This effort was not deemed to be as effective as some other outreach activities might be, so it is on hold.

Public Education Program

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Public Education Program will continually be implemented to help reduce risk and help the City's residents be prepared for all types of hazards, preparedness and mitigation measures, and responses during hazard events.

Alerts and Warning System

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City's reverse 911 program has been implemented and will help reduce all types of hazardous risks.

Lead jurisdiction: City of Elk Grove

Emergency Operation Center (EOC)

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is still ongoing.

Critical Facilities Database Development and Data Maintenance Processes

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

The critical facilities database was developed and is being updated as needed. This will help reduce risks by identifying the locations of critical facilities.

Increase Redundancy/ Functionality of Water Wells and Sewer Lift Stations

Lead jurisdiction: City of Galt

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Increase Data Capacity of Emergency Frequencies

Lead jurisdiction: City of Galt

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Data Center Disaster Recovery Improvement

Lead jurisdiction: Los Rios Community College District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Project completed successfully and was funded by District funds.

Community Emergency Response Training (CERT)

Lead jurisdiction: Los Rios Community College District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Funding was not available for this project and it will not be pursued in the future. We continue to train employees on Campus Community Emergency Response Training (CCERT)

Update the critical facilities identified during this DMA planning effort with the City's GIS technical group to support emergency management efforts.

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Critical facilities list will be updated by City OES and Utilities with the current efforts on the Emergency Action Plan grant. It should be completed in late 2015.

Bird Strike Mitigation Actions

Wildlife Hazard Management Plan

Lead jurisdiction: Sacramento County Airport System

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Wildlife Hazard Management Plan (WHMP) for Sacramento International Airport (SMF) was approved by the Federal Aviation Administration (FAA) on April 8, 2013.

Dam Failure Mitigation Actions

Mather Dam Improvements

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): On December 11, 2012, County Board of Supervisors approved a Cooperative Agreement with the US Air Force to provide up to $5,350,000 to fund the study, design, and construction of dam improvements to bring the dam into compliance with DSOD requirements. The US Air Force transferred ownership of the dam to Sacramento County in May 2013. County Water Resources, with design consultant AECOM, continue to coordinate the study and design of dam improvements with DSOD.

As of 2015, hydrology & hydraulic analysis, environmental surveys, and permit investigations occurred over the past year. Design work continues to progress.

Alder Creek Miners Dam

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): It was noted in 2012 that this site is in the City of Folsom, on the Aerojet property, in Alder Creek within the drainage area of the Glenborough planning area. The Developer, Gencorp, is working with the City of Folsom and the County Dept of Water Resources to determine what should be done to assure safety of the dam. The Division of Dam Safety has stated, in an April 22, 2010 email to the County Water Resources that the dam is not of a size that requires certification through their office (being 21' high and 35AF volume). Nevertheless, catastrophic failure could cause some short term flooding of Folsom Blvd and Hwy 50, possibly of greater interest is the many feet of sediment that has accumulated in the reservoir.

As of late 2014, there is no news on this subject; this should be addressed, with the City of Folsom as the Aerojet redevelopment proceeds. 2015 again noted no change. The Glenborough project consultant is working to respond to questions from FEMA regarding the functionality of the dam. The reservoir is property owned by the City of Folsom, while the ramifications could affect the County.

Improved Flood Inundation and Evacuation Plan for Probable maximum flow from New Spillway at Folsom Dam

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Folsom Dam Joint Federal Project is well underway with construction expected to be completed in Late 2017. The next project at Folsom will be to raise the dam providing additional volume. It is expected that the completed dam project will reduce the 1:200yr peak flood flow in the lower American River to about what the mean 1:100yr flow is today. Thus, allowing for certification of the levee system in accordance with the requirements of Central Valley Flood Protection legislation (2007-SB-5 and subsequent bills). Meanwhile, SAFCA is working to certify the American River levees to the 1:100yr FEMA standard.

In 2014, we received the 200-yr flood maps from the California Department of Water Resources, assuming a release of 230,000 cubic feet per second from the dam. Based on this information and other flow rates the City and County of Sacramento will prepare inundation and evacuation maps (funded by a grant from the state). In 2015, the City and County with Reclamation District 1000 and American River Flood Control are preparing a flood emergency action plan update.

Folsom Dam Joint Federal Project

Lead jurisdiction: SAFCA

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Folsom Dam Raise

Lead jurisdiction: SAFCA

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Drought Mitigation Actions

Drought Contingency Plan

Lead jurisdiction: Southgate Park & Recreation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Earthquake Mitigation Actions

Hughes Stadium Renovation at Sacramento City College

Lead jurisdiction: Los Rios Community College District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Was successfully completed with District funds.

Flood Mitigation Actions

Improve County ALERT (Automated Local Evaluation in Real Time) system of stream and rain gages

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In 2014, partially funded by a State grant, this project is underway. Water Resources is working to assure that the computer system is working properly (indoors) before we begin upgrading the units at the ALERT sites (outdoors). 2015 Status: The ALERT 2 upgrade project is well underway. The system of ALERT 1 and ALERT 2 gages is functioning fine and will serve the community well even as the upgrades continue. Expansion of the ALERT system will depend upon land development and interests in monitoring the streams.

Elevation Projects to Mitigate Flood Risk

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: as the County looks ahead to implementation of the flood insurance reform, there is a strong possibility that property owners may become more interested in flood risk mitigation. There is one home elevation project slated for 2016 in the Delta area. Water Resources anticipates increased interest in flood hazard mitigation prompted by increasing flood insurance cost.

Arcade Creek Corridor Plan

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: There is some effort to construct two bike trail crossings over Arcade Creek. The County remains interested in other actions recommended by the Watershed Group. The bike trail project is continuing.

Elevate up to Three Homes on Long Island (Grand Island Road, Sacramento River)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): There is one applicant on Long Island beginning design work. As of 2015, the project is progressing.

Mitigation Projects for Repetitive Loss Structures/Areas

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: as the County looks ahead to implementation of flood insurance reform, there is a strong possibility that property owners may become more interested in flood risk mitigation.

Improve Strawberry Creek Basins at East Stockton Blvd

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: the City of Sacramento and SAFCA constructed berms and channel improvements along a portion of Strawberry Creek in 2013 to protect existing residential areas form overbank flooding. These areas were removed from the FEMA floodplain in 2014 LOMR (remap) based on the model developed for the US Army Corps and the channel improvement constructed. The work by the City largely resolved downstream flooding concerns. However the updated LOMR model will be used to evaluate potential impacts to these channel improvements and flood control system due to future development in upstream areas of Strawberry Creek with Sacramento County and Elk Grove.

Triangle Detention Basin

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: the County is seeking additional right of way at the inter-basin transfer to construct a second detention basin. Both the Triangle Rock Basin and the second basin will allow the inter-basin transfer of flow from Laguna Creek to Gerber Creek to be cut-off. A CLOMR will be submitted to FEMA once the right-of-way for the second basin has been acquired and a basin design prepared.

Unionhouse Detention Basin Upstream of East Stockton Blvd Partnering with Park District and SAFCA

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In 2012 it was reported that Water Resources continues to work with the City of Sacramento, the Corps of Engineers and Sacramento Area Flood Control Agency. As of 2014, there was nothing new to report on this measure.

Unionhouse Creek Joint Use Detention Basins – Park Active or Passive Joint Use

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: This measure is moving forward as development is planned in the watershed area.

South Sacramento Stream Group Detention Basins

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: Sacramento County continues to evaluate development planning in the County to ensure there will be no impacts to FIS base flood elevations within the City of Sacramento and is working closely with the City of Sacramento and SAFCA to evaluate impacts that development projects may have on recently constructed state and federal flood control projects. Sacramento County is working with the US Army Corps, SAFCA and the City of Sacramento to construct improvements along Florin Creek including an off-line detention basin at a park site owned by Southgate Recreation and Park District. The project will reduce out bank flooding and remove about 500 homes in the City and 20 homes in the County form the FEMA floodplain.

Elder and Gerber Creek

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): in 2012 it was reported that Water Resources continues to seek opportunities prepare this project for further advancement by development interests. In 2013, it was stated that the land development interests are engaging again with Water Resources after a long recession. There should be more to report next year. In 2014, Water Resources was actively working with County Real Estate Division to acquire channel right-of-way. Development interests intend to construct the lower reach of Elder Creek, the upper reach of Elder Creek, and the upper reach of Gerber Creek in the next two construction seasons. 2015 saw ground breaking, with target to complete in 2018.

Florin Creek Basins –Florin Vineyard Drainage Master Plan

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In 2012 there was very little development activity

at the time. The finance plans are not yet implemented. In 2013, there seemed to be some renewed land development interest; there might be more to report next year. In 2014, the developer of a proposed subdivision named Florin Vineyards is working on a drainage study to detail a proposed reach of concrete lined channel to serve the fact that downstream drainage flowline is too high for the pipe that had been a part of the original drainage master plan document. As of 2015, developers continue to work on a drainage study to evaluate creek drainage improvements that mitigate flood impacts and address environmental constraints.

Joint Use Detention-Park Basins on Laguna Creek

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In 2012, it was reported that this project can be ready for a Vineyard Springs Developer to construct after the Triangle weir is in place and subject to hydraulic analysis and an approved FEMA map revision submittal. Water Resources continues to pursue this goal. It was reported in 2013 that there seems to be some renewed land development interest; there might be more to report next year. As of 2014, the weir was constructed at Triangle Aggregate.

Southgate Basin - The County is working to obtain the Corps permit. The preliminary design is complete for the Southgate detention basin, construction will await developer interest in obtaining the fill material from the basin.

Pasa Robles Drive - Concrete Channel Lining Rehabilitation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not started.

Chicken Ranch Slough - Concrete Channel Lining Rehabilitation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not started. Funding for initial studies is included in the current fiscal year budget.

Morrison Creek - Concrete Channel Lining Rehabilitation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not started.

Mayhew Slough - Concrete Channel Lining Rehabilitation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not started.

Strong Ranch Slough - Concrete Channel Lining Rehabilitation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not started.

Keep Watershed Management Plan Current CRS Activity 450 (county and cities)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): As of 2012, the Watershed Management Plan is inserted into the Local Hazard Mitigation Plan as an appendix, and is currently being evaluated (for Community Rating System credit) by a consultant to the Insurance Services Office. In 2014 it was reported that the watershed management plan is being outreached to the affected cities for review and comment. Status: Every year there are development plans, FEMA floodplain studies, hydrology and hydraulic analyses, and of late a state mandated 200-year flood hazard mitigation requirement; meanwhile, watersheds know no political boundaries. CEQA sets the tone for assuring no adverse impact, but watershed models may show unintended consequences farther downstream from a development area. Consequently, it is important for the cities and county to maintain a continuous dialog in an effort to assure each other that the flood hazards are not exacerbated. In order to accomplish this, Water Resources developed the CRS Activity 450 Watershed Management Plan as an appendix to the Countywide Hazard Mitigation Plan, which is updated on a five year cycle, next update is due October 2016.

Woodside Condominiums Repetitive Flood Loss Property

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): There has been no activity on this mitigation measure. Water Resources stands ready to assist Woodside including the pursuit of mitigation project grant funding. Status: National Flood Insurance Program, as reformed in 2014, will continue to increase insurance rates. It was recommended to the homeowners' association to retain the services of an engineering consultant who could prepare elevation information to assure that their insurance agent correctly rates their policy. Meanwhile, Water Resources annually discusses flood preparedness and flood hazard mitigation measure with the Woodside manager and HOA president.

Conversion to NAVD88 vertical datum (from NGVD29)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): As of 2014, this effort is progressing. Conversion to NAVD 88 Vertical Datum – Status: This effort continues, it was suggested that the County consider seeking a FEMA grant to assist in the assurance that NAVD88 benchmarks are widely available for those surveyors who do not use GPS survey systems.

Mitigation projects to reduce flood risk to critical facilities.

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Starting in the fall of 2014, Sacramento City and County will be updating flood plain maps and information for the American River Flood Plain utilizing the new river flow rates provided by the US Bureau of Reclamation. The new flood plain maps will be used to develop evacuation planning, strengthening infrastructure facilities based on the new information.

Hydrologic and Hydraulic Modeling in Compliance with 2012 Central Valley Flood Protection Plan

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): in 2012, the standards and applicability are not yet clearly stated by California officials. It was noted in 2014 that there should be more to report on this in 2015-2016. The CVFPP Urban Level of Protection Criteria "ULOP" is published by the state and the County intends to implement it. The City and County of Sacramento and the City of Elk Grove will work with SAFCA to develop a plan to achieve 200-yr flood protection before 2025, in accordance with ULOP, for urban areas protected by levees. ULOP also applies to streams with more than 10 square miles of contributing watershed area. Update 2015 Status: the CVFPP Urban Level of Flood Protection Criteria requires analysis of the 1:200yr storm event. In discussions with weather and climatology professionals there seems to be some uncertainty in the determination of the depth, duration and intensity of such a statistically improbable event particularly in light of the President's Executive Order 13690, recommending consideration of global climate change. It was suggested that the County seek a FEMA grant to assist in this analysis.

Delta Area Fire Station Needs to be Elevated or Flood Proofed to Protect Against Levee Breach Flooding to Assure Function in that Disaster Event.

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not started.

Update and Adopt Floodplain Management Ordinance in Light of Levee De-accreditation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Board of Supervisors adopted the updated floodplain management ordinance. This activity is completed as of 2014. In 2015, it was reported that the California Central Valley Flood Protection law requires amendment to the Ordinance to assure reasonable level of protection from the 1:200yr flood hazard in urban areas where the contributing watershed exceeds ten square miles. The Central Valley Flood Protection Plan Urban Level of Flood Protection Criteria requires inclusion of mitigation for the 1:200 year flood hazard in the Zoning Code, thus a revision to the County's Floodplain Management Ordinance. Water Resources staff are working on this.

Mitigate Peak Flow on Dry Creek and Tributaries (including Sacramento County and City of Roseville)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): There is no regional flood control basin proposed for Dry Creek. As of 2015, Placer County Flood Control with the City of Roseville is planning a basin on Antelope Creek that is reported to reduce peak flow in Dry Creek, measured at Vernon Street by ultimately to 800 cubic feet per second. Phase 1 work should begin in coming few years.

Repetitive Loss Church Building on Dry Creek

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Water Resources stands ready to provide technical assistance and/or to apply for FEMA grant opportunities to help mitigate this situation. Annual outreach efforts should serve to keep this in the mind of the owners. In 2014, as the County looks ahead to implementation of the flood insurance reform, there is a strong possibility that property owners may become more interested in flood risk mitigation.

Determine Cause and Mitigate Mercury and Methyl Mercury Coming from Tributaries of American River

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): As reported in 2012, the County Stormwater Program is pursuing the following actions, primarily as part of the Sacramento Stormwater Quality Partnership (SSQP, a collaboration of the County and the cities of Citrus Heights, Elk Grove, Folsom, Galt, Rancho Cordova, and Sacramento):

1. Continuing to implement the Mercury Plan submitted in 2004 to the Central Valley Regional Water Quality Control Board. This plan includes provisions for mercury control, including proper management of mercury wastes (proper lamp disposal by County maintenance, and household hazardous waste services for the public), control of industrial sites with the potential to discharge mercury, municipal operations (e.g. street sweeping, channel cleaning) and public outreach efforts.

2. Developing a quantitative model to better estimate the contribution of structural BMPs at new and existing developments for removing mercury (and other pollutants).

3. Completed Phase I control study of structural BMPs done in compliance with the Delta Mercury TMDL. The results of the control study will be utilized to refine estimates of the effectiveness and feasibility of controlling mercury within the urban watershed.

4. Contributed to the development and funding of the Methylmercury Exposure Reduction Plan (a program implemented by the California Department of Public Health), as required by the Delta Mercury TMDL.

5. Explore opportunities to work with other parties subject to mercury TMDLs to develop approaches for reducing key mercury sources cost effectively on a watershed basis. This may include working with entities such as the California Department of Water Resources and others that are involved in managing Delta waterways, levees, islands, and other land uses and activities that have the potential to impact methylmercury levels.

The County was unable to reach agreement with the US Bureau of Reclamation to support a joint study of mercury discharges from Alder Creek. The County is interested in continuing to explore funding sources and partners to characterize and mitigate as necessary thepotential hazard of mercury laden sediment in Alder Creek including that in the impoundment created by the small dam on the creek. upstream from Folsom Boulevard.

6. Continuing support California Product Stewardship Council efforts to promote Extended Producer Responsibility for mercury lamps and other mercury containing products.

Pump Stations

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): 2015 status: D05 Howe Avenue is scheduled for construction in 2016. D02 Kadema and D09 Mayhew are currently under construction. D45 Franklin Morrison and D06 North Mayhew design is scheduled for 2016. D11 West Coloma was removed from the list when the City of Rancho Cordova assumed ownership of the facility this past year.

Public Outreach Mailers

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): These mailers go out every year, September through November

Drainage improvements to reduce flooding on key evacuation routes

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In 2014, it was reported that the County will be working on evacuation routing as part of the urban flood emergency action planning project with the City of Sacramento. This will occur over the next few years {under a grant from the state}. Furthermore, when the Capital Southeast Connector Project is constructed it will be a facility that can serve as a major evacuation route to the region.

South Branch Arcade Creek – Gum Ranch Basin (with Fair Oaks Park District)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In 2014, there was no developer for this project. 2015 Status: The schedule for land development is in the hands of the landowner to decide.

Dry Creek Flood Hazard Mitigation Acquisitions with County Park Dept

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): As the County looks ahead to implementation of the flood insurance reform, there is a strong possibility that property owners may become more interested in flood risk mitigation.

Arcade Creek at Evergreen Estates Floodwall improvements

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The levee-floodwall system is shown on the FEMA flood insurance rate maps as provisionally accredited, however that status has expired and the neighborhood will be mapped as a special flood hazard area in the next FEMA map revision. The project necessary to bring the wall into FEMA 100-yr and California 200-yr design standard is very expensive and involved disturbance to non-benefitting property owners. Meanwhile, the wall has served the neighborhood well saving them from at least three floods (1995, 1997, 2005) since it was constructed. Physical flood fighting is necessary during exceptional high water events. The improvement necessary, to assure flood protection by the floodwall system, is very expensive, affecting Winding Way and several private properties. There is a developer holding the vacant land to the west of Evergreen Estates who is motivated, but the cost of the

flood control improvements are prohibitive. This will become a greater concern as the NFIP reform is implemented. There may be motivation to consider alternatives such as home elevation. 2015 Status: The City of Sacramento plans to reconstruct the Auburn Blvd bridge crossing Arcade Creek, immediately downstream of the subject floodwall. Water Resources is working with the City to determine if there is anything that can be done to improve conveyance, knowing that the existing condition leaves Auburn Blvd vulnerable to flood water overtopping in the 1:20 year storm event (e.g. Dec 31, 2005). Meanwhile, Water Resources is talking to FEMA about levee mapping procedures in hope of lowering the base flood elevation in Evergreen Estates.

Linda Creek Peak Flow Mitigation

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Any development in this watershed pays the Zone 11C supplemental fee for Linda Creek 'fair share' mitigation. The funds are transferred to Placer County Flood Control as compensation for impacts to the watershed. FEMA flood insurance rate mapping, dated August 16, 2012, includes the latest study prepared by Nolte Engineering (under a FEMA cooperating technical partnership agreement), and Placer County prepared an updated model of the Dry Creek watershed. County Water Resources has no significant flood control projects planned in this watershed, but intends to cooperate with Placer County as mitigation projects are contemplated.

In 2014, Placer County Flood Control developed a new nexus study, there may be a minor adjustment to the fee in this area as the Zone 11 Fee Study is updated it will be outreached to Placer County for comment.

Improve flood protection and/or Evacuation Planning for Mobile Home/RV Park at Manzanita/Auburn. Alternatively, the park Should Establish Flood Warning and Evacuation Procedures.

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The property owner hired an engineer (Watermark) to consider mitigation measures. – Status: nothing to report at this time.

Capital Improvement Projects – Pipelines (2012-13)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The following projects were constructed in 2012: El Sur/Arden Way, Elkhorn Boulevard/Schofield Way – Phase 2, Flagstone Street/Agate Way, and New York Avenue/Oriana Court.

Projects under construction in 2013: Elkhorn Boulevard/Schofield Way – Phase 3. The Ravenwood Avenue project was re-assessed and the construction date was revised to 2015. The Barrington Road project

investigation determined the project was not needed and the project was deleted. A portion of the Kings Way/Verna Way project was pulled from the project to create the El Camino Ave – Transportation Project Phase I project. This project was scheduled for construction in 2013 as a part of an Additive bid section of a County Transportation project. Due to high bids on the Base Bid, County Transportation did not add any Additives to their project. As a result, the El Camino Ave – Transportation Project Phase I project was deleted and the planned work was returned to the Kings Way/Verna Way project. In addition, the Kings Way/Verna Way project was re-assessed and the construction date was revised to 2017. The 3509 El Camino Avenue project was re-assessed and combined with other adjacent projects resulting in the revised name of Kentfield Way/Watt Avenue and construction date of 2014.

In 2015, it was reported that the Ravenwood and Kentfield Way/Watt Avenue projects are currently under construction. The Kings Way/Verna Way project remains on schedule for 2017.

Capital Improvement Projects – Pipelines (2014-15)

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Somersby/Wixford and Eastern/Arden projects were re-assessed and their construction dates were revised to be beyond 2018. The Rich Hill Drive project was re-assessed and the construction date was revised to 2018. The following projects have been added to replace the three previously scheduled projects with construction dates noted in parenthesis:

- Femoyer Street Outfall (2014)
- Florin Road/Frasinetti Road (2014)
- Kentfield Way/Watt Avenue (2014)
- Kovanda Avenue (2014)
- Rowena Way (2014)
- Ravenwood Avenue (2015)

As of 2015, the Kentfield Way/Watt Avenue and Ravenwood projects are currently under construction. The Florin Road/Frasinetti Road project is under review and may no longer be needed due to recent upstream private development improvements.

New City Sump 90 Operation Plan

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Nothing to report. The schedule is led by the City of Sacramento Department of Utilities as the pump operator.

Land Acquisition

Lead jurisdiction: Southgate Park & Recreation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Conservation Easements

Lead jurisdiction: Southgate Park & Recreation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Multi-jurisdictional Cooperation within Watersheds

Lead jurisdiction: Southgate Park & Recreation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

South Sacramento Streams Group

Lead jurisdiction: SAFCA

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

American River Common Features

Lead jurisdiction: SAFCA

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

CVFPP - Flood Emergency Plan

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): A DWR grant was awarded to the City and County of Sacramento, reclamation districts, and other local partners in September 2013. The grant includes writing a regional emergency action plan, upgrading the ALERT system, funding part of the new reverse 911 system, flood inundation maps, and emergency response training. Currently, the new emergency action plan and flood inundation maps are in draft format.

Adopt Additional Floodplain Development Standards

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Development Services Task Force has made recommendations on additional floodplain development standards and submitted them to FEMA. These will be added to the City's Floodplain Ordinance will be taken to City Council this fall of 2015 along with the Comprehensive Flood Management Plan.

Update the General Plan to include the requirements of the CVFPP

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City updated its General Plan in March 2015 and has incorporated the required maps and policies to comply with the CVFPP and SB 1278. The City will have its zoning code amended by March 2016 to meet other CVFPP and SB1278 requirements.

Historic Magpie Creek Study

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): FEMA's new guidelines, "The Revised Analysis and Mapping Procedures for Non-Accredited Levees", are in final form as of July 2013. Using these guidelines will allow the City and FEMA to map the Magpie Creek floodplain assuming overtopping of the diversion instead of just assuming the diversion is non-existent. This will allow for more accurate and realistic floodplains. FEMA is still working on the physical map revision study for Magpie Creek.

South Sacramento Streams Project: Union Pacific Railroad Flood Wall

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The flood wall was completed at the 2012. The certification data for the flood wall was submitted to FEMA on June 18, 2013. About 3,200 residents were removed from the floodplain in May 2014.

Natomas Levee Improvement Project (NLIP)

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The work is complete to meet the A99 Zone criteria in the Natomas Basin. The project received federal authorization from Congress in June 2014 for the NLIP, which was another FEMA A99 requirement. The A99 flood zone became effective on June 16, 2015. For 200-year protection and to obtain X Zone for the basin, it is predicted that this construction work will be completed in approximately 2019 by the Corps.

Retrofit of Repetitive Loss Properties

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City submitted a request to FEMA in December 2007 and September 2009 to remove 19 properties from the Repetitive Loss List. In the January 2011 repetitive loss data, these 19 properties were removed from the unmitigated Repetitive Loss list. The list has dropped from 40 to 21 properties. Grants were applied for in September 2011 to retrofit 3 repetitive loss properties, but the Local Hazard Mitigation Plan was not approved by FEMA and City Council until June 2012. Grants will be pursued in the future.

Preferred Risk Policy (PRP) Outreach Campaign

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Since July 2010, the City has engaged in a public education campaign to educate property owners in the City of Sacramento about PRP policies, the benefits of having a PRP to protect your home and investment, and the dangers of living behind levees. In spring of 2011, City staff attended 6 community meetings in Natomas held by the Sacramento Area Flood Control Agency and hosting a table at each of the meetings sharing information regarding the importance of flood insurance. The City also worked with the Sacramento Business Journal and the Natomas Buzz on stories pertaining to the impacts of the Corrective Action Plan and the current flood zone designation in Natomas.

The City also promoted flood insurance by: insertion of the "Be Flood Ready" Brochure in the November City of Sacramento Utility Bills; the billboard on Business Interstate 80 carrying the "Be Flood Ready. Buy Flood Insurance." Message from November 2010-February 2011; and ads on Regional Transit buses for November and December 2010 stating "Be Flood Ready. Buy Flood Insurance." The City saw more than a 10% increase in PRP policies from 2008 to 2010. Although, this is hard to measure since Natomas residents were in the 2-year PRP extension program and the floodplain changes from Letter of Map Revisions and Physical Map Revisions.

	AE, A,A0, AH	AR,A99, STD.X	PRP	TOTAL
Apr-08	NA	NA	NA	43,789
Aug-08	737	12,360	30,050	43,147
May-09	1,318	16,984	30,107	48,409
Aug-09	924	30,974	19,459	51,357
May-10	1,047	15,091	33,434	49,572
Sep-10	1,106	15,372	32,722	49,200
Mar-12	791	10,676	36,459	47,926
Oct-13	571	3,788	40,277	44,636

Drainage Projects for Repetitive Loss Properties

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City submitted a request to FEMA in December 2007 and September 2009 to remove 19 properties from the Repetitive Loss List. In the January 2011 repetitive loss data, these 19 properties were removed from the unmitigated Repetitive Loss list. The list has dropped from 40 to 21 properties. Grants were applied for in September 2011 to retrofit 3 repetitive loss properties, but the LHMP was not approved by FEMA and City Council until June 2012. Grants will be pursued in the future. In addition, the City listed local drainage projects for three repetitive loss sites in the 2013 American River Basin Integrated Water Management Plan, which allows for grant opportunities.

Unionhouse Creek Existing Conditions LOMR and Channel Improvements

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The construction for channel improvements along Unionhouse Creek was finished at the end of 2012. A CLOMR was not completed for Unionhouse Creek because the Base Flood Elevation was not increased with the proposed project. A LOMR was submitted in June 2013 to reflect the Unionhouse Creek project and the other South Sacramento Streams Group floodwalls. In May 2014, the LOMR was approved. Approximately 3,200 parcels were removed from the floodplain.

Emergency Notification and Evacuation Planning

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The Reverse 911 system of emergency notification is complete. Now, in addition to regular testing and deployment, two „self registration portal announcement" system launches were completed (February 2012). These announcements reached 14,145 locations in the North Natomas / 95835 zipcode. Communications Center Staff attended the Natomas Charter School Festival (May 2012) in an effort to educate area residents about the Reverse 911 system"s self registration portal for mobile devices. Staff took a wireless laptop so interested persons could initiate registration on site. The Winter 2012 edition of City Express, a quarterly City of Sacramento newsletter, included an article titled, "What is Reverse 911 and why should I sign up?". Since 2012, County and City OES have implemented an even faster system than Reverse 911 called Everbridge. The residents who registered for Reverse 911 were transferred to the new system.

Drainage Projects from the City's Priority Drainage Project List

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The drainage projects constructed in 2014 included:

- Sump 157 Access Ramp – $73,000
- PG&E Ditch Improvements - $888,000
- Sears Ditch Liner Repair Project - $233,000
- River Park drainage Improvements - $512,000
- Sump 44 Discharge Main Replacement - $50,000

The design and/or construction of following projects are currently underway:

- Sump 115 Electrical Rehabilitation - $160,000
- Sump 117 Electrical Rehabilitation - $233,000 Sump 38 & 39 Switchgear Replacement - $280,000
- Sump 22 Generator Control Panel - $30,000
- Leisure Lane/Hwy 160 Box Culvert - $250,000
- Drainage Sump Outfall Design - $300,000
- Sump 90 Inlet Channel Repair - $118,000
- Sump 142 Site and Outfall Repair - $90,000
- Sump 138 Site and Outfall Repair - $149,000
- Sump 34 Load Bank Project - $254,000
- Sump 28 Load Bank Project - $180,000
- 65th Avenue/25th Street Drainage Improvement - $437,000
- Basin 141 Pipe Improvements - $1,650,000
- Hudson Way Drainage Improvements - $150,000
- Florin Creek Detention Basin - $4,000,000

Riconada Flood Wall

Lead jurisdiction: City of Citrus Heights

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Storm Debris Removal

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Based on the 2012 revisions to the local flood plain hazard, the city changed the project. A new project includes install approximately 500' of 42" Storm drain pipe in an effort to remove 13.1 acres of runoff area that contributed to Riconada. This area is being redirected to a location 250' downstream of the street. The initial 250' of pipe, inlets and outfall has been installed as part of a new development. The City will complete the pipe & inlet installation in 2017.

Drainage and Flood Control Programs

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Drainage and Flood Control Programs are implemented to reduce risk and losses. The Drainage and Flood Control Programs are identified in the City of Elk Grove's Storm Drainage Master Plan.

LID Rain Garden Plaza

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project has been constructed; however, it is an educational stormwater garden/facility which provides continuous education and outreach efforts on Low Impact Development (LID) practices and using stormwater as a resource.

School Street Alley Drainage Improvements

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed and it reduced localized flooding in the alley. The Storm Drainage Master Plan efforts identified this area as being impacted by localized flooding if improvements were not completed.

Elk Grove Creek Outfalls

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed to prevent backwater flows onto the streets from the creek. This improvement reduces risks of localized flooding on the streets.

Elk Grove Creek Restoration

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed and helped with habitat restoration efforts.

Waterman Road Culvert Repair and Replacement

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed and it replaced a damage 66-inch culvert under the roadway reducing risks to the roadway failing and impacts to drainage flow.

Waterman Road Culvert Replacement

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed and it replaced a badly deteriorated culvert under the roadway reducing risks to the roadway failing and impacts to drainage flow.

Elk Grove Creek Flood Protection and Clean Water

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is on-going. The City submitted for a Prop 1 grant for $2.5 million to construct the project.

Elk Grove Watershed Recommended Improvements

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed which enlarged existing pipes and constructed 24-acre-feet of detention storage to reduce flooding. The Storm Drainage Master Plan modeling efforts identified this area as being impacted by flooding if improvements were not completed.

Multi-Functional Drainage Corridor for Shed C

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is on-going and will be constructed as new development is implemented.

9816 Sheldon Road – Enlarge Culverts

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed which enlarged existing pipes and constructed 24-acre-feet of detention storage to reduce flooding. The Storm Drainage Master Plan modeling efforts identified this area as being impacted by flooding if improvements were not completed.

Sheldon Road Drainage Project

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is constructed and replaced existing culver5s with two 2x4 foot box culverts under Sheldon Road and one 2x4 foot box culvert under Bader Road to reduced localized flooding. The Storm Drainage Master Plan modeling efforts identified this area as being impacted by localized flooding if improvements were not completed. (same project as above)

Sleepy Hollow Detention Basin Retrofit

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is on-going and is part of a Prop 84 Stormwater Grant. This project will help mitigate impacts to the surrounding community on reducing the 10-year and 100-year storm elevations in the detention basin; serve as a pilot/demonstration project for conversion of conventional detention basins into multi-use/benefit detention basins for holistic watershed protection; increase existing groundwater elevations; improve the habitat of local and migrating wildlife species; and provide a valuable recreational space for public with a jogging/walking trail.

Sleepy Hollow Lane Drainage Improvements

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is targeted as a future project to install an 18-inch pipe to carry stormwater runoff from low spots in the roadway that flood periodically.

East Elk Grove Area/ Rural Region Improvements

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is targeted as a future project to accommodate future development and existing deficiencies with detention basins, pipelines, culverts, and open channels.

Sheldon Road Ditch Improvements and Multi-Use Trails

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is targeted as a future project to construct a multi-use ditch along the roadway which addresses the unique rural characteristics of the area.

Laguna Creek Watershed Improvements (New Pipeline and Enlarge Existing Pipelines)

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed with new pipeline and enlarged existing pipelines to reduce flooding. The Storm Drainage Master Plan modeling efforts identified this area as being impacted by localized flooding if improvements were not completed.

Deer Creek Watershed Improvements (New Detention Basins)

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is targeted for the future to accommodate future development with a 5 acre-feet of storage detention.

SCADA System for the Stormwater Pump Stations

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is on-going. Hard line phones wires were installed at all of the pump stations, except for one pump station that has a wireless connection due to access issues. Auto dialers were installed at the pump stations to trigger an alarm to alert staff for high water levels and malfunctions. These improvements will help manage the pump stations during storm events.

Dry Well Installation at Kent Street and St. Anthony Court

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed. These areas were subject to frequent flooding. The City received calls on an annual basis from residents impacted by the flooding. The installation of dry wells alleviate reoccurring flooding that occurred by improving the conveyance capacity.

Elk Crest Drive Pipes

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was constructed which enlarged existing pipes to reduce street and property flooding. The Storm Drainage Master Plan modeling efforts identified this area as being impacted by localized flooding if improvements were not completed.

Strawberry Creek Detention Basin Retrofit

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is on-going. A portion of the project has been completed by constructing a dry well in the water quality portion of the detention basin. The dry well is part of a Prop 84 Stormwater Grant to help capture, cleanse and infiltrate stormwater to recharge groundwater supplies to help mitigate for the drought and climate change.

Laguna Creek and Whitehouse Creek Multi-Functional Corridor Enhancement

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is targeted for the future.

Whitehouse Creek Watershed Improvements

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is in progress and will accommodate future development with new pipelines, enlarge existing pipelines, and detention basins. The Storm Drainage Master Plan modeling efforts identified this area as being impacted by flooding if improvements were not completed. This project will also provide habitat enhancements.

Grant Line Channel Improvements (Pump Station and Enlarge Pipes)

Lead jurisdiction: City of Elk Grove

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is targeted for the future.

Alder Creek Watershed Council

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Redevelopment Area Drainage Improvements

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Drainage System Maintenance Tax Assessment

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Floodplain Mapping

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Drain Inlet Retrofit Capital Improvement Plan (CIP)

Lead jurisdiction: City of Galt

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Creek/Streams Vegetation Management Plan

Lead jurisdiction: City of Galt

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sunrise Boulevard Widening Kiefer to Jackson

Lead jurisdiction: City of Rancho Cordova

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Project is ongoing and is included in this Plan Update.

Flood Response Equipment

Lead jurisdiction: Cosumnes Community Services District Fire Department

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood Response Training

Lead jurisdiction: Cosumnes Community Services District Fire Department

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Coordinate with SAFCA, CA-DWR, USACE, and Sacramento County on Proposed Flood Control projects on Magpie Creek

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): In the beginning of 2012, SAFCA purchased four vacant parcels in the Magpie Creek 100-year floodplain with a FEMA grant. The parcels are along Raley Blvd. between Vinci and Santa Ana Ave. The proposed project has not been constructed. It will be years before the Army Corps of Engineers can construct this project.

Storm Water Management Practices – Implement Storm Water Management Practices as identified in Stormwater Quality Design Manual

Lead jurisdiction: Southgate Park & Recreation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Main Drainage Canal Bank Stabilization and Sediment Removal

Lead jurisdiction: Reclamation District #1000

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project has not been started. The District is looking at the flood safety issues associated with this project and may determine it does not significantly reduce the flood risk. The District may look at other similar projects that provided a more significant reduction in the flood risk.

Security of District Facilities

Lead jurisdiction: Reclamation District #1000

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The District has initiated security risk improvements at some of its critical facility sites. A security fence was installed along a portion of the perimerter fencing system around Pumping Plant No. 1. Since this fence was constructed we have not had a security breach at this location. A contract to construct a security fence around the inner perimeter of Pumping Plant No. 8 has been awarded and the work is being constructed in 2016. Other security measures are in the planning phase.

South River Pump Station Flood Protection Project

Lead jurisdiction: Sacramento Regional County Sanitation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

SRCSD Critical Facilities Flood Study (Planning)

Lead jurisdiction: Sacramento Regional County Sanitation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Levee Failure Mitigation Actions

Hydromodification and Stormwater Quality countywide

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The County developed a hydromod basin-sizing calculator (the SAHM Calculator). Status: nothing to report at this time.

Ring Levees to Protect Delta Historic Villages

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Depends on community interest and funding

Levee Breach Scenario, Inundation, Evacuation, and Recovery Planning for Rural Areas South of Freeport

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City and County of Sacramento will be developing an Urban Flood Emergency Action Plan over the next two years, subject to State grant funding. In 2014 it was reported that th County awaits approval of a grant from the State. As of 2015, the grant is approved and contracts are issued, work is underway for a completion schedule at the end of 2016.

Improved Flood Inundation and Evacuation Plan for Structural Flood Control System Failure Scenarios in Urban Areas

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City and County of Sacramento will be developing an Urban Flood Emergency Action Plan over the next two years, the State grant funding was approved and the project is underway. As of 2015, the County awaits approval of a grant from the State. As of 2015, the grant is approved and contracts are issued, work is underway for a completion schedule at the end of 2016.

Human Vertical Evacuation Structures in Areas of Widespread Flood Hazard

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): The City and County of Sacramento will be developing an Urban Flood Emergency Action Plan over the next two years. This component will be in discussions during the upcoming LHMP 2017 update.

Livestock Vertical Evacuation Mounds in Areas of Widespread Flood Hazard

Lead jurisdiction: Sacramento County

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Searching for a funding source. This component will be in discussions during the upcoming LHMP 2017 update.

Implement the Recommended Actions of the Sherman Island Five Year Plan

Lead jurisdiction: Reclamation District #341

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): RD 341 has implemented multiple projects mentioned in the 2011 plan. The Projects, along with ongoing annual levee maintenance have reduced the risk of levee failure on Sherman Island.

Highway 16 Levee Rehabilitation Project

Lead jurisdiction: Reclamation District #800

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): RD 800 was unable to secure funding for the HWY 16 Levee Rehabilitation Project.

Bank and Levee erosion

Lead jurisdiction: Reclamation District #1000

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): No work has been initiated on this project other than monitoring the critical sites. Because of the recent drought years with lower than normal river levels, the sites have not significantly eroded any further.

Severe Weather: Heavy Rains and Storms Mitigation Actions

Public Education/Outreach Extreme Weather

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Heating and Cooling Centers for Extreme Weather

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

District Wide Roofing Renovations

Lead jurisdiction: Los Rios Community College District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Project has been ongoing with the majority of the project completed using District funds. Please keep on the list.

Tree Management

Lead jurisdiction: Southgate Park & Recreation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Wildfire Mitigation Actions

Fuels Reduction in the American River Parkway

Lead jurisdiction: City of Sacramento/Sacramento Metropolitan Fire District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): A CWPP for the American River Parkway was completed in June of 2014.

Previous to 2014 on the American River Parkway

1. The Invasive Plant Management Plan (IPMP) was initiated in the early 2000's and has since effectively minimized all populations of the highly flammable giant reed, Spanish broom, pampas grass over the entire American River Parkway, and (in pilot project areas) yellow star thistle. This project is being maintained on an annual basis to control these flammable weed species.

2. Sacramento Regional Conservation Corps removed ladder fuels in the wildland urban interface, defined as within 100 feet of private property lines, on the American River Parkway. (These areas were revisited for maintenance in 2014, as listed below).

American River Parkway 2014

1. Public and maintenance roadways were limbed up to allow adequate emergency vehicle clearance in the River Bend and Sunrise Areas. Maintaining roadway clearance through tree limbing should occur every 4-6 years.

2. Fire fuel reduction within 100 feet of private property lines (including limbing up trees, removing vines, and removing dead wood) was maintained at Fair Oaks Bluff, Lower Sunrise, Sailor Bar and Rossmoor Bar. This was a maintenance effort for a portion of a larger area that was initially treated in 2010. Maintaining fire fuel reduction areas along private property lines should occur every 4-6 years.

3. A firebreak system was initiated along existing maintenance roads in the Woodlake and Cal Expo areas, by mowing 10 feet on either side of existing roads (to create a 30 foot wide firebreak.) These mowed firebreaks should continue to be maintained on an annual basis.

4. The Woodlake and Cal Expo fire road system was mapped and labeled with signs for City of Sacramento Fire Department. Signage should be maintained as needed.

5. Fire breaks were disked at Rossmoor Bar and Lower Sunrise as part our routine annual maintenance routine. These fire breaks should continue to be maintained on an annual basis.

6. County ordinance passed limiting places where barbeques and smoking are permitted in American River Parkway.

7. Maintenance roadways at Sailor Bar and Sacramento Bar were limbed up to allow adequate emergency vehicle access.

8. All park fire hydrants mapped, categorized, tested, and painted for high visibility.

9. Access gates to fire roads painted for high visibility.

10. Brush removed from private property fence line at Lower Sunrise and Sailor Bar.

11. Sacramento City Fire conducted training burns in the open fields in the Woodlake and Cal Expo Area of the American River Parkway. Firefighters were trained in wildland fire suppression techniques, which benefited the Parkway by also reducing the flashy fuel loads in these open fields.

12. New firebreak systems are regularly maintained.

13. Passed County ordinances which limit locations of barbeques and combustibles.

14. Goats and sheep brought into the downstream reach (Cal Expo to Discovery), to reduce ladder fuels in forested areas.

Other Regional Park areas

Dry Creek Parkway:

1) Maintenance roadways were limbed up to allow emergency vehicle access. This was a first time treatment for these firebreaks and will continue to be maintained.

2) A prescribed burn was conducted in the open fields on either side of Q Street, as part of an annual maintenance routine. Fuels reduction in these fields, through burning or through an alternative measure should continue each year.

3) Mowed fire breaks were maintained along paved bike trail, as part of an annual maintenance routine. These fire breaks should continue to be maintained on an annual basis.

4) In fire break areas, trees were limbed up to allow mowing under trees and to reduce risk of ground to crown fires. This was a first time treatment for these firebreaks. Maintaining the firebreaks through tree limbing should occur every 4-6 year.

Mather Park:

1) Firebreaks behind homes and along roadways were mowed as part of our annual maintenance routine. These fire breaks should continue to be maintained on an annual basis

Indian Stone Corral:

1) In 2014: KD Goat Ranch brought 250 goats for 48 days to reduce flashy fuel cover. Goats grazed from late June to early August. Staff is very pleased that the treatment achieved the desired results, with minimal damage to the oak trees. Fuels reduction, through grazing or, through an alternative measure, should continue every one to three years.

2) Goats returned in early summer 2015.

Rollingwood Open Space:

1) In 2011, and in 2014: Fire fuel reduction within 100 feet of private property lines (including limbing up trees, removing vines, and removing dead wood) was maintained along the western section of the Rollingwood Open Space. This was a maintenance effort on a portion of a larger area that was initially treated in 2010. Maintaining these fire fuel reduction areas should occur every 4-6 years.

Coordinate with the County and State to Create defensible space to protect vital infrastructure located in the American River Parkway from wildfires (from 2005 Plan)

Lead jurisdiction: City of Sacramento

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. The City of Sacramento Fire Department and City Emergency Services are working with the Sacramento County Parks Department who oversees the American River Parkway. The County Parks Department is currently controlling vegetation growth surrounding SMUD, PG&E and WAPA transmission lines that traverse the parkway.

Fuel Reduction and Modification

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Wildfire Prevention Outreach

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Wildfire Hazard Identification

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Arson Prevention & Control Outreach

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Ignition Resistant Building Construction Upgrades

Lead jurisdiction: City of Folsom

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Reduction of Fire Hazard SRCSD Bufferlands

Lead jurisdiction: Sacramento Regional County Sanitation District

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Twin Rivers School District Mitigation Actions

Reduce Risk to Flooding of Northern Area Schools

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

New drainage plans to sites within the flood areas including, site drainage, storm drain upgrades and re-grading fields to shed water (on-site) away from buildings.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Work with City/County/Water departments to create defensible spaces at sites where nearby creeks are prone to flooding. Build-up earthen berms (off-site) to shed water away from critically located schools.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Update the Emergency Preparedness Plan and the Emergency Operations Plan so that in event of emergency or disastrous event, personnel and procedures are in place and streamlined. This will include purchase of new equipment not reliant on typical system power; including communications equipment, emergency housing and supplies.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Working with the Department of the State Architect (DSA) on Earthquake Retrofit Plan on all sites.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Revise and update district-wide Storm Water Prevention Plan

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Create email notification system for families for emergency situations.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Incorporate new rules for M&O department to keep drains clear, trees trimmed and vegetation removed to minimize impact during heavy rains.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Create defensible perimeter space – for fire areas. Trees trimmed and vegetation removed to minimize impact during fire season.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Updating Evacuation Plans.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Updating District Policy for new Construction.

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Updating Evacuation Plans for Excessive Heat

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Updating Evacuation Plans for Streambank Erosion

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Updating Evacuation Plans for Fog

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Chapter 3 Planning Process

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and

3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Sacramento County recognized the need and importance of the update process for their 2011 Local Hazard Mitigation Plan and initiated its development. After receiving a grant from the Federal Emergency Management Agency (FEMA), which served as the primary funding source for this plan, the County contracted with Foster Morrison Consulting, Ltd. (Foster Morrison) to facilitate and develop the plan. Jeanine Foster, a professional planner with Foster Morrison, was the project manager and CRS lead in charge of overseeing the planning process and the development of this LHMP update. Chris Morrison, also a professional planner with Foster Morrison, was the lead planner for the development of this update. The Foster Morrison's team's role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA);
- Meet the DMA requirements as established by federal regulations and following FEMA's planning guidance;
- Support objectives under the National Flood Insurance Program's Community Rating System and the Flood Mitigation Assistance program;
- Facilitate the entire planning process;
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data;
- Assist in facilitating the public input process;
- Produce the draft and final plan documents; and
- Coordinate with the California Office of Emergency Services (Cal OES) and FEMA Region IX plan reviews.

3.1 Local Government Participation

Sacramento County and the City of Sacramento, as the two participating National Flood Insurance Program (NFIP), Community Rating System (CRS) communities, the other six incorporated communities, and participating special districts made a commitment to this 2016 LHMP Update, as participating jurisdictions. The DMA planning regulations and guidance stress that each local government (participating jurisdiction)

seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;
- Detail where within the planning area the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For the Sacramento County Planning Area's HMPC, "participation" meant the following:

- Providing facilities for meetings;
- Attending and participating in the HMPC meetings;
- Completing and returning the Data Collection Worksheets;
- Collecting and providing other requested data (as available);
- Managing administrative details;
- Making decisions on plan process and content;
- Identifying mitigation actions for the plan;
- Reviewing and providing comments on plan drafts; including annexes
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to comment on the plan;
- Coordinating, and participating in the public input process; and
- Coordinating the formal adoption of the plan by the governing boards.

The County and all jurisdictions with annexes to this plan seeking FEMA approval met all of these participation requirements. In most cases one or more representatives for each jurisdiction attended the HMPC meetings described in Table 3-4 and also brought together a local planning team to help collect data, identify mitigation actions and implementation strategies, and review and provide data on plan drafts. Appendix A provides additional information and documentation of the planning process.

In order to promote the integration of CRS into this planning process, the HMPC representatives from the County and City of Sacramento were selected based on their areas of expertise relative to the CRS mitigation categories as detailed in Table 3-1 and Table 3-2. In addition, the Sacramento County Community Development Department, Planning and Environmental Review Division, Long Range Planning Section (Todd Taylor, Associate Planner and Mike Winter, Senior Planner) and the City of Sacramento, Community Development Department (Remi Mendoza, Associate Planner, Long Term Planning) in association with planners from many of the other cities and Foster Morrison Planners were involved in the development of this plan update through attendance at meetings, coordination, providing data, future land use planning support, and help with meeting facilitation. In addition to attending meetings, providing draft text for inclusion in the plan, reviewing plan documents, and coordinating input from other departments and stakeholders, Sacramento County and City of Sacramento planners also provided information on development since the last plan, mapping, text, and details on future development areas, input on current mitigation capabilities, and new and in-progress modifications to the General Plan and associated documents specific to Sacramento County's and City of Sacramento's floodplain management provisions for regulating to the 200-year level of flood protection.

Table 3-1 Sacramento County LHMP Staff Capability with Six Mitigation Categories

Jurisdiction/Departments	Prevention	Property Protection	Natural Resource Protection	Emergency Services	Structural Flood Control Projects	Public Information	Other
Sacramento County							
*Community Development Department/Planning and Environmental Review Division, Long Range Planning Section– Todd Taylor	X	X	X			X	X
*Emergency Services – Steve Catalme/Roger Ince	X	X	X	X	X	X	X
Department of Water Resources, Flood Management and Engineering/Sacramento County Water Agency- George Booth	X	X	X	X	X	X	X
Department of Water Resources, Flood Management and Engineering- Celine Livengood	X	X	X			X	X
County Sustainability Manager, Department of Waste Management and Recycling - Judy Robinson						X	X
City of Sacramento							
*Community Development Department/Long Term Planning – Remi Mendoza	X	X	X			X	X
*Emergency Services – Jason Sirney	X	X	X	X	X	X	X
Department of Utilities – Floodplain Management/Engineering – Connie Perkins	X	X	X	X	X	X	X
Department of Utilities – Floodplain Management/Engineering – Kelly Sherfey	X	X	X	X	X	X	X
Public Information – Rhea Serran						X	X

*LHMP staff on both the HMPC and Steering Committee

Specific individuals representing Sacramento County and City of Sacramento (CRS communities) departments and other jurisdictions participating in this LHMP Update were actively involved throughout the plan update process as identified in Appendix A in the sign-in sheets for the meetings and as evident through the data, information and input provided by HMPC representatives to the development of this LHMP Update. This Chapter 3 and Appendix A provides additional information and documentation of the planning process and participants to this plan update, including members of the steering and working committees, comprising the HMPC.

3.2 The 10-Step Planning Process

Foster Morrison established the planning process for updating the Sacramento County LHMP using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1. Organize Resources;
2. Assess Risks;
3. Develop the Mitigation Plan; and
4. Implement the Plan and Monitor Progress.

Into this process, Foster Morrison integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program; Pre-Disaster Mitigation program; Community Rating System; Flood Mitigation Assistance Program; Severe Repetitive Loss program; and new flood control projects authorized by the U.S. Army Corps of Engineers.

Table 3-2 shows how the modified 10-step process fits into FEMA's four-phase process. The sections that follow describe each planning step in more detail.

Table 3-2 Mitigation Planning Processes Used to Develop the Sacramento County Local Hazard Mitigation Plan

DMA Process	Modified CRS Process
1) Organize Resources	
201.6(c)(1)	1) Organize the Planning Effort
201.6(b)(1)	2) Involve the Public
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies
2) Assess Risks	
201.6(c)(2)(i)	4) Identify the Hazards
201.6(c)(2)(ii)	5) Assess the Risks
3) Develop the Mitigation Plan	
201.6(c)(3)(i)	6) Set Goals
201.6(c)(3)(ii)	7) Review Possible Activities
201.6(c)(3)(iii)	8) Draft an Action Plan
4) Implement the Plan and Monitor Progress	
201.6(c)(5)	9) Adopt the Plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan

This LHMP update involved a comprehensive review and update of each section of the 2011 plan and includes an assessment of the success of the participating communities in evaluating, monitoring and

implementing the mitigation strategy outlined in the initial plan, as previously described in more detail in Chapter 2 and throughout Chapter 4.

The process followed to update the plan is detailed in the above table and the sections that follow and is in conformance with the latest DMA planning guidance and the CRS 2013 Coordinator's Manual. As part of this plan update, all sections of the plan were reviewed and updated to reflect new data, processes, participating jurisdictions, and resulting mitigation strategies. Only the information and data still valid from the 2011 plan was carried forward as applicable into this LHMP update.

3.2.1. Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

With Sacramento County's, the City of Sacramento's and other participating jurisdictions' commitment to participate in the DMA planning process and the CRS program, Foster Morrison worked with the County's Department of Water Resources (County DWR), as overall project lead, to establish the framework and organization for development of the plan. An initial meeting was held with key community representatives to discuss the organizational and process aspects of this plan update process. At the beginning of this planning process, a resolution was passed by Sacramento County and the City of Sacramento, the two CRS communities, establishing the planning process and the Hazard Mitigation Planning Committee (HMPC). These executed resolutions are included in Appendix A.

The initial kick-off meetings were held on April 5 and 6, 2015. To better facilitate the planning process, for each planned meeting, duplicate meetings were held in the northern part of the City of Sacramento and the southern part of the County in Elk Grove. Invitations to these kickoff meetings were extended to key county departments, the seven incorporated communities, special districts located within the planning area, as well as to other federal, state, and local stakeholders, including representatives from the public, that might have an interest in participating in the planning process. Representatives from participating jurisdictions and HMPC members to the 2011 plan were used as a starting point for the invite list, with additional invitations extended as appropriate throughout the planning process. The list of initial invitees is included in Appendix A.

The HMPC was established as a result of these initial meetings, as well as through interest generated through the initial public meetings and outreach conducted for this project as detailed later in this section. The HMPC, comprising key county, city, special district, and other government and stakeholder representatives and the public, developed the plan with leadership from the County DWR and facilitation by Foster Morrison. Each participating jurisdiction seeking FEMA approval of the plan had representation on the HMPC. The HMPC was comprised of members of the steering committee established for this process (as discussed further in this section) as well as other representatives from key county, city, and other government agencies, key stakeholders, and the public, with an interest in hazard mitigation. The following participated on the HMPC: THESE LISTS WILL BE FINALIZED NEAR THE END OF THE PLAN

Sacramento County

- Agricultural Commission

- Airports
- Assessor
- Community Development, Planning and Environmental Review
- Emergency Services
- Geographic Information Systems
- Health and Human Services, Public Health
- Fire
- Regional Parks
- Sheriff
- Sustainability
- Transportation
- Waste Management and Recycling
- Water Agency
- Water Resources

Participating Cities

- City of Citrus Heights
- City of Elk Grove
- City of Folsom
- City of Galt
- City of Isleton
- City of Rancho Cordova

City of Sacramento

Other Government and Stakeholder Representatives:

- Brannan Adrus Levee Maintenance District* and Reclamation Districts 554*, 556*, 1002*, 2111*
- California Department of Water Resources (Cal DWR)
- Consumnes Fire*
- Folsom Fire Safe Council
- Herald Fire Protection District
- Golden State Water Company
- Los Rios Community College*
- National Weather Service
- Reclamation District 1000*
- Reclamation District 341, 800*
- Reclamation Districts -ADD OTHERS HERE
- Sacramento State
- Sacramento Metro Air Quality Management District
- Sacramento Metro Fire District*
- Sacramento Municipal Utility District
- Southgate Park and Rec District*
- Sacramento County Regional Sanitation District*
- Sacramento Area Sewer District*
- Twin Rivers Unified School District*
- UC Davis, Capital Region Climate Readiness Collaborative

*Indicates participating jurisdiction seeking FEMA approval of this plan

Citizens

- Meg Arnold, Valley Vision
- Richard Coombs, Nepenthe/Campus Commons, Insurance, Legal, & Safety Committee
- Chris Ferrerai, GEI Consultants
- Tim Hodgson, Courtland Town Association
- Robert Mead
- Walt Hoppe
- Dan Henderson, ESRI
- Alan Vail, VCS Consulting

A list of participating HMPC representatives for each participating jurisdiction is included in Appendix A. The above list of HMPC members also includes several other government and stakeholder representatives that were invited to participate and contributed to the planning process. This list includes all HMPC members that attended one or more HMPC meetings detailed in Table 3-4. In addition to providing representation on the HMPC and Steering Committee, participating jurisdictions formulated their own internal planning teams to collect and provide requested data and to conduct timely reviews of the draft documents as further detailed in each annex to this plan and as detailed in the list of HMPC representatives for Sacramento County.

Steering Committee

The HMPC includes both a Steering Committee and Working Group. The Steering Committee is the policy body which has primary input and decides what is included in the plan document. The Working Group provides data and information to the Steering Committee for consideration. The Steering Committee is comprised of key representatives from the County and the incorporated communities, and other agency and public representatives. The non-local government members of the Steering Committee (citizens and other outside stakeholders) represent more than 50% representation of the committee. See Table 3-3 and Appendix A for details on the makeup of the Steering Committee.

Table 3-3 Sacramento County LHMP Steering Committee

Community/Representative	Department/Organization	Citizen	Stakeholder	# Meetings
Sacramento County				
George Booth/Mark Rains	Water Resources/ Flood Control			3/4
Todd Taylor	Community Development/ Planning Services			1
Roger Ince/Steve Catelme	Emergency Services			1/1
Judy Robinson	Sustainability			4
Robert Mead	Resident	X		4
Chris Ferrari	Resident/GEI	X		2
Walt Hope	Resident	X		4
Emmerson Zapata	Resident	X		1
Lance Armstrong	Resident	X		1

Community/Representative	Department/Organization	Citizen	Stakeholder	# Meetings
Charlie Moore	Resident	X		1
Meg Arnold	Valley Vision		X	3
Karla Tejadn	Golden State Western Company		X	1
George Whitney	Resident	X		1
Colin Bailey	Env. Justice Coalition for Water		X	1
Alan Vail	Resident/VCS Consulting	X		2
Frederick Gayle???	??			1
Russ Ekman	State DWR MA09		X	1
City of Citrus Heights				
Kevin Becker	Principal Engineer			1
City of Elk Grove				
Connie Nelson				4
City of Folsom				
Sarah Staley/Ron Phillips	Engineer			2
City of Galt				
Bill Forrest/Alice Bernardino				3/1
Town of Isleton				
Romi Balbini	Director of Public Works			3
City of Rancho Cordova				
Allen Quynn 4				
City of Sacramento				
Kelly Sherfey/Connie Perkins	Department of Utilities, Floodplain Management/Engineering			4/2
Remi Mendoza	Community Development/Planning			4
Jason Sirney	Emergency Services			1
Maria Lorenso-Lee	Resident	X		3
Richard Coombs	Campus Commons Insurance, Legal & Safety		X	4
Others Joining At RA Meeting				
Rebecca Lane	Citizen/city of sac?			1
Sami Nall	Cal DWR			1
Kirkland Stout	Sacramento State			1
Dan Henderson	Esri			2
Amber Mace	UC Davis			1

Community/Representative	Department/Organization	Citizen	Stakeholder	# Meetings
Kathleen Ave	Cap Region Climate Readiness/SMUD			1
From Delta Public/Team meeting				
Mike Miramazehere	GEI Consultants			2
Bill Virvitch				1
Ross Dibble	Resident			1
Joyce Dibble	Resident			1
Pam Hodgson	Resident			1
Tim Hodgson	Resident			3
Tim Franesich	Resident			1
Paul Franusicl	Resident			1
Homer Herod	Resident			1
Bob Berger	Resident			1
Peter Stone	Resident			1
Heinz Lorza Saberig	Resident			1

Table 3-3 demonstrates the Sacramento County Steering Committee members' expertise in the six mitigation categories (Prevention, Property Protection, Emergency Services, Natural Resource Protection, Structural Flood Control Projects, and Public Information) The Sacramento County and City of Sacramento (as the CRS communities) staff responsible for community land use and comprehensive planning for the County were active participants on the HMPC and Steering Committee and provided data and information to support development of the plan. Specifically, this includes the Planning Services Divisions of the Community Development Departments from Sacramento County and the City of Sacramento as previously described. The support of staff from all participating jurisdictions were called upon to collect and provide requested data and to conduct timely reviews of the draft documents. Note that the above list of HMPC and steering committee members also includes citizens and several other government and stakeholder representatives that contributed to the planning process. Specific participants from these other agencies are identified above and, with supporting documentation included in Appendix A.

Meetings

The planning process officially began with a kick-off meeting held in both the northern portion of the City of Sacramento in the Natomas area, and in the Southern part of the County in Elk Grove, on April 5 & 6, 2016, followed by public kick-off meeting held the same day as each of the two meetings at 6:00 pm at the same locations. The meetings covered the scope of work and an introduction to the DMA, CRS, and FMA requirements. During the HMPC meetings, participants were provided with data collection worksheets to facilitate the collection of information necessary to support development of the plan. Using FEMA guidance, these worksheets were designed to capture information on past hazard events, identify hazards of concern to each of the participating jurisdictions, quantify values at risk to identified hazards, inventory existing capabilities, record possible mitigation actions, and to capture information on the status of

mitigation action items from the 2011 plan. A copy of the worksheets for this project are included in Appendix A. The County and each jurisdiction seeking FEMA approval of this plan update completed and returned the worksheets to Foster Morrison for incorporation into the plan document.

During the planning process, the HMPC communicated through face-to-face meetings, email, telephone conversations, file transfer protocol (ftp) and Dropbox websites, and through a County developed webpage dedicated to the plan development process. This later website was developed to provide information to the HMPC, the public and all other stakeholders on the LHMP process. Draft documents were also posted on these websites so that the HMPC members and the public could easily access and review them. The LHMP website can be accessed at:

- Sacramento County – http://www.waterresources.saccounty.net/stormready/Pages/Hazard-Mitigation-Planning-Committee-2016-Plan-Update.aspx

The HMPC met formally five times during the planning period (April 2016 – November 2016) which adequately covers the four phases of DMA and the 10-Step CRS planning process. The formal meetings held and topics discussed are described in Table 3-4. Agendas and sign-in sheets for each of the meetings are included in Appendix A.

In addition to the five HMPC meetings, an additional HMPC/community meeting was held the evening of June 21, as an extension of HMPC Meeting #2. This meeting was held in the Delta area at the Courtland Fire House to provide a local forum for both the participating Delta RDs and the community members to participate in the LHMP Update process. This Delta-focused meeting combined the elements of both the kickoff meeting and HMPC #2 for this LHMP Update process and also included information on the Emergency Action Planning being done to address flood emergencies in the Delta area. This meeting is also included in the table below.

Table 3-4 HMPC Meetings

Meeting Type	Meeting Topic	Meeting Date(s)	Meeting Location(s)
HMPC #1 Kick-off Meeting	1) Introduction to DMA and the planning process 2) Overview of current LHMP; 3) Organize Resources (CRS Steps 1,2,&3): the role of the HMPC, planning for public involvement, coordinating with other agencies/stakeholders 4) Introduction to Hazard Identification	4/5 & 6, 2016	South Natomas Community Center, Sacramento and Laguna Town Hall, Elk Grove
HMPC #2	1) Risk assessment overview and work session -CRS Step 4: Assess the Hazard -CRS Step 5: Assess the Problem	6/21 & 22, 2016	Bannon Creek Elementary School, Sacramento and Laguna High School, Elk Grove
Delta Area Meeting	1) Introduction to DMA and the planning process 2) Risk assessment overview and work session 3) Emergency Action Planning Status	6/21, 2016	Courtland Fire House, Courtland
HMPC #3	1) Review of risk assessment summary 2) Review and update of mitigation goals -CRS Step 6: Set Goals -CRS Step 7: Review possible activities	7/12, 2016	Bannon Creek Elementary School, Sacramento and Laguna High School, Elk Grove

Meeting Type	Meeting Topic	Meeting Date(s)	Meeting Location(s)
HMPC #4	1) Review of mitigation alternatives 2) Review and update of mitigation actions from the 2010 plan 3) Identify updated list of mitigation actions by hazard 4) Review of mitigation selection criteria 5) Update and prioritize mitigation actions 6) Mitigation Action Strategy Implementation and Draft Action Development -CRS Step 7: Review possible activities -CRS Step 8: Draft an Action Plan	7/13, 2016	Bannon Creek Elementary School, Sacramento and Laguna High School, Elk Grove
Delta Area Meeting	1) Review of RD participation in this LHMP Update Process 2) Review and discussion of hazard risks and vulnerabilities in the Delta area 3) Review and discussion of potential mitigation alternatives 4) Overview and development of RD annexes	9/9, 2016	Courtland Fire House, Courtland
HMPC #5	1) Review of final HMPC, jurisdictional and public comments and input to plan 2) Review and documentation of changed conditions, vulnerabilities and mitigation priorities 3) CRS Step 8: Draft an Action Plan 4) CRS Step 9 & 10: Plan maintenance and Implementation Procedures		

Planning Step 2: Involve the Public

Up-front coordination discussions with the Sacramento County Department of Water Resources, City of Sacramento Utilities Department, respective planning staff and floodplain managers established the initial plan for public involvement. Public involvement activities for this plan update included press releases, outreach on weekly County e-newsletter and social media, stakeholder and public meetings, development of an LHMP webpage and associated website postings, and the collection of public and stakeholder comments on the draft plan through a variety of mechanisms as further described below, as well as specific targeted outreach to different groups of people and other agencies throughout the county and incorporated municipalities. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2011 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for this plan update. As part of the plan development process, a Public Involvement Strategy was also developed to ensure a meaningful public process and to focus efforts on maximizing CRS credits for public outreach. At the planning team kick-off meetings, the HMPC discussed additional strategies for public involvement and agreed to an approach using established public information mechanisms and resources within the community.

Early Public Meetings

Public outreach for this plan update began at the beginning of the plan development process with an advertisement placed in the local newspaper and other local outreach methods to inform the public of the purpose of the DMA and the hazard mitigation planning process for the Sacramento County Planning Area

and an advertisement placed to invite the public to early public meetings held in duplicate in the northern portion of the City of Sacramento and the southern portion of the County to kick-off the project on April 5 & 6, 2016 at the South Natomas Community Center in Sacramento and Laguna Town Hall in Elk Grove. These meeting locations were selected for easy access for all area residents.

Final Public Meetings

The first draft of the plan was provided to the HMPC in September of 2016, with a public review draft provided in October of 2016. Two public meetings were held on November ???? 2016 to present the draft LHMP and to collect public comments on the plan prior to finalization and submittal to Cal OES/FEMA. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large and included an advertisement in the local paper inviting the public to attend the formal public meetings. The advertisement in the local newspapers included information on the date, location and time of the meeting, and where the draft plan could be accessed in the community. Two articles were also included in the local newspaper, both prior to and reporting on the final public meetings. Similar to the early public meetings, the two public meetings on the draft plan were held in the northern and southern sides of the County to facilitate participation by all Planning Area residents. In addition to a copy of the draft plan being placed on the County website in advance of these meetings, hard copies of the draft of the plan were made available to interested parties at four Sacramento County Public Libraries: NAMES.

Figure 3-1 Public Outreach Table at Sacramento County Library –

WILL BE INSERTED

Source: Sacramento County

Documentation to support the final public meeting can be found in Appendix A. In addition to advertisement for public participation, notices of meetings were sent directly to all persons on the HMPC contact list and also to other agency and key stakeholders with an interest in the Sacramento County Planning Area. The majority of these people reside in Sacramento County or in surrounding communities. Because this is a multi-jurisdictional planning effort, all public outreach activities for this plan update were conducted in cooperation with and on behalf of Sacramento County and the City of Sacramento, as the two CRS communities, the other incorporated communities, and all participating jurisdictions. The formal public meetings for this project are summarized in Table 3-5. As mentioned above, the Delta meeting held on June 21, 2016 is also included in the list of public meetings as it was a combined HMPC/Public meeting specific to the Delta community.

Table 3-5 Schedule of Public and Stakeholder Meetings

Meeting Topic	Meeting Date	Meeting Locations
1) Intro to DMA, CRS and mitigation planning 2) 2016 LHMP Update Process	4/5 & 6, 2016	South Natomas Community Center, Sacramento and Laguna Town Hall, Elk Grove
) Introduction to DMA and the planning process 2) Risk assessment overview and work session 3) Emergency Action Planning Status	6/21, 2016	Courtland Fire House, Courtland

Meeting Topic	Meeting Date	Meeting Locations
Presentation of Draft LHMP and solicitation of public and stakeholder comments	10/ ???, 2016	

Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Written public comments were provided by only two members of the public, with several agency stakeholders providing input and comments on the draft plan and other related data throughout the plan development process. All press releases, newspaper advertisements and articles, website postings, and public outreach efforts are on file with the Sacramento County DWR and are included in Appendix A.

Other Public Outreach Efforts

Beyond these more formal public involvement activities, the update process also included the following public outreach activities included in Table 3-6 which are further documented and described in Appendix A. The public outreach activities described here were conducted with participation from and on behalf of all jurisdictions participating in this plan, including the CRS communities of Sacramento County and the City of Sacramento.

Table 3-6 Other Public Outreach Efforts

Effort	Description
Article in Newspaper	An article was published in the Elk Grove Citizen after the Kickoff meetings to make citizens in the County aware of the hazard mitigation update process and invite participation and attendance at upcoming HMPC and Public Meetings
Survey	A public survey was posted on the County's website at the beginning of the planning process inviting the public to comment on how prepared both the County and individuals are for a possible natural disaster, including flood events
Sacramento County LHMP Update Website	Information on the Plan update process and location of documents, and final HMPC and public meeting locations were posted on the County website. Links to the County website were placed on websites from the other incorporated communities. This website also included a link to the Survey.
Delta Area Community Meeting	This meeting was held in the Delta area at the Courtland Fire House to provide a local forum for both the participating Delta RDs and the community members to participate in the LHMP Update process.
Public Outreach at Sacramento County Public Library, ?? location	The County prepared a table in the reference section with the draft plan at the Sacramento County Public Library, ??? location. Invitations were placed on Facebook, the County website, and as part of the advertisement for public meetings to let the public know that the documents were there for review and input.

The draft plan is currently available online on the Sacramento County website at: http://www.waterresources.saccounty.net/stormready/Pages/Hazard-Mitigation-Planning-Committee-

2016-Plan-Update.aspx. The public outreach activities described here were conducted with participation from and on behalf of all jurisdictions participating in this plan, including the CRS communities of Sacramento County and the City of Sacramento, other incorporated communities, and participating jurisdictions.

Public Outreach Survey

An integral element in hazard mitigation planning is broad public participation. Information provided by residents fosters a better understanding of local hazard concerns and can spawn innovative ideas to reduce impacts of future hazard events. A public opinion survey was accomplished to gather information from Sacramento area residents concerning local hazards. The survey was located on the County's LHMP website throughout most of the planning process and survey participation was promoted through public meetings, program websites, press releases, social media, and other public outreach events as previously described. Following is a summary of survey results. The survey and survey results are included in Appendix G.

Program for Public Information (PPI) Strategy

As part of their overall flood outreach programs, Sacramento County and the City of Sacramento have in place a Program for Public Information (PPI) strategy designed to maximize credits under CRS Activity 330, Outreach Projects. The objective of CRS credit for a PPI is to provide additional credit for information programs that are designed to meet local needs and that are monitored, evaluated, and revised to improve their effectiveness. The PPI is an ongoing public information effort to design and transmit the messages that the community determines are most important to its flood safety and the protection of its floodplains' natural functions. Program elements include instructing residents on actions they should take before, during and after storm events to mitigate their flood risk. These actions can include being aware of your own flood risk, implementing mitigation options available such as elevating or retrofitting a home, or understanding the benefits of purchasing flood insurance, even if a resident is outside of a federal flood hazard area.

These County and City PPI programs are important to consider in the development and implementation of this LHMP Update to ensure coordination and effectiveness of all public outreach and education efforts in the Sacramento County Planning Area.

Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, and/or their interest as a neighboring jurisdiction, representatives from the following agencies were invited to participate on the HMPC: LIST WILL BE UPDATED NEAR THE END OF THE PLANNING PROCESS

- Cal OES
- Cal Fire
- California Department of Water Resources
- Community Services Districts

- Incorporated communities in Sacramento County
- Fire Protect Districts
- Fire Safe Alliance
- Flood Control Districts
- Irrigation Districts
- National Weather Service
- Neighboring Communities
- NFIP/CRS Program Coordinators
- Public Utility Districts
- Red Cross
- Resource Conservation District
- United States Corps of Engineers
- Water Agencies
- Water Districts

Coordination with key agencies, organizations, and advisory groups throughout the planning process allowed the HMPC to review common problems, development policies, and mitigation strategies as well as identifying any conflicts or inconsistencies with regional mitigation policies, plans, programs and regulations. Coordination involved contacting these agencies through a variety of mechanisms and informing them on how to participate in the plan update process and if they had any expertise or assistance they could lend to the planning process or specific mitigation strategies. Coordination with these groups included, holding face-to-face meetings, sending outreach letters or e-mails, some with follow up phone calls; and making phone calls alone to out of area agencies. All of these groups and agencies were solicited asking for their assistance and input, telling them how to become involved in the plan update process, and inviting them to HMPC meetings. This coordination with other agencies is documented in Appendix A and includes a summary table of who was contacted, the method of contact, that the purpose. Supporting documentation such as meeting telephone conversation logs are also included.

In addition, as part of the overall stakeholder and agency coordination effort, the HMPC coordinated with and utilized input to the LHMP update from the following agencies:

- American Red Cross
- CAL OES
- CAL FIRE
- California Department of Finance
- California Department of Water Resources
- California Geological Survey
- California Highway Patrol
- California Office of Environmental Health Hazard Assessment
- California Register of Historic Places
- Central Valley Water Board
- FEMA Region IX
- Invasive Species Council of California
- Library of Congress
- Local Government Affairs Committee
- National Oceanic and Atmospheric Association
- National Performance of Dams Program
- National Register of Historic Places
- National Resource Conservation Service

- National Response Center
- National Weather Service, WFO Sacramento
- North State Building Industry Association
- United States Army Corps of Engineers
- United States Bureau of Land Management
- United States Bureau of Reclamation
- United States Department of Agriculture
- United States Farm Service Agency
- United States Forest Service
- United States Geological Survey
- Western Regional Climate Center

Several opportunities were provided for the groups listed above to participate in the planning process. At the beginning of the planning process, invitations were extended to many of these groups to actively participate on the HMPC. Specific participants from these groups are detailed in Appendix A. Others assisted in the process by providing data directly as requested in the Data Worksheets or through data contained on their websites or as maintained by their offices. Further as part of the public outreach process, all groups were invited to attend the public meetings and to review and comment on the plan prior to submittal to CAL OES and FEMA. In addition, as part of the review of the draft plan, key agency stakeholders were contacted and their comments specifically solicited as described further in this Section and included in Appendix A.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability to hazards. Sacramento County uses a variety of comprehensive planning mechanisms, such as general plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

- THIS LIST WILL BE UPDATED FROM THE LISTS IN CHAPTER 4 AND EACH ANNEX

These and other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Data from these plans and ordinances were incorporated into the risk assessment and hazard vulnerability sections of the plan. Where the data from the existing studies and reports is used in this plan update, the source document is referenced throughout this plan update. The data was also used in determining the capability of the community in being able to implement certain mitigation strategies. Appendix B, References, provides a detailed list of references used in the preparation of this plan update.

3.2.2. Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

Foster Morrison led the HMPC in a research effort to identify, document, and profile all the hazards that have, or could have, an impact the planning area. Starting with the 2011 plan, natural hazards of concern were added, deleted, and modified for this LHMP Update. Data collection worksheets and jurisdictional annexes were developed and used in this effort to aid in determining hazards and vulnerabilities and where the risk varies across the planning area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities.

The HMPC also conducted a capability assessment to review and document the planning area's current capabilities to mitigate risk from and vulnerability to hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process, methodologies, and results are included in Chapter 4 Risk Assessment.

3.2.3. Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

Foster Morrison facilitated brainstorming and discussion sessions with the HMPC that described the purpose and process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Chapter 5 Mitigation Strategy. Additional documentation on the process the HMPC used to develop the goals and strategy is in Appendix C.

Planning Step 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, a complete first draft of the plan was developed. This complete draft was provided for HMPC review and comment via a Dropbox web link. Other agencies were invited to comment on this draft as well. HMPC and agency comments were integrated into the second public review draft, which was advertised and distributed to collect public input and comments. The HMPC integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the CAL OES and FEMA Region IX to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

3.2.4. Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction using the sample resolution contained in Appendix D.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. An overall implementation strategy is described in Chapter 7 Plan Implementation and Maintenance.

Finally, there are numerous organizations within the Sacramento County Planning Area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the implementation and ongoing success of this plan and mitigation in Sacramento County and is addressed further in Chapter 7.

Implementation and Maintenance Process: 2011

The 2011 Sacramento County, California Local Hazard Mitigation Plan Update included a process for plan maintenance and implementation of the mitigation strategy as well as formal updates to the plan document. The 2011 process called for annual reviews with the status of mitigation strategy implementation documented in an annual report. In addition the 2011 process called for a formal plan update as required by DMA regulations every 5 years. In accordance with the process outlined in the 2011 plan, formal annual reviews were conducted and documented by the Sacramento County Department of Water Resources and the City of Sacramento's Department of Utilities, and this LHMP update, once complete, will meet the DMA formal update requirements.

Specifically, Sacramento County's existing plan was completed and adopted by the County in 2011. It was anticipated that in compliance with the five-year update requirement, the next complete update of the plan would be in 2016. This current plan update process was initiated in spring 2016, and finished in November 2016 with the submittal of this LHMP update to Cal OES and FEMA Region IX.

As stated, documented reviews of the 2011 plan took place on an annual basis by the County and participating jurisdictions, and the 2011 LHMP was integrated into many other planning mechanisms in the County. The entire LHMP was adopted and incorporated by reference into the Sacramento County General Plan Safety Element as part of their General Plan Update Process. For those jurisdictions who have not yet updated their Safety Element, this LHMP Update will be adopted/incorporated by reference into the respective Safety Element updates. The risk assessment portion of the 2011 LHMP was relied on and further integrated into other planning mechanisms. Table 3-7 lists the planning mechanism the 2011 LHMP was integrated into by Sacramento County. Each of the jurisdictional annexes have similar tables that show how the 2011plan was specifically integrated into their local community planning mechanisms.

Table 3-7 Incorporation of Sacramento County LHMP into Other Planning Mechanisms

Planning Mechanism 2010 LHMP Was Incorporated or Implemented Through	Details	
Sacramento County General Plan - Pg 1075	SA-32	The County will implement the Multi-Hazard Mitigation Plan in the planning and operations of the County to achieve the goals, objectives, and actions of the County's Multi-Hazard Mitigation Plan.

The plan implementation and maintenance process as set forth in the 2011 plan has been updated for this LHMP update. The revised update implementation and maintenance process for the Sacramento County 2016 LHMP update is set forth in Section 7 of this plan document. A strategy for continued public involvement for this update process is also included in Chapter 7.

Chapter 4 Risk Assessment

Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:

1. Identify Hazards;
2. Profile Hazard Events;
3. Inventory Assets; and
4. Estimate Losses.

Data collected through this process has been incorporated into the following sections of this chapter:

- **Section 4.1: Hazard Identification: Natural Hazards** identifies the natural hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.
- **Section 4.2: Hazard Profiles** discusses the threat to the planning area and describes previous occurrences of hazard events and the likelihood of future occurrences.
- **Section 4.3: Vulnerability Assessment** assesses the planning areas' exposure to natural hazards; considering assets at risk, critical facilities, future development trends, and, where possible, estimates potential hazard losses.
- **Section 4.4: Capability Assessment** inventories existing mitigation activities and policies, regulations, plans, and projects that pertain to mitigation and can affect net vulnerability.

This risk assessment covers the entire geographical extent of the Sacramento County Planning Area, which includes Unincorporated County, all incorporated communities and other participating jurisdictions. Throughout this chapter, information is presented for the Sacramento Planning Area as a whole and specific to Unincorporated Sacramento County. Since this plan is a multi-jurisdictional plan, an assessment of e how the hazards and risks vary from jurisdiction to jurisdiction is included. While these differences are noted in this chapter, they are expanded upon in the annexes of the participating jurisdictions. If no

additional data is provided in an annex, it should be assumed that the risk and potential impacts to the affected jurisdiction are similar to those described here for the entire Sacramento County Planning Area.

This LHMP update involved a comprehensive review and update of each section of the risk assessment. As part of the risk assessment update, new data was used, where available, and new analyses were conducted. Where data from existing studies and reports was used, the source is referenced throughout this risk assessment. Refinements, changes, and new methodologies used in the development of this risk assessment update are summarized in Chapter 2 What's New and also detailed in this Risk Assessment portion of the plan.

4.1 Hazard Identification: Natural Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The Sacramento County HMPC conducted a hazard identification assessment to determine the hazards that threaten the Planning Area. This section details the methodology and results of this effort.

Data Sources

The following data sources were used for this Hazard Identification: Natural Hazards portion of the plan:

- 2013 State of California Hazard Mitigation Plan
- FEMA Disaster Declaration Database

4.1.1. Results and Methodology

Using existing natural hazards data and input gained through planning meetings, the HMPC agreed upon a list of natural hazards that could affect Sacramento County. Hazards data from the California Office of Emergency Services (Cal OES), FEMA, California Department of Water Resources, the National Oceanic and Atmospheric Administration (NOAA), and many other sources were examined to assess the significance of these hazards to the Planning Area. Significance was measured in general terms and focused on key criteria such as frequency and resulting damage, which includes deaths and injuries, as well as property and economic damage. The natural hazards evaluated as part of this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future. Only the more significant (or priority) hazards have a more detailed hazard profile and are analyzed further in Section 4.3 Vulnerability Assessment.

The following hazards in Table 4-1, listed alphabetically, were identified and investigated for this plan update. As a starting point, the updated California State Hazard Mitigation Plan was consulted to evaluate the applicability of new hazards of concern to the State to the Sacramento County Planning Area. Building upon this effort, hazards from the past plan were also identified, and comments explain how hazards were updated from the previous plan. All hazards from the 2011 plan were profiled in this plan, with the wind hazard being moved from heavy rain and storms to the discussion on tornado. The agricultural hazard was

modified to focus more on severe weather impacts. Water shortage was added to the drought hazard. New hazards include climate change as a stand-alone hazard.

Table 4-1 Sacramento County Hazard Identification and Comparison

2016 Hazards	2011 Hazards	Comment
Agricultural Hazards	Agricultural Hazards: Insects/Pests	The hazard significance was changed. A vulnerability assessment was added as a result. Climate change impacts were expanded upon.
Bird Strike	Bird Strike	Similar analysis was performed.
Climate Change	–	New stand-alone hazard. Climate change influence on other hazards was touched on in the last plan.
Dam Failure	Dam Failure	Similar analysis was performed on updated parcel and assessor data. Climate change impacts were expanded upon.
Drought and Water Shortage	Drought	Water shortage was added to the hazard. Climate change impacts were expanded upon.
Earthquake	Earthquake	Similar analysis was performed.
Earthquake: Liquefaction	Earthquake: Liquefaction	Similar analysis was performed.
Flood: 100/200/500-year	Flood: 100/200/500-year	Updated DFIRM and assessor's data was used to perform enhanced analysis, to include flooded acres. Climate change impacts were expanded upon.
Flood: Localized Stormwater Flooding	Flood: Localized Stormwater Flooding	Similar analysis was performed. Climate change impacts were expanded upon.
Landslides	Landslides and Debris Flows	Similar analysis was performed.
Levee Failure	Levee Failure	Updated DFIRM and assessor's data was used to perform enhanced analysis. Climate change impacts were expanded upon.
River/Stream/Creek Bank Erosion	River/Stream/Creek Bank Erosion	Similar analysis was performed. Climate change impacts were expanded upon.
Severe Weather: Extreme Temperatures - Heat	Severe Weather: Heat	Similar analysis was performed. Climate change impacts were expanded upon.
Severe Weather: Extreme Temperatures – Cold/Freeze	Severe Weather: Freeze	Similar analysis was performed. Climate change impacts were expanded upon.
Severe Weather: Fog	Severe Weather: Fog	Similar analysis was performed. Climate change impacts were expanded upon.
Severe Weather: Heavy Rains and Storms (Thunderstorms/Hail, Lightning)	Severe Weather: Heavy Rains and Storms (Thunderstorms/Hail, Lightning/Wind)	Wind was removed and added to the tornado profile. Climate change impacts were expanded upon.
Severe Weather: Wind and Tornadoes	Severe Weather: Tornadoes	Wind was added to this profile. Climate change impacts were expanded upon.

2016 Hazards	2011 Hazards	Comment
Subsidence	Subsidence	Due to recent drought conditions, a greater discussion of groundwater impacts was added. Climate change impacts were expanded upon.
Volcano	Volcano	Similar analysis was performed.
Wildfire	Wildfire	Similar analysis was performed using updated assessor's data. Climate change impacts were expanded upon.

Table 4-2 was completed by the County and HMPC to identify, profile, and rate the significance of identified hazards, specific to the Sacramento County Planning Area and unincorporated Sacramento County. Only the more significant (or priority) hazards have a more detailed hazard profile and are analyzed further in Section 4.3 Vulnerability Assessment. Table 4-38 in Section 4.2.22 Natural Hazards Summary provides an overview of these significant hazards.

Table 4-2 Sacramento County Planning Area/Unincorporated County Hazard Assessment

Hazard	Geographic Extent	Probability of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Agricultural Hazards	Significant	Highly Likely	Critical	Medium	Medium
Bird Strike	Limited	Highly Likely	Critical	Medium	Low
Climate Change	Extensive	Highly Likely	Critical	High	–
Dam Failure	Significant	Unlikely	Catastrophic	Medium	High
Drought and Water Shortage	Extensive	Likely	Limited	High	High
Earthquake	Limited	Occasional	Critical	Medium	None
Earthquake: Liquefaction	Significant	Occasional	Limited	Medium	None
Flood: 100/200/500-year	Significant	Occasional/Unlikely	Catastrophic	High	High
Flood: Localized Stormwater Flooding	Limited	Highly Likely	Limited	Medium	High
Landslides	Limited	Unlikely	Negligible	Low	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	High
River/Stream/Creek Bank Erosion	Limited	Highly Likely	Limited	Medium	High
Severe Weather: Extreme Temperatures – Cold/Freeze	Extensive	Likely	Limited	Low	High
Severe Weather: Extreme Temperatures – Heat	Extensive	Highly Likely	Critical	High	High
Severe Weather: Fog	Extensive	Highly Likely	Limited	Low	Medium
Severe Weather: Heavy Rains and Storms (Thunderstorms, Hail, and Lightning)	Extensive	Highly Likely	Critical	Medium	High
Severe Weather: Wind and Tornadoes	Limited	Highly Likely	Limited	Low	Medium
Subsidence	Significant	Highly Likely	Limited	Low	Medium
Volcano	Limited	Unlikely	Limited	Low	None
Wildfire:(Burn Area/Smoke)	Significant	Highly Likely	Limited	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Probability of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

4.1.2. Disaster Declaration History

One method the HMPC used to identify hazards was the researching of past events that triggered federal and/or state emergency or disaster declarations in the Planning Area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). USDA declarations are discussed in Section 4.2.7. FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors. Sacramento County received 17 federal and 28 state declarations since 1950. Of the 17 federal declarations 12 were for flood, rains and severe storm events, 2 for earthquake, 2 for levee break, 1 was for drought, and 1 was for Hurricane Katrina evacuations (all counties in the United States were declared). Of the 11 remaining state declarations, 8 were for flood, rains and severe storm events. 1 was for drought, 1 was for energy emergency, and 1 was related to a railroad explosion.

Based on the disaster declaration history provided in Table 4-3, Sacramento County is among the many counties in California susceptible to disaster. Details on federal and state disaster declarations were obtained by the HMPC, FEMA, and Cal OES and compiled in chronological order, from present, in Table 4-3.

Table 4-3 Sacramento County State and Federal Disasters Declaration, 1950-2015

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
2014	Napa Earthquake	Natural	Earthquake	EM4193	–	9/17/2014
Drought	California Drought	GP 2014-13	1/17/2014	–	–	–
2008	Central Valley Drought	Drought	Drought	GP 2008-03	6/12/2008	–
2008	2008 January Storms	Flood	Storms	GP 2008-01	1/5/2008	–
2005/2006	2005/06 Winter Storms	Flood	Storms	DR-1628	-	2/3/2006
2005	Hurricane Katrina Evacuations	Economic	Hurricane	EM-3248 2005	-	9/13/2005
2001	Energy Emergency	Economic	Greed	GP 2001	1/1/2001	–

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
1998	1998 El Nino Floods	Flood	Storms	DR-1203	Proclaimed	2/19/1998
1997	1997 January Floods	Flood	Storms	DR-1155	1/2/97-1/31/97	1/4/1997
1996	Torrential Winds and Rain	Flood	Storms	GP 96-01	1/21/1996	–
1995	1995 Late Winter Storms	Flood	Storms	DR-1046	Proclaimed	1/10/1995
1995	1995 Severe Winter Storms	Flood	Storms	DR-1044	1/6/95-3/14/95	1/13/1995
1989	Loma Prieta Earthquake	Earthquake	Earthquake	DR-845	10/18/89-10/30/89	10/18/1989
1986	1986 Storms	Flood	Storms	DR-758	2/18-86-3/12/86	2/18/1986
1983	Winter Storms	Flood	Flood	DR-677	12/8/82-3/21/83	2/9/1983
1982	High Tides and Rains	Flood	Storms	-	12/8/1982	–
1982	Heavy Rains and Flooding	Flood	Storms	DC 82-03	4/1/1982	–
1980	Delta Levee Break	Flood	Levee break	EM-3078	1/23/1980	1/23/1980
1977	1977 Drought	Drought	Drought	EM-3023	-	1/20/1977
1973	Southern Pacific Railroad Fires and Explosions (Roseville)	Fire	Explosion	-	4/30/1973	–
1972	Andrus Island Levee Break	Flood	Levee break	DR-342	6/21/1972	6/27/1972
1969	1969 Storms	Flood	Storms	DR-253	1/23/69-3/12/69	1/26/1969
1964	1964 Late Winter Storms	Flood	Storms	DR-183	-	12/24/1964
1963	1963 Floods	Flood	Storms	-	2/14/1964	–
1958	1958 April Storms and Floods	Flood	Storms	DR-52	4/5/1958	4/4/1958
1958	1958 February Storms and Floods	Flood	Storms	CDO 58-03	2/26/1958	–
1955	1955 Floods	Flood	Flood	DR-47	12/22/1955	12/23/1955

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
1950	1950 Floods	Flood	Flood	OCD 50-01	11/21/1950	–

Source: Cal OES, FEMA

This disaster history (combined FEMA and state) suggests that Sacramento County experiences a major event worthy of a disaster declaration every 1.25 years. The County has an 80.3 percent chance of receiving a federal or state disaster declaration in any given year.

Disasters since 2011

There has been one FEMA Emergency Management declaration for the Napa earthquake in 2014 since the 2011 plan. In addition, there have been 10 USDA Secretarial Disaster Declarations for drought (discussed in Section 4.2.7) since 2011.

4.2 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Section 4.1 Hazard Identification Natural Hazards, are profiled individually in this section as it applies to both the Sacramento County Planning Area and the Unincorporated County. In general, information provided by planning team members is integrated into this section with information from other data sources. These profiles set the stage for Section 4.3 Vulnerability Assessment, where the vulnerability is quantified, as data allows, for each of the priority hazards.

Each hazard is profiled in the following format:

- **Hazard/Problem Description**—This section gives a description of the hazard and associated issues followed by details on the hazard specific to the Sacramento County Planning Area and the unincorporated County. Where known, this includes information on the hazard extent, area, seasonal patterns, speed of onset/duration, and magnitude and/or any secondary effects.
- **Past Occurrences**—This section contains information on historical incidents, including impacts where known. The extent or location of the hazard within or near the Sacramento County Planning Area and the unincorporated County is also included here. Historical incident worksheets were used to capture information from participating jurisdictions on past occurrences.
- **Frequency/Likelihood of Future Occurrence**—The frequency of past events is used in this section to gauge the likelihood of future occurrences specific to the Sacramento County Planning Area and the Unincorporated County. Where possible, frequency was calculated based on existing data. It was determined by dividing the number of events observed by the number of years on record and multiplying by 100. This gives the percent chance of the event happening in any given year (e.g., three droughts over a 30-year period equates to a 10 percent chance of a experiencing a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:
  - ✓ **Highly Likely**—Near 100 percent chance of occurrence in next year or happens every year

- ✓ **Likely**—Between 10 and 100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less
- ✓ **Occasional**—Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years
- ✓ **Unlikely**—Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

- **Climate Change**—This section contains the effects or influence of climate change to that hazard (if applicable). The possible ramifications of climate change on the hazard are discussed.

Section 4.2.22 Natural Hazards Summary provides an initial assessment of the profiles and assigns an initial level of significance or priority to each hazard. Those hazards determined to be of high or medium significance are characterized as priority hazards that required further evaluation in Section 4.3 Vulnerability Assessment. Those hazards that occur infrequently or have little or no impact on the Planning Area, including unincorporated Sacramento County, were determined to be of low significance and not considered a priority hazard. Significance was determined based on the hazard profile, focusing on key criteria such as frequency and resulting damage, including deaths/injuries and property, crop, and economic damage. The ability of a community to reduce losses through implementation of existing and new mitigation measures was also considered as to the significance of a hazard. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the Planning Area, enabling the County and participating jurisdictions to focus resources where they are most needed.

The following sections provide profiles of the natural hazards that the HMPC identified in Section 4.1 Hazard Identification. The severe weather hazards are discussed first because it provides an overview of climatological conditions in the planning area, it sets the stage for the types of natural hazards likely to occur, and it is often the secondary hazards generated by severe weather (e.g., flood and wildfire) that can result in the most significant losses. The other hazards follow alphabetically.

Data Sources

The following data sources were used for this Hazard Profiles portion of the plan:

- 2013 State of California Multi-Hazard Mitigation Plan
- CALFED Levee System Integrity Program
- CAL FIRE Wildfire History Database
- California Climate Adaptation Strategy
- California Department of Water Resources Division of Safety of Dams
- California Department of Water Resources Best Available Maps
- California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources. 2010.
- California Division of Mines and Geology
- California Natural Resources Report
- Delta Risk Management Strategy. June 2011.
- Federal Aviation Administration National Wildlife Database
- Federal Aviation Administration Wildlife Strike Database
- Federal Emergency Management Agency: Building Performance Assessment: Oklahoma and Kansas Tornadoes

- Federal Emergency Management Agency: Multi-Hazard Identification and Risk Assessment. 1997
- Federal Emergency Management Agency – Wind Zones in the United States
- Johnstone, J. and Dawson, T. Climatic context and ecological implications of summer fog decline in the coast redwood region. Proceedings of the National Academy of Sciences, January 7, 2010.
- Galloway, Jr Dr. Gerald E. Levees in History: The Levee Challenge. Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.
- Lighthouse Marina EIR/EIS. E D A W, Inc., November, 1985.
- Mount J, Twiss R. 2005. Subsidence, sea level rise, seismicity in the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science. Vol. 3, Issue 1 (March 2005), Article 5.
- National Aeronautics and Space Administration
- National Drought Mitigation Center
- National Flood Insurance Program
- National Integrated Drought Information System
- National Oceanic and Atmospheric Administration's National Climatic Data Center
- National Oceanic and Atmospheric Administration Storm Prediction Center
- National Performance of Dams Program
- National Weather Service Heat Index
- National Weather Service Sacramento – Climate of Sacramento, California, 2010
- National Weather Service Wind Chill Index
- North American Breeding Bird Survey
- Post Authorization Change Report for the Sacramento River Bank Protection Project Draft EIS
- Public Policy Institute of California. If drought continues: Environment and poor rural communities most likely to suffer. [press release]. 2015.
- Sacramento Bee
- Sacramento County Airport System
- Sacramento County Agricultural Commissioner's Reports, 2010-2014
- Sacramento County Flood Insurance Study, June 16, 2015
- Sacramento County Department of Water Resources – 2011 to 2015 Storm Reports
- Sacrament County 2035 General Plan
- Sacramento County General Plan Background Report
- Sacramento County Watershed Master Plan
- Sacramento County WMA Strategic Plan
- Some Significant Wildlife Strikes to Civil Aircraft in the United States, January 1990 – November 2015. U.S. Department of Agriculture Animal and Plant Health Inspection Service Wildlife Services. December 3, 2015.
- State of California Department of Conservation Farmland Mapping and Monitoring Program
- Underwood, E. Models predict longer, deeper US droughts. Science, 347(6223) 707 DOI: 10.1126/science.347.6223.707. 2015.
- University of California Santa Barbara Department of Geology
- United State Geologic Survey. Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977.
- United States Geological Survey. Open File Report 2015-3009. 2015.
- USA TODAY
- US Department of the Interior. Fact Sheet 2014-3120. December 2014.
- US Army Corps of Engineers
- US Bureau of Reclamation

- US Drought Monitor
- US Geological Survey: Volcanic Ash: Effect & Mitigation Strategies.
- Ingebritsen, S.E. and Ikehara, M. Sacramento-San Joaquin Delta: The Sinking Heart of the State. US Geological Survey Report FS-005-00.
- USDA Secretarial Disasters Declarations
- Western Regional Climate Center
- Wildlife Strikes to Civil Aircraft in the United States 1990–2012. US Department of Transportation and Animal and Plant Health Inspection Services. September 2013.

4.2.1. Severe Weather: General

Severe weather is generally any destructive weather event, but usually occurs in the Sacramento County Planning Area as localized storms that bring heavy rain, hail, lightning, and strong winds.

The National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) has been tracking severe weather since 1950. Their Storm Events Database contains data on the following: all weather events from 1993 to current (except from 6/1993-7/1993); and additional data from the Storm Prediction Center, which includes tornadoes (1950-1992), thunderstorm winds (1955-1992), and hail (1955-1992). This database contains 212 severe weather events that occurred in Sacramento County between January 1, 1950, and December 31, 2015. Table 4-4 summarizes these events.

*Table 4-4 NCDC Severe Weather Events for Sacramento County 1950-12/31/2015**

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Cold/Wind Chill	13	0	0	0	0	$0	$0
Dense Fog	6	6	1	38	0	$2,120,000	$0
Drought	19	0	0	0	0	$0	$0
Excessive Heat	1	0	0	0	0	$0	$0
Extreme Cold/Wind Chill	1	0	0	0	0	$0	$0
Flash Flood	4	1	0	0	0	$4,400,000	$0
Flood	29	1	0	0	0	$8,826,000	$7,800,000
Frost/Freeze	6	0	0	0	0	$200,000	$5,000,000
Funnel Cloud	6	0	0	0	0	$0	$0
Hail	7	0	0	0	0	$11,030	$0
Heat	31	0	1	30	1	$0	$0
Heavy Rain	18	0	0	1	0	$365,000	$50,000
Heavy Snow	1	0	0	0	0	$0	$0
High Surf	1	0	0	0	0	$0	$0
High Wind	36	1	0	0	0	$8,842,000	$39,000
Lightning	1	0	0	0	0	$150,000	$0
Strong Wind	9	0	1	0	2	$2,185,000	$0

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Thunderstorm Winds	7	0	0	0	0	$0	$0
Tornado	11	0	0	0	0	$1,455,000	$0
Wildfire	3	0	0	0	0	$3,000,000	$0
Winter Storm	2	0	0	0	0	$0	$0
Total	**212**	**9**	**3**	**69**	**3**	**$31,554,030**	**$12,889,000**

Source: NCDC

*Note: Losses reflect totals for all impacted areas

The NCDC table above summarize severe weather events that occurred in Sacramento County. Only a few of the events actually resulted in state and federal disaster declarations. It is interesting to note that different data sources capture different events during the same time period, and often display different information specific to the same events. While the HMPC recognizes these inconsistencies, they see the value this data provides in depicting the County's "big picture" hazard environment.

As previously mentioned, most all of Sacramento County's state and federal disaster declarations have been a result of severe weather. For this plan, severe weather is discussed in the following subsections:

- Extreme Temperatures – Cold/Freeze
- Extreme Temperatures – Heat
- Fog
- Heavy Rains and Storms (Thunderstorms/Hail, Lightning)
- Wind and Tornadoes

Climate Change and Severe Weather

Climate change can have direct implications on almost every hazard addressed in the plan, with earthquake and bird strike being possible exceptions. Climate change has the potential to alter the nature and frequency of most hazards. The potential for climate change influences on hazards are further noted in each of the hazard discussions

4.2.2. Severe Weather: Extreme Temperatures – Cold and Freeze

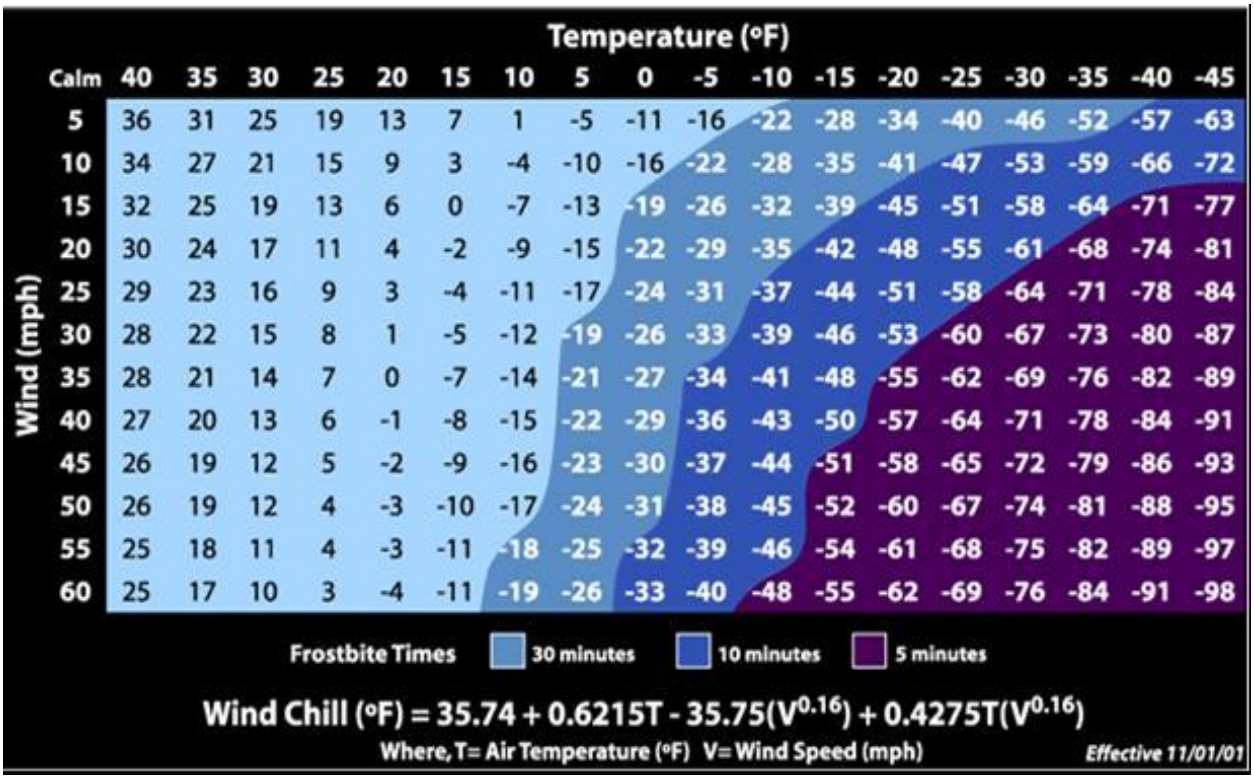
Hazard/Problem Description

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities. Extreme cold can also affect the crops grown in Sacramento County.

In 2001, the NWS implemented an updated Wind Chill Temperature index, shown in Figure 4-1. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As

the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-1 Wind Chill Temperature Chart



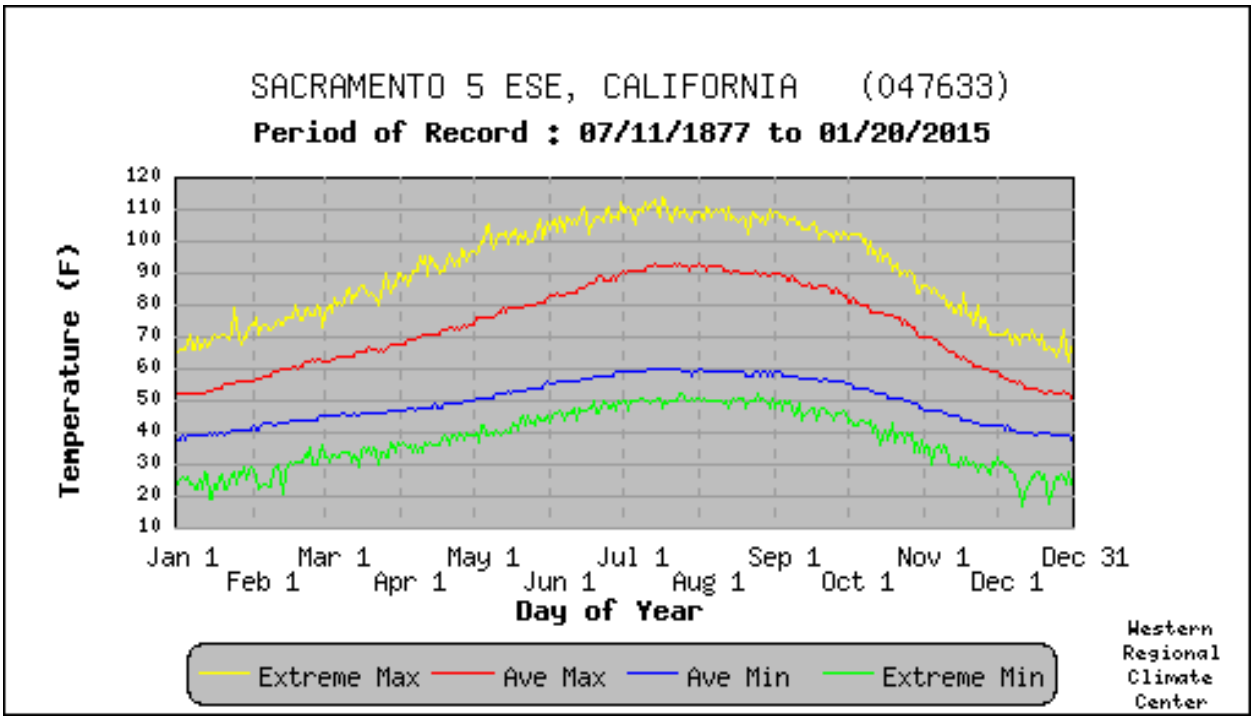
Source: National Weather Service

The effects of freezing temperatures on agriculture in Sacramento County are discussed further in Section 4.2.7 Agricultural Hazards. Information from the oldest continually reporting weather station in the County is summarized below and in Figure 4-2.

Sacramento County (5 ESE Weather Station, Period of Record 1877 to 2015)

According to the WRCC, monthly average minimum temperatures in the County from November through April range from the upper-30s to the upper-50s. The lowest recorded daily extreme was 17°F on December 11, 1932. In a typical year, minimum temperatures fall below 32°F on 8.3 days with no days falling below 0°F.

Figure 4-2 Sacramento County—Daily Temperature Averages and Extremes



Source: Western Regional Climate Center

Past Occurrences

Disaster Declaration History

There have been no state or FEMA disaster declarations for Sacramento County associated with extreme cold or freeze. There have been three USDA secretarial disaster declarations for Sacramento County from cold and freeze, which can be found in Table 4-22 in the Section 4.2.7 Agriculture Hazards of this document.

NCDC Events

The NCDC data recorded 22 cold and freeze incidents for Sacramento County since 1993. A summary of these events are shown in Table 4-5. Specific events from the NCDC database that caused injuries, deaths, or damages in Sacramento County are discussed below the table.

Table 4-5 NCDC Winter Storms and Extreme Cold Events in Sacramento County 1993 to 12/31/2015

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Cold/Wind Chill	13	0	0	0	0	$0	$0
Extreme Cold/Wind Chill	1	0	0	0	0	$0	$0

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Frost/Freeze	6	0	0	0	0	$200,000	$5,000,000
Winter Storm	2	0	0	0	$0	$0	$0
Total	**22**	**0**	**0**	**0**	**$0.00**	**$200,000**	**$5,000,000**

Source: NCDC

*Deaths, injuries, and damages are for the entire event, and may not be exclusive to the County.

- **December 4, 1998** – A substantial freeze occurred as valley temperatures dropped into the middle to upper 20s.
- **December 6, 1998** – The second Arctic blast in a five-day period produced well below normal temperatures. The cold air not only affected the Northern Sacramento Valley, but also seeped south into the Northern San Joaquin Valley. Record low temperatures as well as low maximum temperatures were recorded at the Sacramento Executive Airport. The City of Sacramento reported a low of 27°.
- **December 29, 1998** – The third Arctic airmass of the month to spread into the Central California interior was the coldest of the three and produced large amounts of crop damage/loss. Downtown Sacramento experienced 6 consecutive days with low temperatures at or below freezing. The lowest temperature recorded downtown was 26°. $2.4 million in crop damages were reported in Sacramento and surrounding counties. A USDA disaster declaration was declared for the County.
- **December 6, 2005 –** Morning temperatures dropped into the 20s across the Sacramento and Northern San Joaquin Valleys. A record low temperature was tied in Sacramento. The temperature at Sacramento Executive Airport (SAC) dropped to 28°, which tied the record set in 1980.
- **November 30, 200**6 – Clear skies and a cold arctic airmass led to freezing temperatures across the planning area. Temperatures dropped to the mid to upper 20s, which was near record values for the date.
- **January 14-23, 2007** – A very cold arctic airmass settled over the region and temperatures in the Central Valley of California dropped sharply for a relatively prolonged period of time. Many temperature records were tied and broken during the episode and the damage to area crops was extensive.
- **April 20-24, 2008** – A cool and dry airmass coupled with light winds resulted in cold morning temperatures from April 20th to the 24th in the planning area. Record low temperatures were set in several locations. Frost and freezing temperatures caused significant damage to young walnuts, prunes, peaches, pears, and wine grapes across the area.
- **December 4, 2008** – High pressure over the area brought light winds and clear skies. This allowed the unusual case of a record minimum and a record maximum both being tied on the same day in the northern Sacramento Valley. Light winds and clear skies brought cold morning temperatures to the northern Sacramento Valley.
- **December 6-10, 2009** – A very cold airmass brought a hard freeze and record cold to the northern Central Valley. Many pipes in homes and businesses froze and burst, including those for fire sprinkler systems. Some crop damage in orchards was also reported. A hard freeze caused pipes and sprinkler systems to burst throughout the southern Sacramento Valley, causing water damage to homes and businesses. There were nine water main breaks reported in Sacramento, with eighty-two customers reporting problems with leaking pipes.

HMPC Events

The HMPC identified the following events related to extreme cold temperatures in the Sacramento County Planning Area.

- PROVIDE INFORMATION ON ANYTHING NOT CAPTURED ABOVE

Western Regional Climate Center Data

The WRCC maintains data on extreme temperatures in the County. Past record lows from the Sacramento 5 ESE Coop Weather Station by month are shown in Table 4-6.

Table 4-6 Record Low Temperatures – Sacramento 5 ESE Weather Station (1877-2015)

Month	Temperature	Date	Month	Temperature	Date
January	19°	1/14/1888	July	47°	7/03/1901
February	21°	2/13/1884	August	48°	8/30/1887
March	29°	3/15/1880	September	44°	9/18/1882
April	34°	4/34/1927	October	34°	10/30/1935
May	37°	5/03/1950	November	27°	11/28/1880
June	43°	6/01/1929	December	17°	12/11/1932

Source: WRCC

Likelihood of Future Occurrence

Highly Likely—Cold and freeze are likely to continue to occur annually in the Sacramento County Planning Area.

Climate Change and Freeze and Snow

According to the California Climate Adaptation Strategy (CAS), freezing spells are likely to become less frequent in California as climate temperatures increase. If emissions increase, freezing events could occur only once per decade in large portion of the state by the second half of the 21st century. According to a California Natural Resources Report in 2009, it was determined that while fewer freezing spells would decrease cold related health effects, too few freezes could lead to increased incidence of disease as vectors and pathogens do not die off.

Preliminary Draft – Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP), Ascent Environmental 2016 Analysis

According to the 2016 Preliminary Draft CAP, which utilized Cal Adapt to model potential climate change impacts to Sacramento County, annual average low temperatures in Sacramento County of 49.8 ºF (from 1961-1990) would increase under the low admissions scenario by 1.6 ºF to 51.4 ºF. Under the high emissions scenario, the average annual low temperature is projected to increase by 6.0 ºF to 55.8 ºF by 2099

4.2.3. Severe Weather: Extreme Temperatures – Heat

Hazard/Problem Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980 more than 1,250 people died. Extreme heat can also affect the agricultural industry. Extreme heat as it affects agriculture in Sacramento County is discussed further in the section on agricultural hazards.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds a level at which the body can remove it, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions.

Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations. Heat waves do not cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios. While heat waves are obviously less dramatic, they are potentially more deadly. According to the 2013 California State Hazard Mitigation Plan, the worst single heat wave event in California occurred in Southern California in 1955, when an eight-day heat wave resulted in 946 deaths.

The Western Regional Climate Center (WRCC) maintains data on weather normal and extremes in the western United States. WRCC data for the County is summarized below and in Figure 4-2 above.

Sacramento County (Sacramento 5 ESE Weather Station, Period of Record 1877 to 2015)

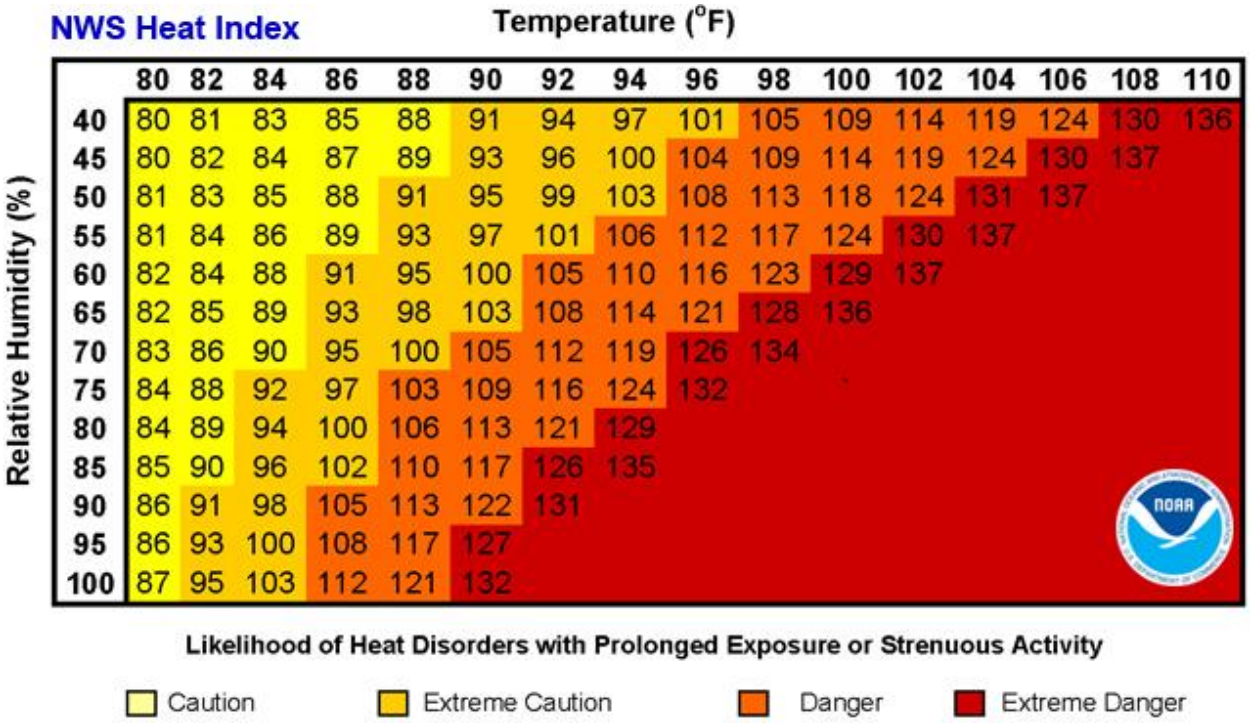
According to the WRCC, in the western portion of Sacramento County, monthly average maximum temperatures in the warmest months (May through October) range from the mid-70s to the low 90s. The highest recorded daily extreme was 114°F on July 17, 1925. In a typical year, maximum temperatures exceed 90°F on 65.4 days.

Figure 4-3 and Figure 4-4 show the Heat Index (HI) that the National Weather Service uses to show the relationship between heat and relative humidity. The Heat Index describes how hot the heat-humidity combination makes it feel. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration. As the HI rises, so do health risks.

- When the HI is 90°F, heat exhaustion is possible with prolonged exposure and/or physical activity.
- When it is 90°-105°F, heat exhaustion is probable with the possibility of sunstroke or heat cramps with prolonged exposure and/or physical activity.

- When it is 105°-129°F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity.
- When it is 130°F and higher, heatstroke and sunstroke are extremely likely with continued exposure. Physical activity and prolonged exposure to the heat increase the risks.

Figure 4-3 Heat Index



Source: National Weather Service

Note: Since HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Figure 4-4 Possible Heat Disorders by Heat Index Level

Heat Index	Category	Possible heat disorders for people in high risk groups
130°F or higher	Extreme Danger	Heatstroke risk extremely high with continued exposure.
105° - 129°F	Danger	Sunstroke, Heat Cramps and Heat Exhaustion likely, Heatstroke possible with prolonged exposure and/or physical activity.
90° - 105°F	*Extreme Caution*	*Sunstroke, Heat Cramps and Heat Exhaustion possible with prolonged exposure and or physical activity.*
80° - 90 °F	Caution	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service

The NWS has in place a system to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts

is when the maximum daytime high is expected to equal or exceed 105°F and a nighttime minimum high of 80°F or above is expected for two or more consecutive days. The NWS office in Sacramento can issue the following heat-related advisory as conditions warrant.

- **Excessive Heat Outlook**: are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to Heat Index forecast map for the contiguous United States those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.
- **Excessive Heat Watch**: is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.
- **Excessive Heat Warning/Advisory**: are issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

Past Occurrences

Disaster Declaration History

There have been no state or FEMA disaster declarations associated with extreme heat. Two USDA Secretarial Disasters related to extreme heat have occurred in the County and can be found in Table 4-27 in Section 4.2.7.

NCDC Disasters

The NCDC data shows 32 extreme heat incidents for Sacramento County since 1993. These are shown in Table 4-7.

Table 4-7 NCDC Extreme Heat Events in Sacramento County 1993 to 12/31/2015

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Excessive Heat	1	0	0	0	0	$0	$0
Heat	31	0	1	30	1	$0	$0
Total	**32**	**0**	**1**	**30**	**1**	**$0**	**$0**

Source: NCDC

- **July 11, 1999** – Afternoon high temperatures averaged 10 to 20 degrees above normal across the central and northern interior. No fatalities or severe heat related injuries were noted by area hospitals, although there was an increase in lesser heat related illnesses caused by prolonged dehydration. Area utilities indicated that facilities were stressed during the event and the voluntary brown out program had to be utilized. SMUD also indicated they broke an all-time record on the 12th for electrical production and distribution. No injuries or fatalities were reported.

- **May 21, 2000** – Daily maximum temperatures across the area reached record levels for three consecutive days and most official reporting sites were fifteen to twenty degrees above normal readings. Sacramento tied or broke records on one or more days. The normal maximum temperature for Sacramento for this period is 82°, yet temperatures reached 100°, 103°, and 99°, all new daily records. No injuries or fatalities were reported.
- **June 13, 2000** – Very hot weather persisted across interior Northern California for three days, resulting in record and near record temperatures at most reporting sites. Sixteen people were treated for heat stroke in Sacramento and Solano counties and one, a 16-year-old male in West Sacramento, died. A heavily used portion of I-80 between Sacramento and San Francisco was closed for several hours to repair three lanes in which the asphalt had buckled due to the sustained heat. Power outages were suffered by more than 100,000 customers during the event. Maximum temperatures were fifteen to twenty degrees above normal throughout the valley and foothills, but what made the weather especially difficult to handle was that the minimum temperatures were also ten to twenty degrees above normal for the period. The hottest day across the area was the 14th, with maximum temperatures of 107°F in Sacramento. The maximum temperatures on the 8th, less than a week earlier, were 71°. Sacramento set a daily high minimum temperature record by dropping only to 68° on the 13th. No injuries or fatalities were reported.
- **July 29, 2000** – Excessive heat impacted the Sacramento and northern San Joaquin Valleys during the last few days of July. Temperatures reached and exceeded 100° in many areas before peaking on the 31st at 104° in Sacramento. No injuries or fatalities were reported.
- **September 18, 2000** – Daily maximum temperature records were tied and broken across the Sacramento and northern San Joaquin valleys. The Sacramento temperature reached 101°, which tied the record previously set in 1984. No injuries or fatalities were reported.
- **September 20, 2000** – The daily high maximum temperature record was set in Sacramento when it reached 102°, breaking the previous record of 101° set in 1994. No injuries or fatalities were reported.
- **July 1, 2005** – July 2005 set a new record for heat in Sacramento. The average temperature in Sacramento was 81.8° for the month. This was the hottest average temperature ever recorded in Sacramento. The old record was 81.6° set in July 2003. In addition, the average low temperature for the month of July was 65.2°, breaking the old record of 65.1° set in July 2003. However, the average high temperature record was not broken. The average for July 2005 was 98.4°, which is well below the record average high of 99.6° set in 1988.
- **July 4-5, 2007** – High pressure over the western United States brought record heat to Northern California on July 4th and 5th. New daily high temperature records were set today at the Downtown Sacramento and the Sacramento Executive Airport sites. At Downtown Sacramento, the temperature reached 108°, which broke the old record of 107° set in 1931. At Sacramento Executive Airport, the temperature reached 107°, which broke the old record of 105° set in 1968.
- **August 23, 2007** – High pressure over California resulted in hot conditions in the planning area. Temperatures in excess of 100° were recorded at many locations in the planning area.
- **May 15-18, 2008** – A strong high pressure ridge over the region produced hot temperatures across interior Northern California from May 14th to May 17th, with many triple digit daily high temperature records set. Record daily high minimum temperatures were also set as clouds and northerly winds maintained the heat overnight. The hot temperatures lingered into the 19th, especially for the northern San Joaquin Valley.
- **July 9, 2008** – A strong upper level ridge brought hot weather to much of the planning area from July 6th to the 10th. High temperatures well over the century mark were recorded, with records tied or set

across the northern Central Valley on the 9th. Overnight temperatures also remained very warm, with several record high minimums set or tied.

- **August 15, 2008** – A strong high pressure ridge allowed high temperatures to reach triple digits across the northern Central Valley. In the planning area, temperatures of 102° to 108° were recorded.
- **August 26-29, 2008** – A strong upper level ridge brought hot weather to much of the area from the 26th to the 28th. High temperatures well over the century mark were recorded, with records tied or set across the northern Central Valley. A daily maximum temperature record of 104° was set at Sacramento Executive Airport. This broke the previous record of 103° set in 1950.

HMPC Events

The HMPC identified the following events related to extreme temperatures in the Sacramento County Planning Area.

- 2013 Jun7& 8 – 100°-112°F
- 2013 Jun 28-30, again Jul 1 – over 100°F for 7 days
- July 1-4, 2013 – A strong high pressure ridge built over Northern California, keeping max temperatures in the Central Valley above 100 for at least 7 days. Overnight temperatures failed to recover, reaching generally down to the mid 60s to 90. The heat wave felt warmer due to the moisture in the air from the previous rainfall on June 26th, as well as from the intrusion of subtropical moisture from the south.
- January 2014 – January was an abnormally dry and warm month for interior Northern California. Many record high temperatures were broken, and a state-wide drought was declared on January 17th.

Western Regional Climate Center Data

The WRCC maintains data on extreme temperatures in the County. Past record highs from the Sacramento 5 ESE Coop Weather Station by month are shown in Table 4-8.

Table 4-8 Record High Temperatures – Sacramento 5 ESE Weather Station (1877-2015)

Month	Temperature	Date	Month	Temperature	Date
January	74°	1/31/1976	July	114°	7/18/1925
February	80°	2/18/1899	August	111°	8/13/1933
March	90°	3/31/1966	September	109°	9/01/1950
April	98°	4/26/2004	October	102°	10/2/1952
May	107°	5/28/1984	November	86°	11/1/1966
June	112°	6/30/1934	December	72°	12/15/1958

Source: WRCC

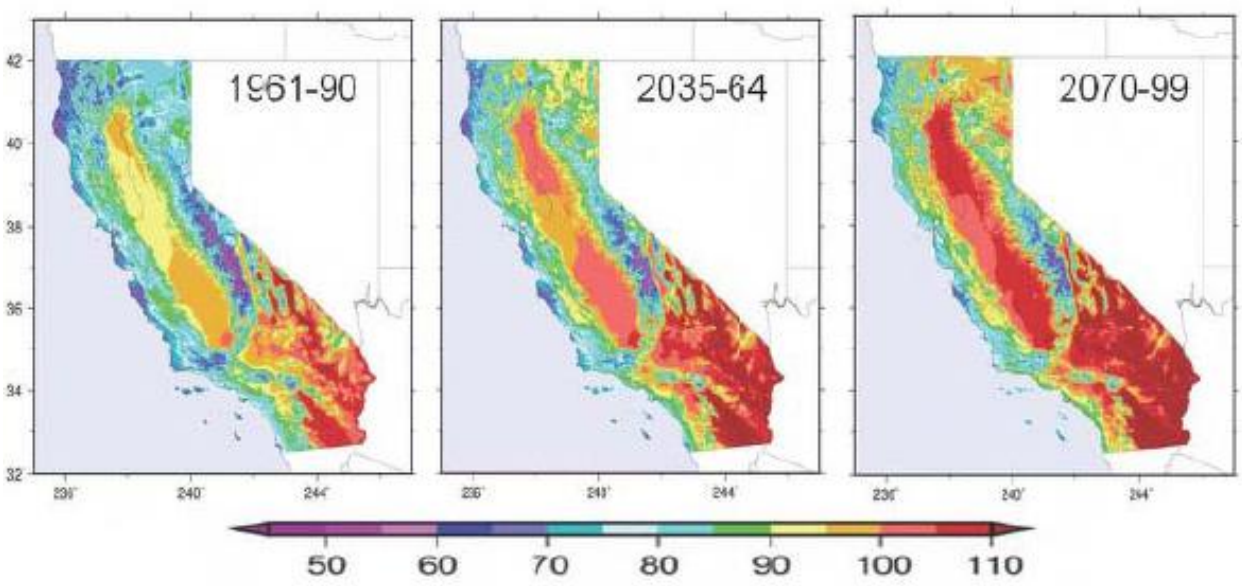
Likelihood of Future Occurrence

Highly Likely—Temperature extremes are likely to continue to occur annually in the Sacramento County Planning Area. Temperatures at or above 90°F are common most summer days in the County.

Climate Change and Extreme Heat

The CAS, citing a California Energy Commission study, states that "over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined." This study shows that California is getting warmer, leading to an increased frequency, magnitude, and duration of heat waves. These factors may lead to increased mortality from excessive heat, as shown in Figure 4-5.

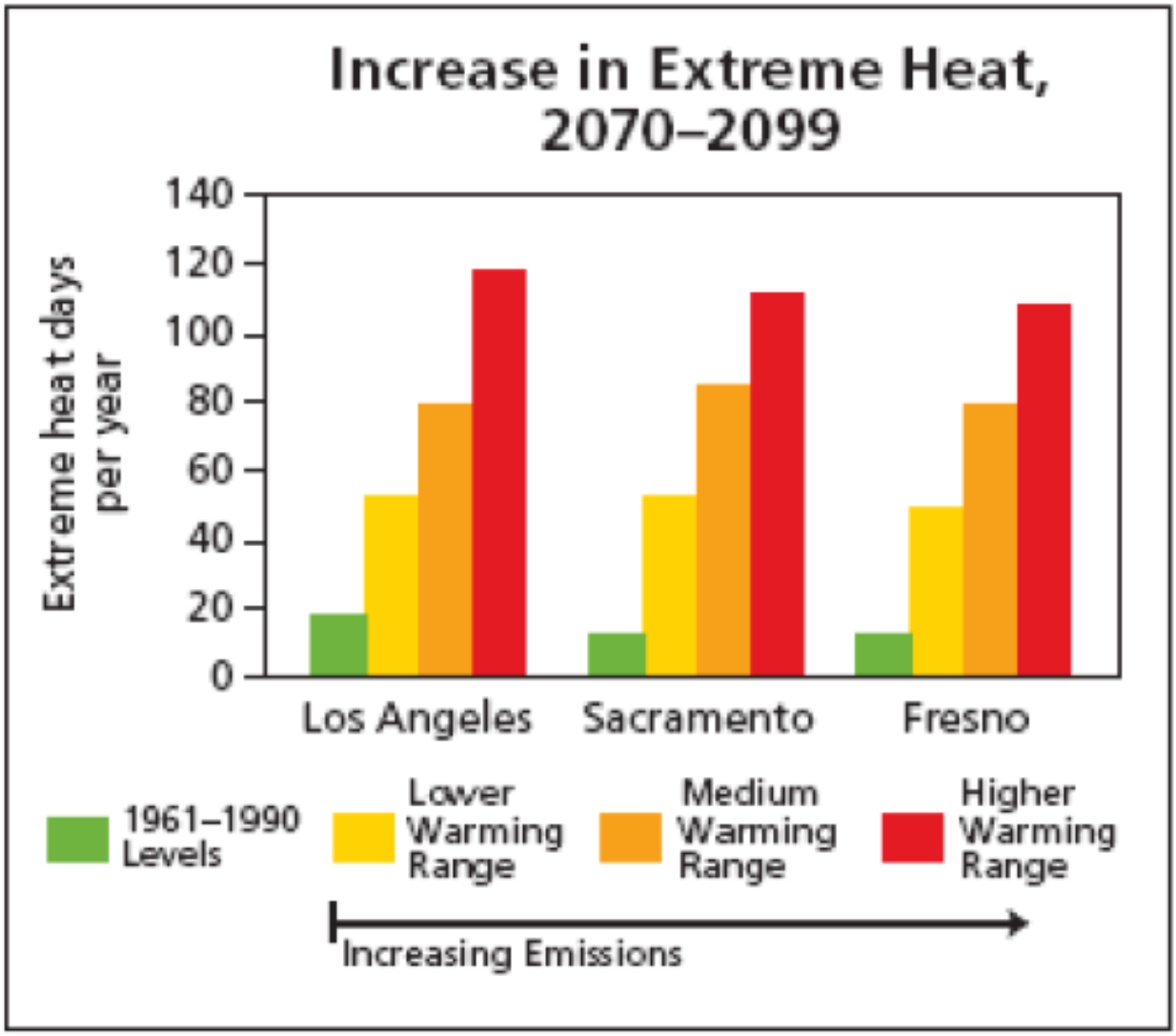
Figure 4-5 California Historical and Projected Temperature Increases - 1961 to 2099



Source: Dan Cayan; California Climate Adaptation Strategy

As temperatures increase, California and Sacramento County will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke and respiratory distress caused by extreme heat. According to the CAS report and the 2010 State of California Hazard Mitigation Plan, by 2100, hotter temperatures are expected throughout the state, with projected increases of 3-5.5°F (under a lower emissions scenario) to 8-10.5°F (under a higher emissions scenario). If temperatures rise to the higher warming range, there could be 100 more days per year with temperatures above 95°F in the City of Sacramento (see Figure 4-6). These changes could lead to an increase in deaths related to extreme heat in Sacramento County.

Figure 4-6 Increase in Heat in Major California Cities from 2070 to 2099



Source: 2010 California State Hazard Mitigation Plan

Preliminary Draft - Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP), Ascent Environmental 2016 Analysis

According to the Sacramento County Phase 1 Vulnerability Assessment, contained within the 2016 Preliminary Draft CAP, which utilized Cal Adapt to model potential climate change impacts to Sacramento County, it concluded that annual average high temperatures in Sacramento County of 73.1°F would increase under the low emissions scenario by 3.1°F to 76.2°F. Under the high emissions scenario, the average annual high temperature is projected to increase by 7.2°F to 80.3°F by 2099.

In addition, research published by California Environmental Protection Agency suggests that heat impacts are felt disproportionately in the northern portions of Sacramento County and the surrounding areas, due to prevailing wind patterns. This phenomenon is likely be exacerbated by climate change.

Extreme Heat Days. Extreme heat days are defined by Cal adapt for Sacramento County as 100 ºF or higher. From 1961 to 1990, Sacramento County has a historical average of four extreme heat days a year. From 2010 to 2016, extreme heat days increase in Sacramento County with a current average of 8 to 9 extreme heat days per year. Utilizing Cal-Adapt, the projected average annual number of extreme heat days under the low emissions scenario is approximately 15 days per year in 2050 and between 19 to 45 days per year at the end of the century. Under the high emissions scenario, Cal-Adapt predicts that Sacramento County will experience 25-31 extreme heat days per year in 2050 and 50 to 67 days per year by 2099. Also to be considered are warm nights. A warm night is defined as a day between April and October where the minimum temperature exceeds the historical minimum temperatures between 1961 and 1990. Historically, Sacramento County has an average of four warm nights a year, with a threshold of 65 ºF. Under the low- and high- emissions scenarios, the number of warm nights is expected to increase to an average of 12-33 nights by 2050 and 23 to 90 nights by 2099.

Frequency and Timing of Heat Waves. When these extreme temperatures are experienced over a period of several days or more, they are considered heat waves. Cal-Adapt defines a heat wave for Sacramento County as an event where the extreme heat day threshold of 100 ˚F is exceeded for five days or more. Based on this analysis, heat waves consisting of a five-day period have occurred in Sacramento County at a rate of about one to two heat waves per decade between 1950 and 2000. The Cal-Adapt model projects an increase in heat waves as the century progresses. Under the low emissions scenario, Sacramento County is expected to experience approximately three heat waves per year around 2050 and up to four per year by 2099. Under the high emissions scenario, an average of three to five heat waves per year by 2050 are projected and up to 12 per year by the end of the century. Also to be noted, as shown in both emissions scenarios, the model projects that the occurrence of these heat waves will occur both earlier and later in the season.

The HMPC noted that low income people and communities of color in urban neighborhoods are particularly vulnerable to heat waves, as they are often segregated and surrounded by heat trapping surfaces like asphalt and less likely to have air conditioning.

4.2.4. Severe Weather: Fog

Hazard/Problem Description

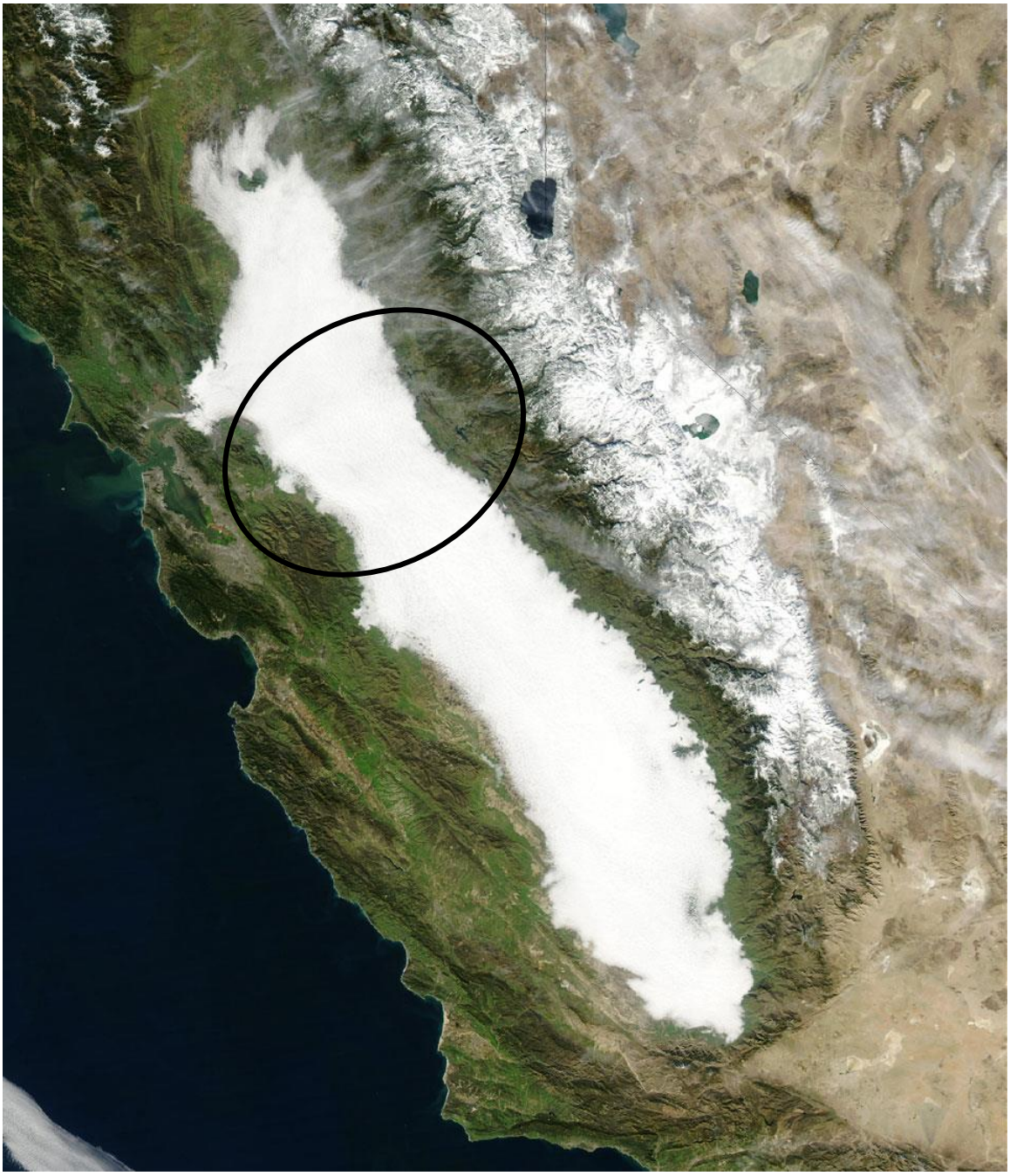
Fog is a collection of water droplets or ice crystals suspended in the air at or near the Earth's surface. Fog results from air being cooled to the point where it can no longer hold all of the water vapor it contains. Fog can form in a number of ways, depending on how the cooling that caused the condensation occurred. The most common types in the County are radiation and advection fog.

Radiation Fog

This type of fog forms at night under clear skies with calm winds when heat absorbed by the earth's surface during the day is radiated into space. As the earth's surface continues to cool, provided a deep enough layer of moist air is present near the ground, the humidity will reach 100% and fog will form. Radiation fog varies in depth from 3 feet to about 1,000 feet and is always found at ground level and usually remains stationary. This type of fog can reduce visibility to near zero at times and make driving very hazardous.

One of the most dangerous types of radiation fog unique to the planning is tule fog. It forms on clear nights when the ground is moist and the wind is near calm. On nights like this, the ground cools rapidly. In turn, the moist air above it cools and causes water vapor to condense. Once it has formed, the air must be heated enough to either evaporate the fog or lift it above the surface so that visibilities improve. It can cover large areas, as seen in Figure 4-7, with Sacramento County's location approximated with the black oval. The fog layer in tule fog often builds to several hundred feet thick, and can effectively block out incoming sunlight.

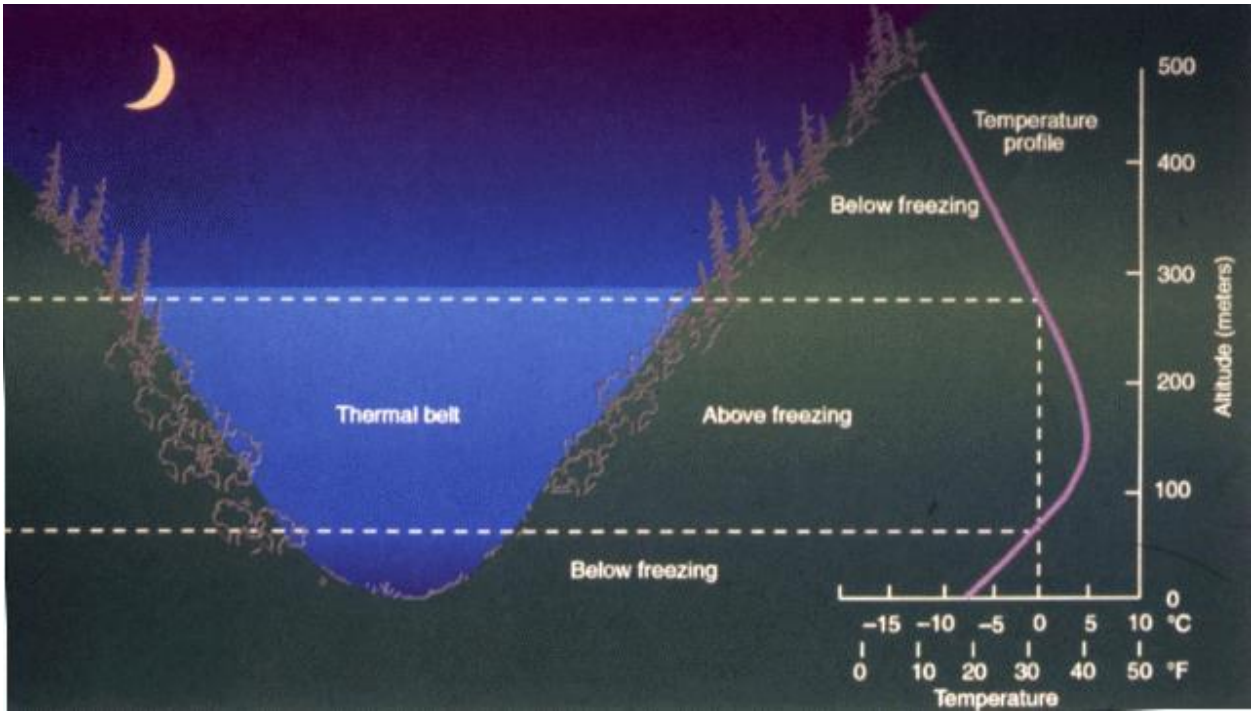
Figure 4-7 Tule Fog in the Central and San Joaquin Valley of California



Source: University of California Santa Barbara Department of Geology.

The Great Valley of California (the Sacramento and San Joaquin Valleys) is essentially a closed air basin. Therefore, the introduction of moisture is not removed from the valley air basin unless pushed or lifted out by atmospheric processes. By the late fall, cool season frontal passages begin to bring rain to the valley floor thereby adding low-level atmospheric moisture. High pressure building aloft behind frontal passages after a significant rain event provides moisture at low atmospheric levels, light wind, clear skies, and a temperature inversion aloft. This can be seen in Figure 4-8.

Figure 4-8 Temperature Inversion Affecting Fog in Valleys like Sacramento Valley



Source: University of California Santa Barbara Department of Geology.

This inversion limits vertical air movement from the valley air basin. Radiational cooling of the ground during the long nights cools the adjacent air and forms fog as temperatures reach dew points. The lack of strong sunshine during the fall and winter daytime hours does not provide sufficient incoming energy to always evaporate the overnight fog development. Thus fog can and does last several days at a time until the atmosphere provides some form of additional drying or mixing. The combination of the previous mentioned parameters and circumstances provides for a rather dense fog where visibility is often limited to mere feet. It is situations like these that often lead to multi-car accidents where one car follows another into a fog bank. Another area prone to fatal accidents is intersections across major roads or heavily traveled roads, where the cross traffic does not have to stop.

Advection Fog

Advection fog often looks like radiation fog and is also the result of condensation. However, the condensation in this case is caused not by a reduction in surface temperature, but rather by the horizontal movement of warm moist air over a cold surface. This means that advection fog can sometimes be distinguished from radiation fog by its horizontal motion along the ground.

The fog season in Sacramento County is typically in the late fall and winter (November through March) but can occur as late as May. Fog typically forms rapidly in the early morning hours. Fog can have devastating effects on transportation corridors in the County. Severe fog incidents can close roads, cause accidents, and impair the effectiveness of emergency responders. These accidents can cause multiple injuries and deaths and can have serious implications for human health and the environment if a hazardous or nuclear waste shipment is involved.

Past Occurrences

Disaster Declaration History

There are no fog related FEMA federal or Cal OES state disaster declarations for Sacramento County. In addition, there are no USDA secretarial disaster declarations associated with fog.

NCDC Events

The NCDC data recorded 5 fog incidents for Sacramento County since 1993. A summary of these events are shown in Table 4-9, with details following the table.

Table 4-9 NCDC Fog Events in Sacramento County 1993 – 12/31/2014

Event	Date	Deaths (Direct)	Injuries (Direct)	Property Damage	Crop Damage	Injuries (Indirect)	Deaths (Indirect)
Dense Fog	12/11/1997	5	26	$1,500,000	$0	0	0
Dense Fog	12/18/1998	1	10	$500,000	$0	0	0
Dense Fog	12/20/1999	0	2	$120,000	$0	0	0
Dense Fog	1/3/2001	0	0	$0	$0	0	0
Dense Fog	1/3/2001	0	0	$0	$0	0	0
Dense Fog	12/8/2015	0	0	$0	$0	0	1
Total		**6**	**38**	**2,120,000**	**$0**	**0**	**1**

Source: NCDC

- **December 11, 1997** – Patchy dense fog was a main contributing factor in a major chain reaction collision on northbound Interstate 5 near Lambert, CA, 17 miles south of downtown Sacramento. The crash involved 8 tractor trailers, 1 tanker truck, and 28 automobiles and small trucks. The five fatalities were burn victims caught in the fires from exploding fuel tanks. 26 other people were injured, and damage of $1.5 million was attributed to the fog.
- **December 18, 1998** – Dense morning fog resulted in a 38 vehicle pileup 10 miles northwest of downtown Sacramento on Interstate 5. The crash involved 26 automobiles, 10 tractor trailers, and 2 motor homes. Interstate 5 was closed for more than 10 hours in both directions. 1 fatality and 10 injuries were recorded. $500,000 in damages was attributed to the fog.
- **December 20, 1999** – Dense fog was responsible for an 8 vehicle pile up on Highway 12 on Andrus Island in south Sacramento County. California Highway Patrol reported visibilities of 75 feet. Two big-rigs and 6 passenger vehicles were involved in the accident. 2 injuries and $120,000 were attributed to the fog. No fatalities occurred during this fog event.

- **January 3, 2001** – Dense fog affected morning travel between the Central Sacramento Valley and the Northern San Joaquin Valley. The Delta was also affected. The California Highway Patrol escorted travelers through Sacramento and Yolo Counties where visibilities lowered to 200 feet. They also reported that the combination of high speeds and dense fog tripled the average amount of minor accidents during the morning commute. Nearly one-third of the commercial flights originating from the Sacramento International Airport were cancelled. No injuries, fatalities, or damages were recorded.
- **December 8, 2015** – Light winds and wet ground allowed fog to develop overnight and in the early morning. Around 5:20 a.m., 42-year-old male was killed when he crossed Power Inn Road at Florin Road against the light and was struck by a northbound vehicle that had a green light, according to the CHP. Poor visibility from fog is believed to have been a factor. Speed and alcohol reportedly did not contribute to the crash.

HMPC Events

The HMPC noted that, in addition to these past occurrences, a report from the NWS Office in Sacramento titled "Climate of Sacramento, California" revised in 2010 listed the following data in Table 4-10 and Table 4-11 regarding dense fog in the Sacramento area. As can be seen by the tables, dense fog is a prominent natural hazard in Sacramento County.

Table 4-10 Greatest Number of Total Days in a Month with Dense Fog 1949 to 2010

Days	Period	Year		Days	Period	Year
17	December 12-28	1985		9	January 12-20	1965
14	December 23 - January 5	2000		9	9 January 17-25	1961
13	January 13-25	1975		9	November 25-December 3	1949
12	December 9-20	2004		9	February 3-11	1954
11	December 3-13	1962		8	February 3-10	1991
10	December 2-11	1977		8	December 23-30	1989
10	December 27 - January 5	1962		8	January 29-February 5	1962
9	December 23-31	2000		8	December 14-21	1956
9	January 6-14	1986		8	December 14-21	1954
9	February 6-14	1971				

Source: Climate of Sacramento California. 2010

*Table 4-11 Greatest Number of Consecutive Days with Dense Fog 1949 to 2010**

Days	Period		Days	Period
23	January 1961		16	January 1955
22	December 1989		15	January 1975
22	December 1985		15	January 1972
20	December 2000		15	January 1965
20	December 1962		14	December 1986
19	December 1963		14	January 1986
19	January 1958		14	January 1983
18	January 1985		14	January 1964
17	January 2003		14	January 1963
16	December 2004		14	January 1962
16	December 1977			

Source: Climate of Sacramento California. 2010

* Only periods with 14 or more days are tabulated.

Likelihood of Future Occurrence

Highly Likely – Based on input from the HMPC, it is likely that major fog events will continue to occur annually in Sacramento County; thus the future occurrence of severe fog is highly likely.

Climate Change and Fog

It is currently unclear if climate change will have any effect on fog issues in the future. Limited data and research performed for redwood regions in California suggests that the occurrence of summertime fog has declined by 33% over the course of the 20th century. These findings were presented by Johnstone and Dawson in the Proceedings of the National Academy of Sciences.

4.2.5. Severe Weather: Heavy Rains and Storms (Thunderstorms, Hail, Lightning)

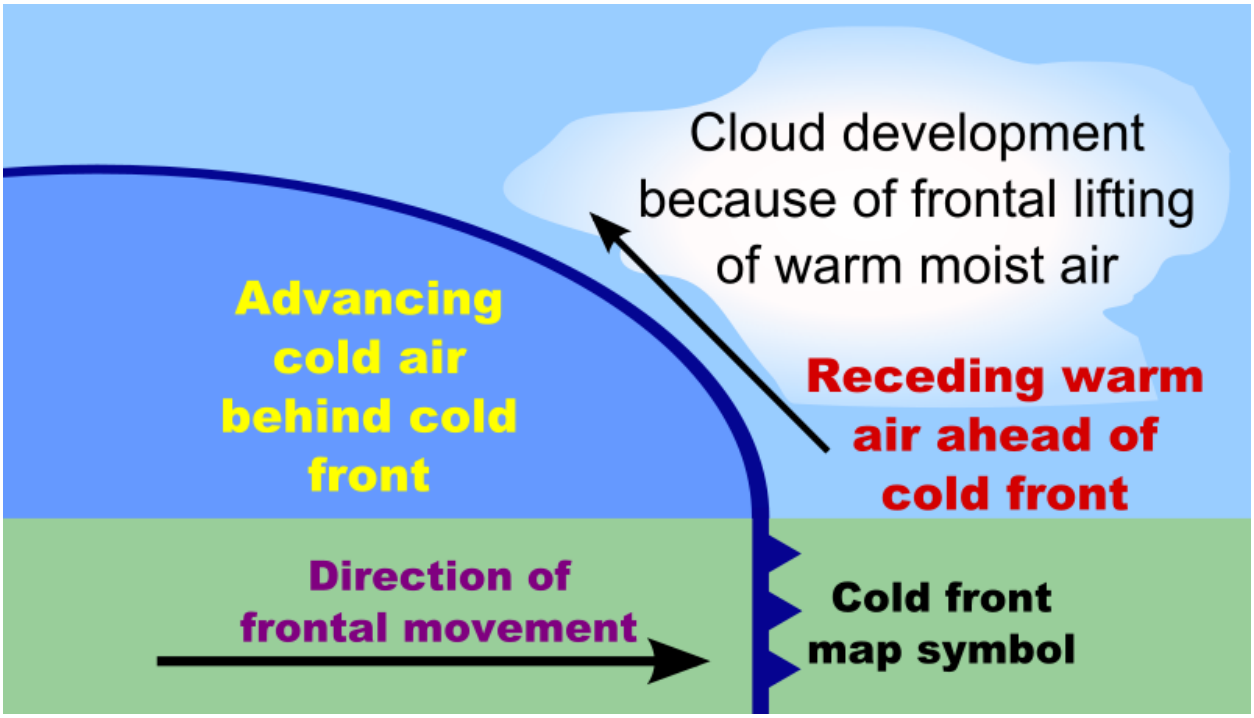
Hazard/Problem Description

Storms in the Sacramento County Planning Area are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the Sacramento County area falls mainly in the fall, winter, and spring months.

Heavy Rain and Thunderstorms

The NWS reports that thunderstorms result from the rapid upward movement of warm, moist air (see Figure 4-9). They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

Figure 4-9 Formation of a Thunderstorm



Source: NASA. http://rst.gsfc.nasa.gov/Sect14/Sect14_1c.html

According to the HMPC, short-term, heavy storms can cause both widespread flooding as well as extensive localized drainage issues. With the increased growth of the area, the lack of adequate drainage systems has become an increasingly important issue. In addition to the flooding that often occurs during these storms, strong winds, when combined with saturated ground conditions, can down very mature trees.

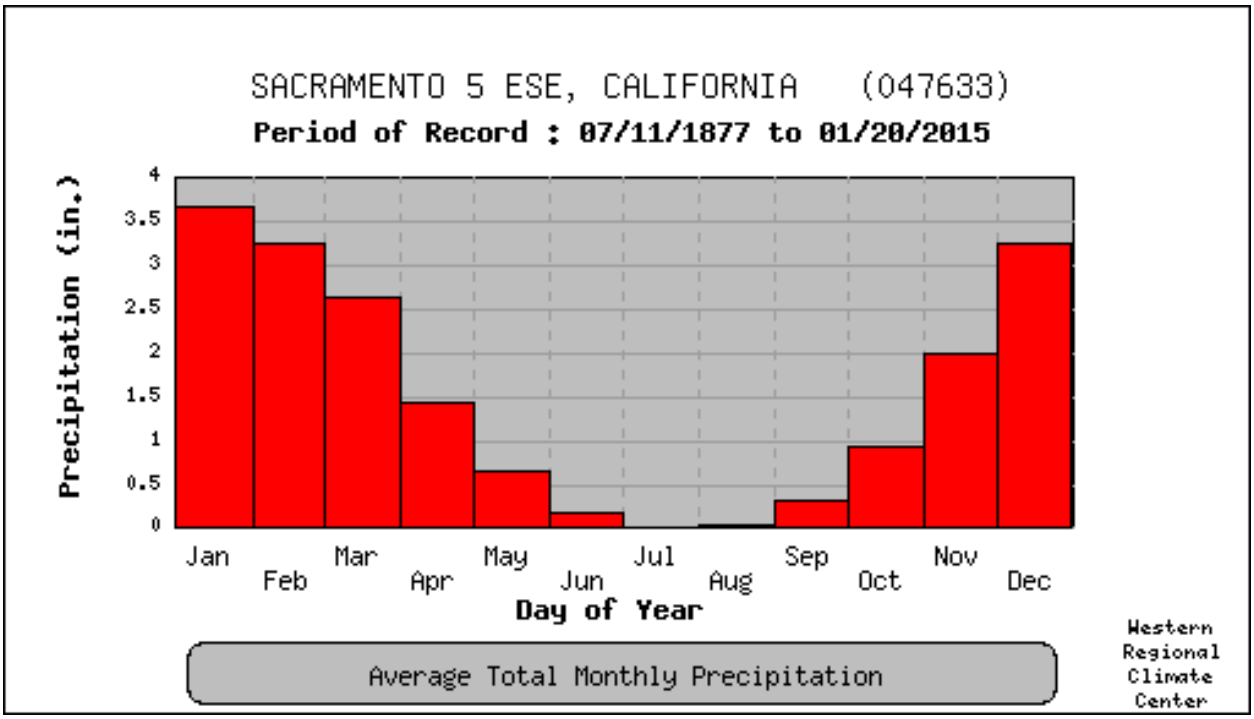
Information from the longest recording weather station in the County is summarized below.

Sacramento County (Sacramento 5 ESE Weather Station, Period of Record 1877 to 2015)

According to the WRCC, average annual precipitation in the County is 18.15 inches per year. The highest recorded annual precipitation is 37.62 inches in 1983; the highest recorded precipitation for a 24-hour period is 5.28 inches on April 20, 1962. The lowest recorded annual precipitation was 11.76 inches in 1976.

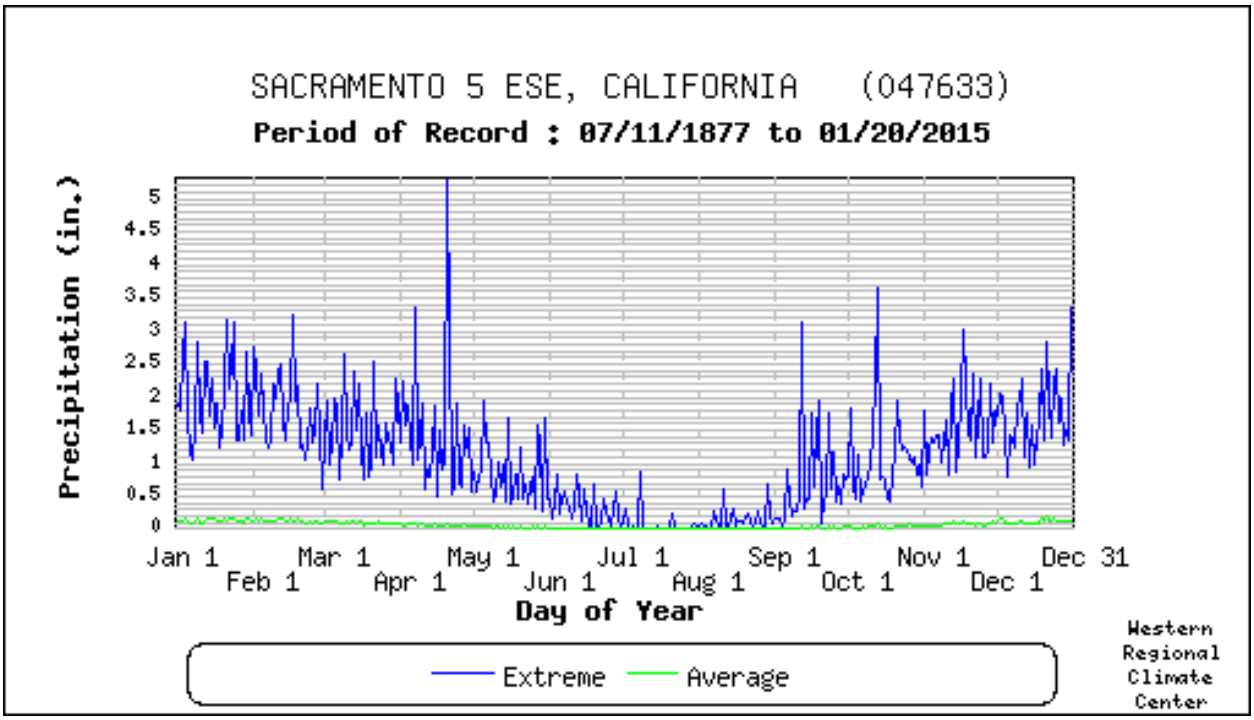
Average monthly precipitation for Sacramento County is shown in Figure 4-10. Daily average and extreme precipitations are shown in Figure 4-11.

Figure 4-10 Sacramento County Monthly Average Total Precipitation



Source: Western Regional Climate Center

Figure 4-11 Sacramento County Daily Precipitation Average and Extremes



Source: Western Regional Climate Center

Hail

Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within the Sacramento County Planning Area. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour (mph). Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-12 indicates the hailstone measurements utilized by the National Weather Service.

Table 4-12 Hailstone Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball

Average Diameter	Corresponding Household Object
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

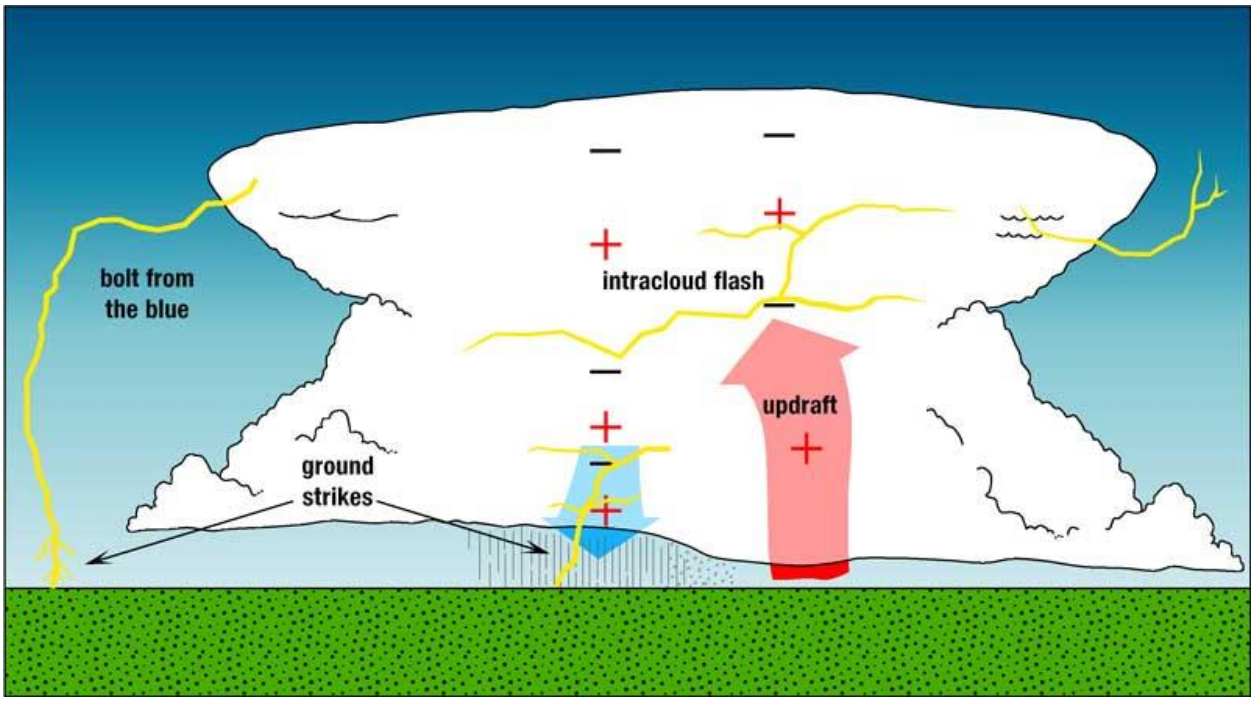
Lightning

Lightning is defined by the NWS as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction. Or, damage may be indirect, when the current passes through or near an object, which generally results in less damage.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat (see Figure 4-12). Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4-12 Cloud to Ground Lightning



Source: National Weather Service

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations turned up multiple events. FEMA federal disaster declarations occurred in 1950, 1955, 1958, 1963, 1969, 1983, 1986, 1989, 1995 (twice), 1997, 1998, 2006. State disaster declarations occurred in 1950, 1955, 1958 (twice), 1963, 1969, 1982 (twice), 1983, 1986, 1989, 1995 (twice), 1996, 1997, 1998, and 2008. More information can be found in Table 4-3 in Section 4.1.2. There have been no USDA secretarial declarations associated with severe storms.

NCDC Events

The NCDC data recorded 33 hail, heavy rain, lightning, and thunderstorm wind incidents for Sacramento County since 1950. A summary of these events are shown in Table 4-13 Specific events in the NCDC database showing damages, deaths, or injuries are detailed below the table; details on notable events follow

Table 4-13 NCDC Severe Weather Events in Sacramento County 1950-12/31/2015

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Hail	7	0	0	0	0	$11,030	$0
Heavy Rain	18	0	0	1	0	$365,000	$50,000
Lightning	1	0	0	0	0	$150,000	$0

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Thunderstorm Wind	7	0	0	0	0	$0	$0
Total	**33**	**0**	**0**	**1**	**0**	**$526,030**	**$50,000**

Source: NCDC

- **March 24, 1994** – A strong upper low pressure system and cold front moved over the area, where rainfall amounts of 0.75 to 1.33 inches were common. Numerous reports of street flooding were reported.
- **January 22, 2000** – In about a 48-hour span, downtown Sacramento more than doubled its seasonal precipitation climbing from 3.91 inches to 8.21 inches. Officially for the event, downtown Sacramento received 4.30 inches. On the 24th, Sacramento easily established a new daily precipitation record with 3.11 inches. The previous record for the date was 1.76 inches. Saturated grounds along with breezy conditions were responsible for a tree's collapse which critically injured a Sacramento resident. The same uprooted tree damaged two passenger vehicles and a residence. SMUD reported that the extreme weather caused 1,871 customers to lose power. Over $15,000 in property damage was attributed to this storm.
- **February 11, 2000** – Heavy rain inundated a sewage pump along Greenback Lane in Folsom. This caused water and raw sewage to sweep downhill and into an impoundment on the American River. Over $100,000 in property damage was attributed to this storm.
- **October 9, 2000** – Lightning struck a television antenna, setting the roof ablaze in the City of Elk Grove. Over $150,000 was attributed to this lightning strike.
- **May 9, 2005** – Hail struck 10 miles north of the City of Sacramento. Hail accumulation on Highway 99 resulted in several accidents. Over $10,000 was attributed to this hail storm.
- **April 2, 2006** – Prolonged heavy precipitation with high snow levels resulted in excessive runoff into area river basins. Hardest hit was the San Joaquin River system and the Delta region. Many area reservoirs had minimal flood storage space as per seasonal norms and the large inflows had to be balanced very carefully with downstream releases to protect the fragile San Joaquin levee system. While the bulk of the flooding affected agricultural and rural properties, some local areas adjacent to waterways experienced flooding of homes and many roads were impassable. However, through the efforts of advance flood-fight measures, careful monitoring of levees, and critical water management coordination among federal, state, and local agencies, the system performed as designed and more serious flooding was averted. Over $250,000 in property damage and $50,000 in crop damage were attributed to this storm.

HMPC Events

The HMPC noted that the all-time record for rainfall during any 24-hour period in Sacramento is 7.24 inches on April 19-20, 1880. Streets were described as "having the appearance of miniature rivers." The rainstorm was also reported (colorfully) in such terms as "steady and business-like", "a perfect torrent", and "more like a cataract than an April shower."

The record maximum one-hour rainfall is 1.65 inches, which fell during the evening of April 7, 1935. Thunderstorms in the area were responsible for the downpour with considerable street flooding reported. (Note: Hourly rainfall records are only available after 1903).

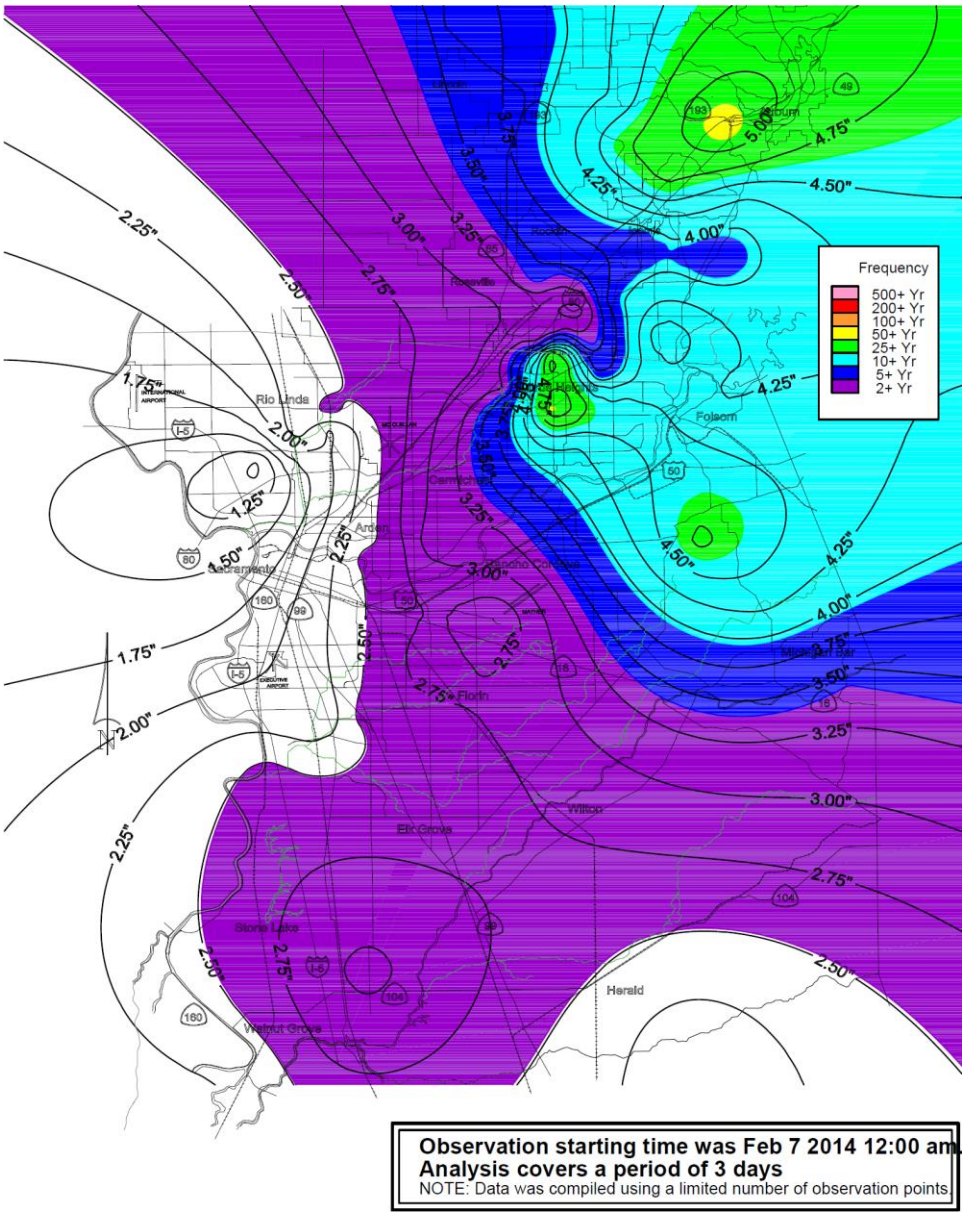
January 1862, with 15.04 inches, is the wettest month on record. This took place before official government observations began. Precipitation records at that time were kept by two physicians, Dr. F.M. Hatch, a retired Army Surgeon, and his associate, Dr. T.M. Logan. Their records are believed to be reliable.

The most rainfall ever recorded in one season in Sacramento is 37.62 inches, set during the 1982-83 rainy season, under the influence of a strong El Niño. This followed the wet season of 1981-82 (32.65 inches), making it the wettest two-year period on record in Sacramento. The most recent El Niño outbreak to saturate the Sacramento area was the 1997-98 water year, which received a whopping 32.25 inches of precipitation. Since rainfall records began in 1849-50, only eight other water years have received more.

The HMPC also provided storm reports from 2011 to 2015. Reports are triggered for the following reasons:1) 75 drainage complaints Countywide, or 25 complaints in any one County Supervisor's District; 2) any structure flooding; and 3) coverage on the news about impending storms or during the storm. Information from those reports is included below.

- **March 2011** – Rain fell continually throughout the week, but the significant storm event began on the 24th. Rainfall totals only reached approximately 1" to 1.5" countywide on the 24th, but fell with high intensities at times on saturated watersheds which exacerbated impacts on stream levels. High winds helped dislodge debris to clog drain inlets. There were a total of 90 service request calls between 11 am on the 24th to 11 am on the 25th. Most calls were for plugged storm drains. There was one report of a flooded structure, but that was not confirmed.
- **December 2, 2012** – A series of consecutive heavy rainfall events caused creeks and streams to rise rapidly due to ground saturation. Reports of a trailer park flooded on Sunday due to rising creek levels along Arcade Creek . Winding Way (road) was reported as flooded in low lying areas as well. Damages included:
  - ✓ 12 homes (6 - homes confirmed, 6 - homes high probability)
  - ✓ 15 garages (8 - garages confirmed, 5 - garages high probability)
  - ✓ 4 duplexes (eight residences)
  - ✓ 29 apartments (2 within Auburn Villa MHP)
  - ✓ 4 mobile/manufactured homes within Auburn Villa MHP
  - ✓ 16 RVs within Auburn Villa MHP
  - ✓ 30 vehicles
- **May 5-6, 2013** – Redevelopment of thunderstorms that were producing torrential rainfall over the urban areas of Sacramento caused several instances of roadway flooding across the area. Law enforcement reported roadway flooding at Exposition Blvd and Heritage Lane with a vehicle stuck in the roadway, two vehicles stuck in water near Arden and Hwy 160, roadway flooding near Watt Ave and Marconi Ave, as well as roadway flooding at H Street and 37th Street.
- **February 7-9, 2014** – A large storm occurred in the County. Rainfall totals of up to 3.5" occurred. Upstream of Folsom Dam, 5" fell in the City of Auburn in Placer County. Storm totals and an estimate frequency interval for the storm are shown on Figure 4-13. 73 calls were handled by the County for service requests.

Figure 4-13 February 7-9th Storm Rainfall Totals and Storm Interval



Source: Sacramento County Department of Water Resources 2014 Storm Report

- **February 5 to 9, 2015** – Countywide rainfall totaled approximately 1 inch to 3 inches and the rainfall intensity was equivalent to the 3-year storm event or less. The Department of Water Resources received 47 drainage service requests. The majority of calls were for localized street flooding and plugged drain inlets. No structure flooding was reported at this time. Three self-service sandbag sites were opened for the storm event, however no sandbags were distributed. Arcade Creek hit monitor stage at Winding Way near the American River College, Cosumnes River hit monitor stage at Michigan Bar (stages in the river are still raising but are not expected to reach flood stage), and the Natomas East Main Drain Canal hit monitor stage at pump station D15. Deer Creek hit flood stage at Scott Road.
- **December 21 and 22, 2015** – Countywide rainfall totaled approximately 0.1 inch to 0.95 inches, and the rainfall intensity was less than a 2-yr event. The Department of Water Resources received 12

drainage service requests. No structure flooding was reported at this time. Cosumnes River hit monitor stage at Michigan Bar and is receding. The Natomas East Main Drain Canal hit monitor stage at pump station D15. Deer Creek hit monitor stage at Scott Road.

Likelihood of Future Occurrence

Highly Likely – Heavy rains and storms are a well-documented seasonal occurrence that will continue to occur annually in the Sacramento County Planning Area.

Climate Change and Heavy Rains and Storms

According to the CAS, while average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. This may bring stronger thunderstorm winds. It is unlikely that hail will become more common in the County. The amount of lightning is not projected to change.

Preliminary Draft - Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP), Ascent Environmental 2016 Analysis

According to the 2016 Preliminary Draft CAP, which utilized Cal Adapt to model potential climate change impacts to Sacramento County, historic precipitation patterns could be altered. Depending on the location, precipitation events may increase or decrease in intensity and frequency. However, while the projections in California show little change in total annual precipitation, even modest changes could significantly affect California ecosystems that are conditioned to historical precipitation timing, intensities, and amounts. Also noted, reduced precipitation could lead to higher risk of drought and increased precipitation could cause flooding and soil erosion. Based on the Cal-Adapt model, the historical annual average rate of precipitation in Sacramento County is 18 inches. Under the high emission scenario, overall precipitation in Sacramento County is expected to decline over the next century, with annual averages decreasing more substantially under the high emissions scenario. Further, changes in weather patterns resulting from increases in global average temperature could result in a decrease in total amount of precipitation falling as snow. Based on historical data and modeling, under both low- and high-emissions scenarios, Cal DWR projects that the Sierra Nevada snowpack will decrease by 25-40 percent from its historic April 1st average of 28 inches of water content by 2050 and 48 to 65 percent by 2100, respectively.

4.2.6. Severe Weather: Wind and Tornadoes

Hazard/Problem Description

Winds

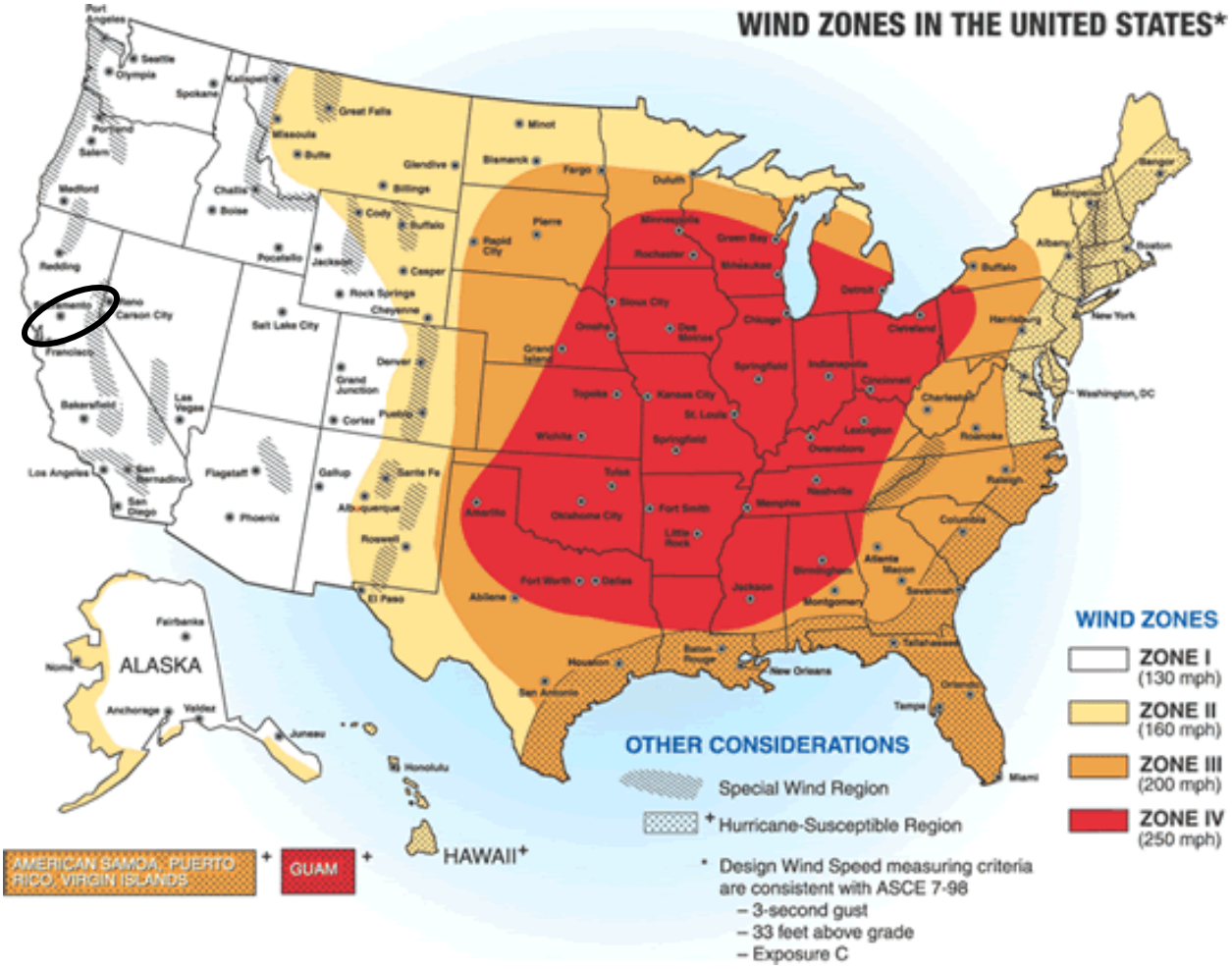
High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss.

The Planning Area is subject to significant, non-tornadic (straight-line), winds. High winds, as defined by the NWS glossary, are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. These winds may occur as part of a seasonal climate pattern or in

relation to other severe weather events such as thunderstorms. Straight-line winds may also exacerbate existing weather conditions by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snow storms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel around the region, and increasing the ferocity of exiting fires. These winds may damage crops, push automobiles off roads, damage roofs and structures, and cause secondary damage due to flying debris.

Figure 4-14 depicts wind zones for the United States. The map denotes that Sacramento County falls into Zone I, which is characterized by high winds of up to 130 mph. Portions of the County also fall into a Special Wind Region.

Figure 4-14 Wind Zones in the United States



Source: Federal Emergency Management Agency

Tornadoes

Tornadoes and funnel clouds can also occur during these types of storms. Tornadoes are another severe weather hazard that can affect the Sacramento County Planning Area, primarily during the rainy season in the late fall and early spring. Tornadoes form when cool, dry air sits on top of warm, moist air. Tornadoes

are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist. They can have the same pressure differential across a path only 300 yards wide or less as 300-mile-wide hurricanes. Figure 4-15 illustrates the potential impact and damage from a tornado.

Figure 4-15 Potential Impact and Damage from a Tornado

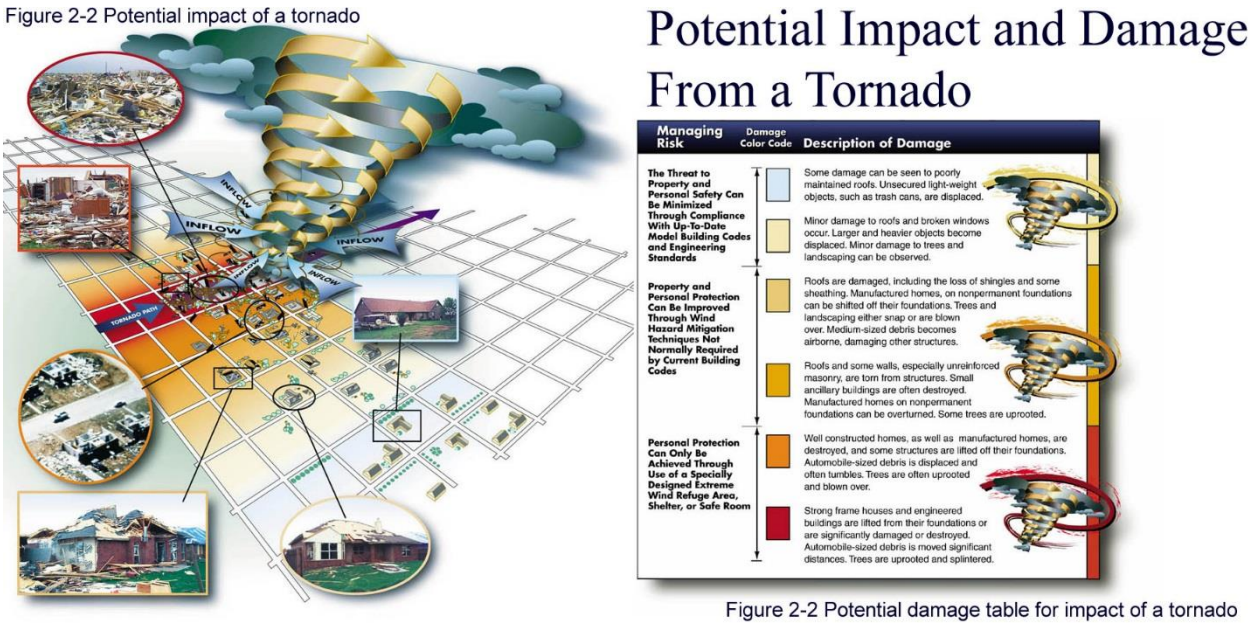


Figure 2-2 Potential damage table for impact of a tornado

Source: FEMA: Building Performance Assessment: Oklahoma and Kansas Tornadoes

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis and better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 4-14 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity. Table 4-15 shows the wind speeds associated with the Enhanced Fujita Scale ratings.

Table 4-14 Original Fujita Scale

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/f-scale.html

Table 4-15 Enhanced Fujita Scale

Enhanced Fujita (EF) Scale	Enhanced Fujita Scale Wind Estimate (mph)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/ef-scale.html

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, the majority of injuries and deaths generally result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Past Occurrences

Disaster Declaration History

There have not been any FEMA federal or state disaster declarations in the Planning Area associated with high winds or tornadoes. There has been one USDA secretarial disaster declaration for wind/tornado in 2005, which is detailed in Table 4-21 in Section 4.2.7.

NCDC Events

Winds

The NCDC data shows 32 wind incidents for Sacramento County since 1993. These are shown in Table 4-16. Winds that resulted in damage, injuries, or deaths are discussed below the table.

Table 4-16 NCDC Wind Events in Sacramento County 1993 to 12/31/2015

Event Type	Number of Events	Deaths	Deaths (indirect	Injuries	Injuries (indirect)	Property Damage	Crop Damage
High Wind	36	1	0	0	0	$8,842,000	$39,000
Strong Wind	9	0	1	0	2	$2,185,000	$0
Thunderstorm Wind	7	0	0	0	0	$0	$0
Total	**52**	**1**	**1**	**0**	**2**	**$0**	**$0**

Source: NCDC

- **February 7, 1998** – Strong winds blew for a second day in a row in the Sacramento and Northern San Joaquin Valleys. The winds were strong enough to push a floating restaurant upstream on the swollen Sacramento River near Sacramento. Power outages left 60,000 customers in Sacramento and 15,000 Solano County customers in the dark for hours. 118 city trees were damaged in Sacramento. In total, $300,000 in property damage was attributed to this wind storm. No injuries or deaths were recorded.
- **November 7, 1998** – Post-frontal winds exceeding 50 mph downed over 400 power lines and trees. Over 125,000 SMUD and PG&E customers temporarily lost power with 90,000 of them in Sacramento County. In addition, $700,000 of damages were reported. No injuries or deaths were recorded.
- **April 3, 1999** – Pre-frontal winds of 40 mph disrupted electrical service for 3,500 PG&E customers. In addition, $59,000 of damages were reported. $20,000 of it was property damage, while $39,000 of crop damage was recorded. No injuries or deaths were recorded.
- **June 17, 2000 –** Sustained winds of 30-40 mph blew through the Carquinez Strait during the afternoon and early evening hours. A motorcyclist traveling on I-680 in nearby Solano County was pushed off the highway near Marshview Road by a stronger gust at approximately 5:25 pm and died of his injuries.
- **October 24, 2000 –** Strong north winds exceeded 40 mph across the interior valley and foothills. More than 20,000 SMUD and PG&E customers were temporarily without power. The winds uprooted trees damaging several homes and vehicles. $40,000 in property damage was attributed to this wind storm. No injuries or deaths were recorded.
- **January 4, 2008** – A 71 mph gust was measured 4 miles west northwest of Elk Grove. A 69 mph wind gust was measured at Sacramento Executive Airport and a 66 mph wind gust was measured at Sacramento International Airport. The State Legislature building had several windows broken and proceedings were forced to be suspended. Many trees were reported down, including an 80 foot oak tree near the intersection of Elm and Hazel in Sacramento. PG&E reported many power poles down throughout the area and thousands of residents and businesses were without power for up to seven days. Several big rigs were reported down by the CHP, including one on I-5 south of River Rd. in Woodland, and another on I-80 east of State Route 113. $7.4 million in property damages were recorded, though not all of them occurred in Sacramento County. No injuries or deaths were recorded.
- **October 27, 2013** – Strong onshore winds brought down large trees for the Southern Sacramento Valley. Sacramento Executive AP peaked at 41mph, Sacramento International AP peaked at 46mph, and Vacaville/Nut Tree peaked at 36mph. Broadcast media reported several large trees down in Sacramento which hit houses, powerlines, and cars. A tree fell on a home near Sac State that caused significant roof damage. $50,000 in property damage was attributed to this wind storm. No injuries or deaths were recorded.
- **December 11, 2014** – Law enforcement, media, and the public reported numerous trees and large branches downed by winds in Sacramento and adjacent suburbs, such as Rosemont, Carmichael, and Florin. These caused local power outages spread across the area. There was a 38 mph gust measured at

7 am at Sacramento Executive Airport, a 40 mph gust at Sacramento International Airport. $500,000 in property damage was attributed to this wind storm. No injuries or deaths were recorded.

- **December 30, 2014 –** Multiple fallen trees caused damage to homes in the Motherlode foothills and in the Sacramento metro area. Trees were reported falling on homes and business in Sacramento, Elk Grove, and Folsom. Fallen trees and branches also caused power outages, with 344,000 customers across northern California impacted. $1,600,000 in property damage was attributed to this wind storm, though not all in Sacramento County. No injuries or deaths were recorded.

Tornado

During the rainy season, the Sacramento County Planning Area is prone to relatively strong thunderstorms, sometimes accompanied by funnel clouds and tornadoes. While tornadoes do occur occasionally, most often they are of F0 or F1 intensity. Documented incidents of tornadoes in the Sacramento County planning area from the NCDC Storm Events Database are listed in Table 4-17 and explained in further detail in the text below the table.

Table 4-17 Sacramento County Tornado Events from 1950 – 12/31/2015

Type	# of Events	Property Loss	Crop Loss	Deaths	Injuries
Funnel Cloud	6	$0	$0	0	0
F0	8	$706,000	$0	0	0
F1	3	$500,000	$0	0	0
F2	1	$250,000	$0	0	0
Total	**18**	**$1,456,000**	**$0**	**0**	**0**

Source: NCDC

- **February 7, 1978** – An F2 tornado was reported in Sacramento County. The tornado was 20 yards wide and was on the ground for approximately 1.9 miles. No deaths, no injuries, and $250,000 in damages were attributed to this tornado.
- **March 22, 1983** – An F1 tornado was reported in Sacramento County. The tornado was 50 yards wide and was on the ground for approximately 1 mile. No deaths, no injuries, and $250,000 in damages were attributed to this tornado.
- **April 9, 1988** – An F1 tornado was reported in Sacramento County. The tornado was 30 yards wide and was on the ground for approximately 1 mile. No deaths, no injuries, and $500,000 in damages were attributed to this tornado.
- **April 24, 1998** – A weak tornado (F0) touched down near a large mall in the Sacramento metro area, severely damaging a tree and damaging two cars. No deaths, no injuries, and $10,000 in damages were attributed to this tornado.
- **February 21, 2005** – On 21 February 2005 Presidents' Day, three tornadoes and several funnel clouds (see Figure 4-16) occurred in the Sacramento valley, including two weak (F0) tornadoes in the Sacramento, CA metropolitan area. The Southport, CA and Natomas, CA tornadoes caused nearly $1 million of damage to residential and commercial property. Amazingly, there were no fatalities or serious injuries despite the amount of flying debris, air-borne projectiles, toppled trees, and an over-turned semi-trailer truck.

Figure 4-16 Images from the President's Day Tornado Outbreak in Sacramento County

Source: Sacramento Bee

- **April 8, 2005** – An F0 made two brief touchdowns in Sacramento County, one 8 miles north of the City of Sacramento and another near the Sacramento Metro Airport. The brief touchdown north of the City caused damage to a church roof, residential property fences, and to tree branches. The brief touchdown near the airport was in an open field and caused no damages. In all, no deaths, no injuries, and $25,000 in damages were attributed to this tornado.
- **February 25, 2007** – Clearing skies over an unstable airmass left in the wake of a very cold winter storm provided an environment favorable for weak convective activity. A very weak tornado (EF0) skimmed a residential area just south of downtown Elk Grove shortly after noon. Damage was minimal but consistent in a narrow one mile path. Most of the damage was to small tree branches but also included two power lines tipped, a rooftop solar heating unit damaged, and there was minor damage to fence panels at two locations. No structural damage was noted. No deaths or injuries were attributed to this tornado.
- **February 25, 2011** – An EF0 tornado touched down at the Mather Field Industrial Park, immediately north of Mather Field. The maximum wind speed of the tornado was estimated at 75 mph with a damage path of one third of a mile. The damage path was in a northeast direction. No injuries nor fatalities have been reported. Damage was to a few trees including a large evergreen tree, broken road signs, and broken windows to multiple cars.
- **October 22, 2015** – A tornado touched down in the City of Elk Grove. Supercells developed behind the cold front along a north-south boundary in the middle of the Central Valley, where both instability and shear were large. Reports of tornado damage were at approximately 3:45pm (PST) near Waterman and Grand Line Roads. The estimated damage path length was about a mile with wind speeds estimated at 90-100mph. A sturdy metal roof was bent back, tree trunks that were several feet in diameter were snapped. Dozens of houses were mildly damaged.

HMPC Events

The Planning Team for the County noted the following events since 2011:

- 2012 – October 22nd @ 3:45 – A tornado occurred in Elk Grove, which caused winds of 90-100 mph.
- 2013 – April 8th and 9th – A strong trough that had brought rain and snow to interior northern California, had moved eastward of the area on Monday, April 8th. This brought strong, gusty northerly winds in its wake across the area, mainly the Central Valley, ridge tops, and wind prone mountain canyons. The strongest periods of winds were on Monday, April 8th from late morning into mid-afternoon. Breezy conditions occurred again on Tuesday, April 9th, though winds were not quite as strong. Sustained winds on Monday reached 25-35 mph with gusts as high as around 50 mph. Sustained winds on Tuesday

were 20-30 mph with gusts as high as around 40 mph. Over 20,000 people were reported to have lost power due to falling trees and wind (though not all in Sacramento County).

- 2013 – Oct 3rd & 27th – High winds occurred. Gusts of 35 – 50 mph.
- March 29th – A Pacific front moved through interior Northern California March 28-30th which brought rain and heavy snow to the area. A supercell strengthened in the Central Sacramento Valley that afternoon that eventually produced an EF0 tornado near Nord, CA that evening.
- 2014 – Dec 11th – Heavy rainfall & winds of about 50-60 mph.
- 2014 – Dec 30th – High winds occurred, causing a power outage to about 344,000 people.
- 2015 – December – there was a tornado that formed over Folsom Lake and impacted El Dorado County
- 2016 – January 19th – Part of a tree fell onto Saverien Drive, blocking the right turn lane. This was a result of rainfall and 40 mph winds.

Likelihood of Future Occurrence

Likely – High winds are a well-documented seasonal occurrence that will continue to occur annually in the Sacramento County Planning Area, making future occurrence highly likely. While occasional, tornadoes do occur in the County as well. Combining the likelihoods results in a likelihood of future occurrence of likely.

Climate Change and High Winds/Tornadoes

According to the CAS, while average annual rainfall may increase or decrease slightly, the intensity of individual events is likely to increase during the 21st century. This may bring stronger thunderstorm winds. The number of tornadoes is not projected to change.

4.2.7. Agricultural Hazards

Hazard/Problem Description

Agricultural production in Sacramento County remains a significant contributor to the local economy. In addition to the almost $470 million in annual production value, there are hundreds of jobs directly tied to agricultural production and thousands more that are impacted indirectly in the production, processing, transportation, and marketing of those commodities. It is estimated that there is approximately a four to one ratio for crops grown in this region, so $470 million in production value is actually a $1.88 billion impact on the local economy.

Sacramento County is at risk from severe weather events and insects/pests that, under the right circumstances, can cause severe economic, environmental, or physical harm. Severe weather and insects affect crop production and can result in economic disasters. These hazards can have a major economic impact on farmers, farm workers, packers, and shippers of agricultural products. They can also cause significant increases in food prices to the consumer due to shortages.

Sacramento is also at risk to noxious weeds that can affect both waterways and agricultural crops. These hazards can have major impact on farmers, farm workers, packers, and shippers of products, as well as those who use waterways for recreation or for water supply.

Important Farmland

According to the California Department of Conservation's Farmland Mapping and Monitoring Program (FMPP), as of 2014, the County has approximately 91,568 acres of prime farmland, 43,105 acres of farmland of statewide importance, 15,125 acres of unique farmland, 58,852 acres of farmland of local importance, and 153,452 acres of grazing land. These numbers have been reduced since 2004 due to increased development in the County.

Sacramento County Agriculture Industry

According to the 2015 crop report, 2015 represented the fourth year of severe drought and that is finally demonstrated in the County's crop production value of $469,947,546 which represents a 6.4% decrease from the adjusted 2014 figure of $502,274,000 (a record high). Although the drought did negatively affect the yields of some crops, another major contributing factor to the lower farmgate was the decrease in prices for many commodities in 2015. It should be noted that many of the 2015 lower commodity prices had increased significantly in 2014 so this may be a re-adjustment to more of a normal price. Sacramento County agriculture demonstrated stability in 2015 as the top ten commodities remain the same and their proportion of the County's agricultural value remained stable as well. All but two of the top ten commodities had a decrease in value. The largest decreases were in milk and field corn. Field corn production dropped 25% and the price per ton dropped 12.7% and milk production dropped 8% and its price per unit dropped almost 30%. Pears also showed a significant decrease (-20%) with a drop in both production and price per ton but Sacramento still remains the top pear producing county in California. The top County commodity, wine grapes, increased in acreage but most likely due to the drought decreased a bit in yield and the price decreased slightly as well. Livestock was a bright spot in 2015 with a 60% increase in the value of aquaculture production and it remains in the top ten commodities. Although the price in cattle and calves remained strong and even increased, many cattlemen had already thinned their herds due to the drought (production was down almost 10%) and the cattle were not carrying the weight that they did in 2014 so producers were unable to take advantage of that strong price and turned in a 13% decrease for 2015. The rest of the livestock in the County showed increases in value so that overall, livestock values increased more than 12% over 2014.

A summation of crop values from 2010-2015 is shown in Table 4-18.

Table 4-18 Sacramento County Crop Values 2010 to 2015

INDUSTRY	2010 Value	2011 Value	2012 Value	2013 Value	2014 Value	2015 Value
Apiary Products	$3,000	$51,000	$50,000	$58,000	$230,000	$234,000
Field Crops	$58,543,000	$78,059,000	$81,030,000	$75,565,000	$80,600,000	$74,612,000
Fruit & Nut Crops	$144,270,000	$145,179,000	$198,334,000	$197,863,000	$196,923,000	$189,117,000
Livestock/Poultry	$43,467,000	$59,141,000	$74,804,586	$71,309,055	$89,953,000	$101,314,546
Livestock/Poultry Products	$50,149,000	$63,654,000	$58,884,000	$65,526,000	$76,994,000	$49,916,000
Nursery Products	$28,925,000	$26,457,000	$23,642,000	$24,916,000	$24,229,000	$23,778,000
Seed Crops	$2,275,000	$2,759,000	$5,511,000	$4,811,000	$4,254,000	$4,812,000

INDUSTRY	2010 Value	2011 Value	2012 Value	2013 Value	2014 Value	2015 Value
Vegetable Crops	$28,311,000	$29,911,000	$18,395,000	$18,909,000	$22,195,000	$26,614,000
GRAND TOTALS	**$355,943,000**	**$405,211,000**	**$460,650,586**	**$458,957,055**	**$495,378,000**	**$470,397,546**

Source: Sacramento County Agricultural Commissioner's Reports, 2010-2014

Natural Hazards and Sacramento County Agriculture

According to the HMPC, agricultural losses occur on an annual basis and are usually associated with severe weather events, including heavy rains, floods, heat, and drought. The 2013 State of California Multi-Hazard Mitigation Plan attributes most of the agricultural disasters statewide to drought, freeze, and insect infestations. Other agricultural hazards include fires, crop and livestock disease, and noxious weeds.

Insects and Sacramento County Agriculture

Sacramento County is threatened by a number of insects that, under the right circumstances, can cause severe economic and environmental harm to the agricultural industry. Insects of concern to plants and crops include the Asian citrus psyllid, Caribbean fruit fly, false codling moth, melon fruit fly, guava Fruit fly, gypsy moth, Japanese beetle, Light brown apple moth, Mediterranean fruit Fly, melon fruit fly, Mexican fruit fly, oriental fruit fly, peach fruit fly, red imported fire ant, and striped fruit fly. The Sacramento County Department of Agriculture traps and monitors all of these agricultural pests. Pest detection is a proactive program that seeks to identify exotic, invasive insects. These pests have a wide host ranges and are difficult and costly to manage once established. Early detection is essential for quick and efficient eradication. Public participation is critical to the success of this program, since staff relies on the goodwill of property owners who allow traps to be placed on their properties. The Agriculture Department deploys 7,800 traps annually between spring and fall.

The California Department of Food & Agriculture Pest Eradication staff with the assistance of the California Conservation Corp help to mitigate the impacts of insect pests by providing human resources to assist in state and local eradication efforts, including surveying private yards and business landscapes to detect the Glassy Winged Sharpshooter, stripping citrus fruit infected by the Mexican Fruitfly, removal of citrus trees which have been infected with Huanglongbing (HLB), also known as Citrus Greening, or cleaning and disinfecting backyards infected by the Exotic Newcastle Disease.

Weeds and Sacramento County Agriculture

Noxious weeds, defined as any plant that is or is liable to be troublesome, aggressive, intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate, are also of concern. Weeds of concern in the County are shown in Table 4-19 and Table 4-20.

Table 4-19 Sacramento WMA High Priority Weeds

Scientific Name	Common Name	Cal-IPC Rank/ CDFA Rating	Notes
Acroptilon repens	Russian knapweed	Mod/B	Few locations along roadsides and fields in Natomas Area

Scientific Name	Common Name	Cal-IPC Rank/ CDFA Rating	Notes
Arundo donax	Giant reed	High/B	Priority for management in riparian areas.
Centaurea solstitialis	Yellow starthistle	High/C	Management in high quality habitat and recreation areas.
Chondrilla juncea	Skeleton weed	MOD/A	Not a priority for mapping and control in Sacramento or foothill counties according to CDFA, weed of concern for counties around Sacramento
Cuscuta japonica	Japanese dodder	--/A	Active eradication program in place.
Cytisus scoparius	Scotch broom	High/C	Not much of this, keep on priority list, abundant in upstream watersheds.
Dittrichia graveolens	Stinkwort	MOD*/NL	Project priority. This weed is the subject of a mapping and eradication program started in 2009.
Eichornia crassipes	Water hyacinth	High*/C	Priority in Delta waterways, still actively sold in nurseries.
Genista monspessulana	French broom	HIGH/C	Scattered locations, sometimes sold in nursery trade, upstream of American River Parkway.
Lepidium latifolium	Perennial pepperweed	High/B	Heavy infestations in the southern part of the County, spreading along roadsides and through contaminated materials.
Ludwigia spp.	Water primrose	HIGH/NL	Project priority. Eradication target for mosquito and vector control work. Spreading in agricultural ditches and Laguna Creek
Sapium sebiferum	Chinese tallow	MOD*/NL	Starting to naturalize in the American River Parkway, Dry Creek and other riparian areas.
Sesbania punicea	Red sesbania	HIGH*/B	Project priority. Target of active eradication program in Dry Creek, abundant in Steelhead, Robla and Arcade creeks.
Spartium junceum	Spanish broom	High/C	Scattered locations in American River Parkway, sometimes sold in nursery trade.

Source: Sacramento WMA Strategic Plan

Status Definitions

Cal-IPC Ranks (Cal-IPC Inventory Categories):

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

CDFA Rating definitions:

"A" –A pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment. A-rated pests are prohibited from entering the state because, by virtue of their rating, they have been placed on the of Plant Health and Pest Prevention Services Director's list of organisms "detrimental to agriculture" in accordance with the FAC Sections 5261 and 6461. The only exception is for organisms accompanied by an approved CDFA or USDA live organism permit for contained exhibit or research purposes. If

found entering or established in the state, A-rated pests are subject to state (or commissioner when acting as a state agent) enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action.
"B"–An pest of known economic or environmental detriment and, if present in California, it is of limited distribution. B-rated pests are eligible to enter the state if the receiving county has agreed to accept them. If found in the state, they are subject to state endorsed holding action and eradication only to provide for containment, as when found in a nursery. At the discretion of the individual county agricultural commissioner they are subject to eradication, containment, suppression, control, or other holding action.
"C"–A pest of known economic or environmental detriment and, if present in California, it is usually widespread. C-rated organisms are eligible to enter the state as long as the commodities with which they are associated conform to pest cleanliness standards when found in nursery stock shipments. If found in the state, they are subject to regulations designed to retard spread or to suppress at the discretion of the individual county agricultural commissioner. There is no state enforced action other than providing for pest cleanliness.
"Q"–An organism or disorder suspected to be of economic or environmental detriment, but whose status is uncertain because of incomplete identification or inadequate information.
"D"–An organism known to be of little or no economic or environmental detriment, to have an extremely low likelihood of weediness, or is known to be a parasite or predator. There is no state enforced action.

Table 4-20 Sacramento WMA Weed Watch List

Scientific Name	Common Name	Cal-IPC Rank/ CDFA Rating	Notes
Ailanthus altissima	Tree of Heaven	MOD/C	Concern in natural areas.
Centaurea calcitrapa	Purple starthistle	MOD/B	A few recorded locations, more abundant in Solano County.
Centaurea sulphurea	Sicilian starthistle	--/B	Expanding outside known location in Folsom.
Cynara cardunculus	Artichoke thistle	MOD/B	In southern Delta, could expand north.
Glyceria declinata	Manna grass	MOD/NL	Invading vernal pools.
Lythrum salicaria	Purple loosestrife	HIGH/B	Small populations are not being actively managed.
Robinia pseudoacacia	Black locust	LIMITED/NL	Concern in riparian areas.
Rubus (armeniacus) discolor	Himalaya blackberry	HIGH/NL	Concern in high-value habitats, widespread.
Taeniatherum caput-medusae	Medusahead	HIGH/C	Widespread, concern in high quality rangeland in eastern County.
Tamarisk sp.	Tamarisk	HIGH - VAR/B	Only a few populations on American River Parkway, could become more widespread.
Tribulus terrestris	Puncture vine	NL/C	Concern to bikers, abundant along Sacramento River bike trail.

Source: Sacramento WMA Strategic Plan. Cal-IPC and CDFA rankings are same as in previous table.

Noxious weeds have been introduced in the Planning Area by a variety of means, including through commercial nurseries. An absence of natural controls, combined with the aggressive growth characteristics and unpalatability of many of these weeds, allows these weeds to dominate and replace more desirable native vegetation. Negative effects of weeds include the following:

- Loss of wildlife habitat and reduced wildlife numbers;
- Loss of native plant species;
- Reduced livestock grazing capacity;
- Increased soil erosion and topsoil loss;
- Diminished water quality and fish habitat;

- Reduced cropland and farmland production; and
- Reduced land value and sale potential.

Disasters and Impacts to Sacramento County Agriculture

Economic Impacts

According to the HMPC, the consequences of agricultural disasters to the Planning Area include ruined plant crops, dead livestock, ruined feed and agricultural equipment, monetary loss, job loss, and possible multi-year effects (i.e., trees might not produce if damaged, loss of markets, food shortages, increased prices, possible spread of disease to people, and loss or contamination of animal products). When these hazards cause a mass die-off of livestock, other issues occur that include the disposal of animals, depopulation of affected herds, decontamination, and resource problems. Those disasters related to severe weather may also require the evacuation and sheltering of animal populations. Overall, any type of severe agricultural disaster can have significant economic impacts on both the agricultural community and the entire Planning Area.

According to the USDA, every year natural disasters, such as droughts, earthquakes, extreme heat and cold, floods, fires, earthquakes, hail, landslides, and tornadoes, challenge agricultural production. Because agriculture relies on the weather, climate, and water availability to thrive, it is easily impacted by natural events and disasters. Agricultural impacts from natural events and disasters most commonly include: contamination of water bodies, loss of harvest or livestock, increased susceptibility to disease, and destruction of irrigation systems and other agricultural infrastructure. These impacts can have long lasting effects on agricultural production including crops, forest growth, and arable lands, which require time to mature.

Impact to Waterways

Some of California's most serious weed problems occur in our waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and CDFA maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate. Based on estimates from the USDA, the permanent establishment of hydrilla in the Sacramento/San Joaquin Delta would result in at least $200 million in annual losses.

Past Occurrences

USDA Disaster Declaration History

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas and those that are contiguous to declared counties, including those that are across state lines. As part of an agreement with the USDA, the SBA offers

low interest loans for eligible businesses that suffer economic losses in declared and contiguous counties that have been declared by the USDA. These loans are referred to as Economic Injury Disaster Loans.

Disaster declarations from 1982 through 2015 are shown in Table 4-21.

Table 4-21 Sacramento County USDA Designations: 1982-2015

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
2015	–	Agricultural	Drought	S3797	–	2/25/2015
2015	–	Agricultural	Drought	S3784	–	2/4/2015
2014	–	Agricultural	Drought	S3743	–	9/17/2014
2014	–	Agricultural	Drought	S3637	–	1/23/2014
2013	–	Agricultural	Wildfire	S3626	–	8/17/2013
2013	–	Agricultural	Drought	S3569	–	8/1/2013
2013	–	Agricultural	Drought	S3558	–	7/31/2013
2012	–	Agricultural	Drought	S3452	–	12/29/2012
2012	–	Agricultural	Drought	S3379	–	9/5/2012
2009	–	Agricultural	Freezing Temperatures	S3109	–	11/25/2010
2008	–	Agricultural	Drought, Unseasonable Frost	S2708	–	7/29/2008
2007	–	Agricultural	Drought	S2563	-	8/9/2007
2007	–	Agricultural	Extremely low temperatures, freezing conditions	S2488	-	1/31/2007
2006	–	Agricultural	Excessive rain and hail	S2322	-	6/26/2006
2005	–	Agricultural	Cold wet weather	S2183	-	12/13/2005
2005	–	Agricultural	Unseasonable rain	S2120	-	8/25/2005
2005	–	Agricultural	Severe high temperatures, low humidity, strong winds	S2113	-	8/18/2005
2003	–	Agricultural	Extreme heat, unseasonable rainfall	S1855	-	12/19/2003
2003	–	Agricultural	Excessive rain, wheat stripe rust	S1812	-	10/23/2003
2002	–	Agricultural	Drought	S1769	-	4/28/2003

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
1998	–	Agricultural	Severe Winter storms, flooding	S1242	-	10/1/1998
1998	–	Agricultural	Severe Winter storms, flooding	M1203 (precursor to DR-1203)	-	2/9/1998
1995	–	Agricultural	Flooding, landslides, mud & debris flows	M1044 (precursor to DR-1044)	-	1/12/1995
1989	–	Agricultural	Earthquake	M-845 (precursor to DR-845)	-	11/4/1989
1988	–	Agricultural	Drought	S401	-	8/1/1989
1982	Rains Causing Agricultural Losses	Agricultural	Storms	GP	10/26/1982	–

Source: USDA, Sacramento County Department of Agriculture

NCDC Events

The NCDC does not track agriculture events. It does note any crop damages that come from severe weather events. These were detailed in Table 4-4 in Section 4.2.1.

HMPC Events

Members of the HMPC noted that many of the events in the drought section of this plan (Section 4.2.11) affected the agriculture industry in the County. Members of the HMPC noted that in the **1960s** there was a significant infestation of Japanese Beetle near the State Capitol in downtown Sacramento.

In the summer of **1983**, the Sacramento County Agriculture Department and the California Department of Food and Agriculture (CDFA) initiated a program to eradicate an infestation of the Japanese Beetle in Orangevale, California. One phase of the eradication program consisted of multiple applications of the pesticide carbaryl to foliage for each of the three summers for 1983, 1984, and 1985. The same materials and procedures were used on earlier gypsy moth infestations in the State. During the peak beetle flight season of the summer of 1984, a number of properties were sprayed every 4 to 9 days rather than the normal interval of 14+ days. Eradication efforts were completed in 1986.

In **1999**, in two Oriental Fruit Fly traps, approximately 1 mile apart, 2 Guava Fruit Flies were detected. In response to the finds, 359 additional Oriental Fruit Fly traps were deployed in an effort to pinpoint the source of the insects. These traps covered a 90-square mile area. Though no further Guava Fruit Flies were found, a 9-square mile area was treated in the core area of the find sites.

Since **2000**, Sacramento County has been under quarantine for the Glassy-winged Sharpshooter. The pest was first found in Rancho Cordova and then in Foothill Farms. The sharpshooter feeds by sucking juices

from a wide variety of plants. For most plants this is not a problem, however, the sharpshooter may spread a lethal bacterial disease to grapes. Luckily the 2 quarantine areas were in urban settings and away from the 25,110 acres of grapes in the County. Since discovering the infestations, hundreds of residential and commercial landscapes were treated in an effort to kill the pest before it spread to the vineyards. After 2 years of negative finds in both Rancho Cordova and Foothill Farms, all quarantine designations were removed in 2009. Trapping and visual surveys continue throughout the county to ensure the pest does not return. Eradication efforts over the 10 year period totaled around $6 million

In **2000**, both Gypsy Moth and Japanese Beetle were both found. Gypsy Moth was found in the Carmichael area prompting crews to deploy 100 more traps in a 4 square mile area. No additional Gypsy moths were trapped, however increased trapping in that area continued into 2001. A single Japanese Beetle was recovered from a trap at the former Mather Air Force Base in Rancho Cordova. It is suspected that the beetle "hitch-hiked" on one of the many air cargo planes landing there. Additional traps were deployed, but no further beetles were found.

In **2001**, the Red Imported Fire Ant was detected at an RV area at Cal Expo, in Sacramento County. The discovery was made by an alert RV camper from Texas who recognized the ants and alerted officials. Additional ant colonies were found by the Cal Expo amphitheater. To eradicate the infestation, an attractive bait was applied to the infested areas for worker ants to take back to the colonies. This bait is designed to disrupt the queens' ability to reproduce, and also inhibit the ants' ability to absorb nutrients. This "one-two punch" approach targets the entire colony and not just the ants above ground.

In **2001**, a single Japanese Beetle was recovered from a trap at the former Mather Air Force Base in Rancho Cordova. It is suspected that the beetle "hitch-hiked" on one of the many air cargo planes landing there. Additional traps were deployed, but no further beetles were found.

In **2002**, five Japanese Beetles were trapped at the former Mather Air Force Base in Rancho Cordova. The old base is now used for air cargo planes; some originating in the eastern United States where Japanese beetles are well established. It is thought that the beetles may have "hitch- hiked" in the cargo holds, only to fly out when the planes were unloaded. In response to the discoveries, visual surveys were conducted and 370 additional traps were deployed. As a precaution against any possible low level infestation, limited pesticide treatments were carried out on the Mather property.

In **2003**, inspectors trapped 2 Oriental fruit flies in the Rosemont area of Sacramento. In response to the finds, additional traps were set in an 81 square mile area. Weekly monitoring of the traps revealed no further evidence of the fly. Although the additional traps were removed from the field in late spring 2004, monitoring traps continued to be inspected. Because a specific site could not be determined to be the source of the flies, no pesticide treatments were conducted.

In mid summer **2004** a single female Japanese beetle was trapped by county ag personnel near the express carrier terminals at Mather Field in Rancho Cordova. The trap was one of over 500 Japanese beetle traps that are placed throughout the County to detect this destructive pest. As all airports are considered high risk sites, trapping levels at Mather Field remained high through the season. An introduced pest of the Eastern United states, Japanese beetles can be attracted to airport lights and fuel odors leading them to become stowaways in the cargo holds of California bound planes. Through a cooperative agreement with

the CDFA, state inspectors will continue to inspect the cargo holds of planes coming from infested eastern states.

In **2005**, Asian Longhorned beetles (ALB) were discovered in Sacramento. Three exotic tree destroying beetles were found at a warehouse specializing in imported stone products in Sacramento in 2005. Identified as Asian Longhorned Beetles, these insects were stowaways in wooden crating material originating from China. The beetles apparently started their journey in Asia as larvae in hardwood trees that were turned into crating lumber. In nature, ALB larvae bore deep into deciduous hardwood trees such as maple, birch, chestnut, poplar, willow, elm and ash – eventually killing them. Introductions of the beetle in New York, Chicago, and New Jersey have caused the destruction of thousands of trees in efforts to eradicate the pest. The discovery of this destructive pest in California presents a serious threat to the environment. In response to the Sacramento find, Sacramento County Ag Commissioner's staff, along with state and federal ag officials quickly implemented detection and eradication procedures:

- The warehouse and all suspect trace forward packing crates were fumigated
- Visual survey of host trees in 9 square mile area (to be continued through 2008)
- Trapping survey of 9 square mile area (1 season only)
- Systemic pesticide applied preventatively to host trees near find site (for 2 seasons)
- Baited "trap" trees used as detection lures deployed near warehouse (to be continued through 2008)

In **2009**, Sacramento County detection traps intercepted a single Oriental Fruit Fly in Citrus Heights, 3 Oriental Fruit Flies in Elk Grove, and a single Mexican Fruit Fly in the Meadowview area. In cooperation with CDFA and the USDA, three separate delimitation areas were set up and hundreds of additional traps were deployed to determine if full blown infestations existed. Pesticide bait stations were placed in a 9 square mile area in Elk Grove where the 3 Oriental Fruit flies were found. After many weeks of not finding additional fruit flies, the traps were removed from each delimitation area and the threat of quarantine declaration was averted.

In **2010**, the first find of Light Brown Apple Moth in the County (Epiphyas postivittana). While no eradication treatments are currently under way, there are concerns about the impacts of quarantine and growers are taking it upon themselves to make dormant treatments of susceptible plantings such as pears and cherries, to limit pest numbers in the spring.

In **2010**, a lone mated female Oriental Fruit Fly was found in a detection trap in the North Highlands area of Sacramento County in June of 2010. Because the find indicated that there was a breeding population present, a quarantine was imposed and pesticide treatments were prescribed. Properties close to the find site received a ground spray of spinosad while insecticide bait stations were distributed over a 9 square mile area. Though the area under quarantine was mostly urban residential properties, some smaller growers and farmers markets were affected. Growers of host fruit originating within the quarantine boundaries were required to treat their produce weekly for 30 days before it could leave the quarantine area. Farmer's Markets and outdoor vendors were required to safeguard fruit and vegetables while displayed with screens or plastic to avoid fruit fly eggs being laid in host fruit. Hundreds of additional traps were deployed in the area but no further fly finds were made. The quarantine was lifted from the area in November 2010.

In **2010**, one single female Japanese beetle was trapped at a residence in Fair Oaks in August 2010. In response, the California Department of Agriculture (CDFA) placed hundreds of additional traps in the area surrounding the find to determine if a breeding population existed. Japanese beetle is not native to the United States but was accidentally introduced to the eastern states from Japan around 1917. Increased trapping levels will continue for 2 more years to monitor the area.

In **2010**, one male Peach Fruit Fly was discovered in South Sacramento in a detection trap. Bactrocera zonata is known in India and Southeast Asia as a serious pest of tropical and subtropical fruits. It is one of the three most destructive flies in India, causing crop losses of 25 to 100 percent in peach, apricot, guava and figs. Damage to the fruit is similar to that caused by the Mediterranean fruit fly and the Melon fly. It has been reared from 33 different types of fruits, a number of which are important commercial crops. It lowers the yield and quality of such fruits as mango, guava, citrus, eggplant, tomato, apple, peach and loquat. In response to the find, hundreds of additional traps were deployed to determine if a breeding population exists. Traps were monitored until early summer 2011.

In **2011**, two more Japanese Beetles were detected in a Fair Oaks neighborhood just east of the Sunrise Mall. The beetles were caught in 2 of the 50 detection traps that blanketed the area in response to the discovery of a single beetle in 2010. Trap density was increased to 160 traps in an effort to pin down the source of the population.

In **2012**, The Japanese beetle (JB) eradication project in Fair Oaks continued into its third year in 2012 with over 700 detection traps monitoring a 49 square mile area just east of the Sunrise Mall. The infestation was first discovered in 2010 after county detection trappers found a lone JB in a trap at a residential property. Two more beetles were trapped in 2011 and an eradication project was triggered. Properties within 200 meters of each find site were treated twice using a foliar spray for the adult JB's and a soil treatment for the immature grubs. In 2012, officials from both state and county agriculture departments were disappointed to detect 4 more adult beetles in the same general area. 23 more properties were added to the treatment area as the quarantine boundaries expanded. Trap numbers were increased in an effort to pin down the infestation - many property owners had at least 2 traps placed in their yards. Pesticide applications were increased to 5 treatments –repeated every two weeks in hopes of getting a handle on the population.

In **2013**, over 700 Japanese beetle traps were redeployed over 49 square miles in the infested area of Fair Oaks and checked throughout the summer by California Department of Food and Agriculture employees. No Japanese beetles were found. In fact 2013 marks the first summer since 2010 that no Japanese beetles were detected in Fair Oaks.

In **2014**, Japanese beetle and Gypsy moth were detected in Sacramento County. Because of these limited detections, no official quarantines were enacted but continuous monitoring and treatment must occur until no further evidence of either pest is found. If the pests are found in additional areas, quarantine holds may be necessary.

In addition to these specific outbreaks, the HMPC noted that Apple Codling Moth is a recurrent pest problem in Sacramento County Orchards.

The HMCP noted that agriculture events occur yearly, though with varying levels of damages.

Likelihood of Future Occurrence

Highly Likely— Due to the high number of recent incidents of severe weather and pests harming agriculture, plants, and humans in the County, it is likely that future damages will occur in Sacramento County. Given the high value of crops in the County, and the high population in the County, agricultural hazards can have large impacts economically and socially.

Climate Change and Agricultural Hazards

According to the CAS, addressing climate change in agriculture will encompass reducing vulnerability through adapting to the ongoing and predicted impacts of climate. Agriculture in California is vulnerable to predicted impacts of climate change, including less reliable water supplies, reduced water quality, increased temperatures, decreased winter freezing, and increased new and existing species of pests and weeds.

4.2.8. Bird Strike

Hazard/Problem Description

The County of Sacramento operates five airports, which have a collective economic impact in excess of $3 billion annually (2008 dollars) and over 5,000 on-site jobs. Four airports comprise the Sacramento County Airport System (SCAS):

- Sacramento International – (SMF) is the region's primary air carrier passenger service airport, accommodating approximately 10 million annual passengers
- Sacramento Executive – (SAC) is a general aviation airport that also serves as a reliever airport for Sacramento International.
- Sacramento Mather – (MHR), formally Mather Air Force Base, serves as the region's primary air cargo airport.
- Franklin Field – (F72) is a small general aviation airport frequently used for flight training.

A fifth airport in the County, McClellan Field, is also operated and maintained by the SCAS. Additionally, there are a number of privately owned airports within Sacramento County, operated for both public and private use, which are not within the purview of the SCAS. The Sacramento airports are in the Pacific flyway for migratory birds and reports more bird strikes annually than any other airport in FAA's Western-Pacific Region (Arizona, California, Hawaii, Nevada).

Sharing both the sky and the airport environment with birds and other wildlife has been a safety and economic concern to aviation personnel since the days of the Wright Brothers. Orville Wright documented the first known bird strike during a flight over a corn field near Dayton, Ohio in 1905. Since Orville and Wilbur Wright's days to the present day, conflicts between wildlife and airplanes have caused damage to aircraft and loss of human life. These conflicts have increased in recent years.

Collisions between wildlife and aircraft (wildlife strikes) are a threat to civil and military aircraft, causing billions of dollars in aircraft damage. Globally, wildlife strikes killed 229 people and destroyed over 210 aircraft between 1988 and 2008. According to the Federal Aviation Administration (FAA) National

Wildlife Database (Wildlife Database), almost 90,000 reported wildlife strikes occurred in the United States 1990 through 2008, with 7,516 strikes in 2008 alone. Birds account for more than 97 percent of wildlife strikes. Most bird strikes happen fairly close to the ground, with sixty percent occurring within 100 feet or less above ground level (AGL), 73 percent at 500 feet AGL or less, and 92 percent at 3,000 feet AGL or less. Reporting of civil aircraft wildlife strikes to the Wildlife Database is voluntary but strongly encouraged. Strike reporting by airlines and airports has gradually increased. While it was historically assumed that only about 20 percent of strikes were reported, the FAA estimates that about 39 percent of the strikes at commercial service airports were reported to the Wildlife Database between 2004 and 2008.

Figure 4-17 Birds Surrounding a Plane after Takeoff

Source: FAA

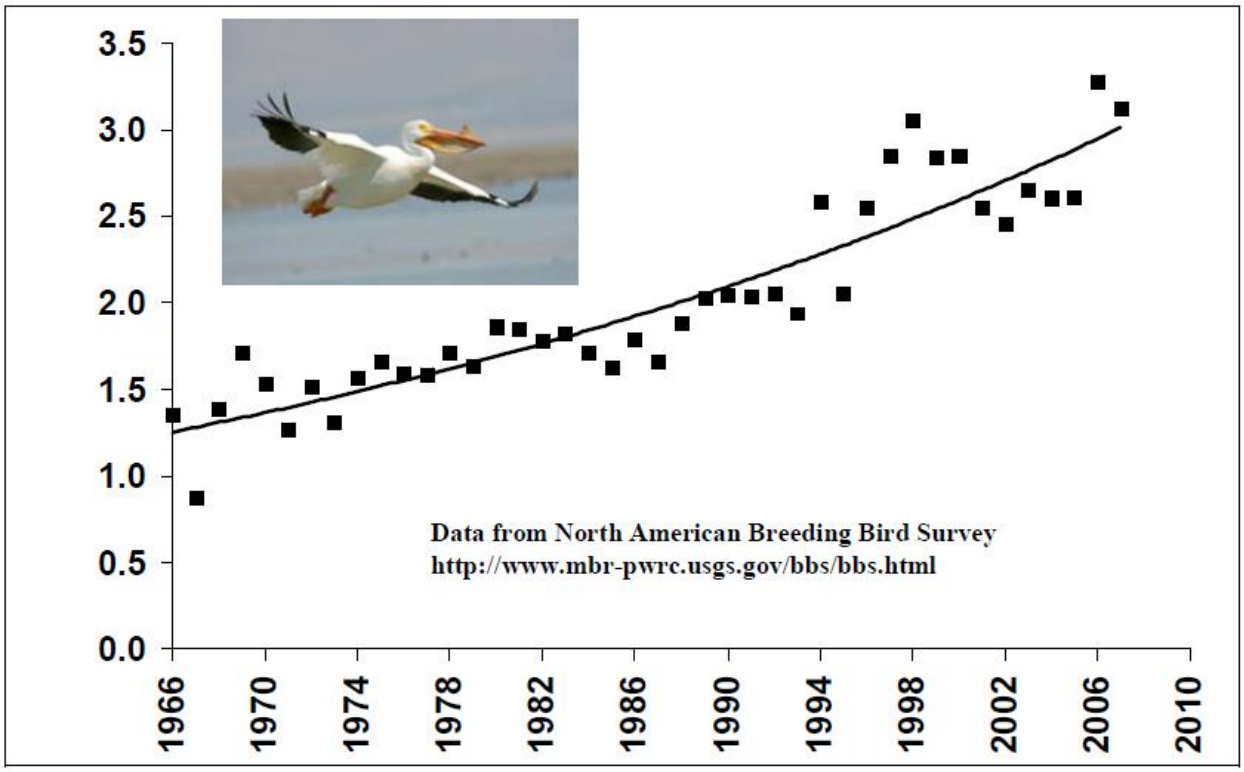
Presently, over $600 million dollars, and over 500,000 hours of aircraft down time, is annually lost due to wildlife strikes (both bird strikes and animal strikes) with civil aircraft in the United States alone. Although the economic costs of wildlife strikes are extreme, the cost in human lives lost when airplanes crash as a result of wildlife strikes is even greater than the economic losses.

Events in early 2009 amplified public awareness of wildlife strikes to aircraft. The dramatic "forced landing" of US Airways Flight 1549 in the Hudson River on January 15, 2009 after Canada geese were ingested in both engines on the Airbus 320 dramatically demonstrated to the public at large that bird strikes are a serious aviation safety issue.

There are many factors effecting today's concern about wildlife and aviation safety, three of these factors are:

- Many populations of wildlife species commonly involved in strikes have increased markedly in the last few decades and adapted to living in urban environments, including airports. For example, from 1980 to 2007, the resident (non-migratory) Canada goose population in the USA and Canada increased at a mean rate of 7.3 percent per year. Other species showing significant mean annual rates of increase included bald eagles (4.6 percent), wild turkeys (12.1 percent), turkey vultures (2.2 percent), American white pelicans (2.9 percent), double-crested cormorants (4.0 percent), and sandhill cranes (5.0 percent). Thirteen of the 14 bird species in North America with mean body masses greater than 8 lbs have shown significant population increases over the past three decades. An example of this is shown in Figure 4-18, which shows the American white pelican population in North America increased at a mean annual rate of 4.3 percent from 1966-2007.

Figure 4-18 American White Pelican Population from 1966-2007



Source: North American Breeding Bird Survey

- Concurrent with population increases of many large bird species, air traffic has increased substantially since 1980. In 2009, the Federal Aviation Administration reported that passenger enplanements in the US had increased from about 310 million in 1980 to 750 million in 2008 (3.2 percent per year), and commercial air traffic had increased from about 18 million aircraft movements in 1980 to 28 million in 2008 (1.6 percent per year). US commercial air traffic is predicted to continue growing at a rate of about 1.3 percent per year to 35 million movements by 2025.
- Commercial air carriers have replaced their older three- or four-engine aircraft fleets with more efficient and quieter, two-engine aircraft. In 1965, about 90 percent of the 2,100 USA passenger aircraft had

three or four engines. In 2005, the USA passenger fleet had grown to about 8,200 aircraft, and only about 10 percent had three or four engines (U.S. Department of Transportation 2009). With the steady advances in technology over the past several decades, today's two-engine aircraft are more powerful than yesterday's three- and four-engine aircraft, and they are more reliable. However, in the event of a multiple ingestion event (e.g., the US Airways Flight 1549 incident on January 15, 2009), aircraft with two engines may have vulnerabilities not shared by their three or four engine-equipped counterparts. Additionally, previous research has indicated that birds are less able to detect and avoid modern jet aircraft with quieter turbofan engines than older aircraft with noisier engines.

These results in a majority of wildlife strikes occur within the immediate airport environment (FAA manual). As a result of these factors, experts within the Federal Aviation Administration (FAA), U.S. Department of Agriculture (USDA), and U.S. Navy and U.S. Air Force expect the risk, frequency, and potential severity of wildlife-aircraft collisions to grow over the next decade.

Land-use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife strikes. The FAA is looking to avoid potential facilities and areas that attract hazardous wildlife and threaten aviation safety. These facilities include:

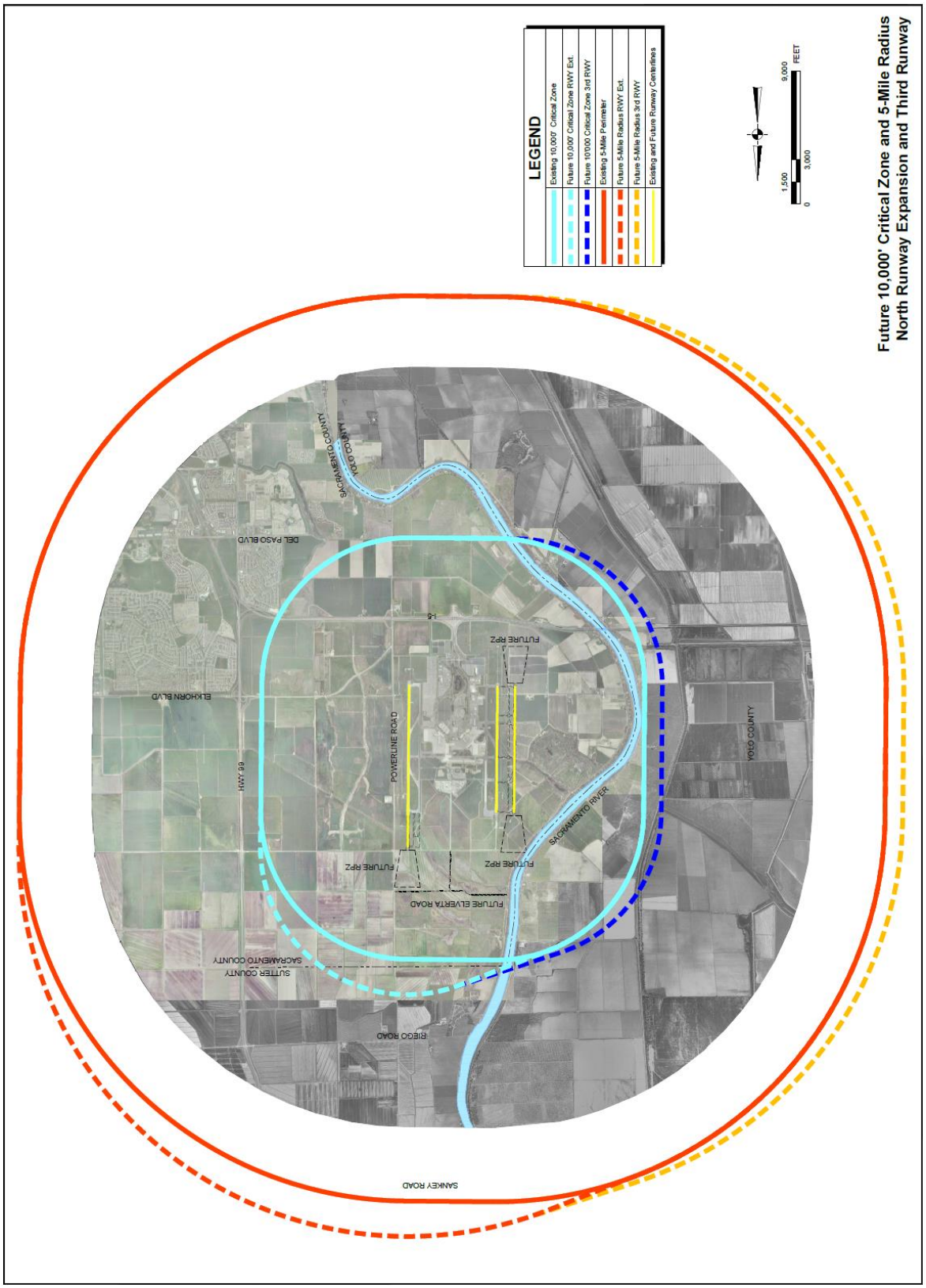
- Waste Disposal Operations
- Water Management Facilities
- Wetlands
- Dredge Spoil Containment Areas
- Agricultural Activities
- Golf Courses, Landscaping, and other Large Grassy Areas

These areas are all known to attract birds, both migratory and native species. Because of this, the FAA recommends the minimum separation criteria outlined below for land-use practices that attract hazardous wildlife to the vicinity of airports.

- Airports Serving Piston-Powered Aircraft – Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 5,000 feet at these airports for any of the hazardous wildlife attractant.
- Airports Serving Turbine-Powered Aircraft – Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 10,000 feet at these airports for any of the hazardous wildlife attractant.
- Protection of Approach, Departure, and Circling Airspace – For all airports, the FAA recommends a distance of 5 statute miles between the farthest edge of the airport's AOA and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

The County of Sacramento has mapped the minimum separation criteria areas for the Sacramento International Airport. The map can be found in Figure 4-19.

Figure 4-19 Sacramento International Airport Separation Distances



Source: Sacramento County Airport System

Past Occurrences

Disaster Declaration History

There have been no disasters related to bird strike in Sacramento County.

NCDC Events

The NCDC does not track bird strike events. They are tracked by the FAA.

FAA Events

The FAA data shows 2,812 bird strike incidents for Sacramento County since 1990. These are shown in Table 4-22. Significant strikes are discussed in greater detail below the table.

Table 4-22 Bird Strikes in Sacramento Airports between 1/1/1990 and 4/1/2015

Airport	Number of Bird Strikes
Sacramento International	2,607
Mather Field	129
Sacramento Executive	43
Franklin Field	1
McClellan Field	32
Total	**2,812**

Source: FAA Wildlife Strike Database

Many of these instances below were sourced from a report titled "Some Significant Wildlife Strikes To Civil Aircraft In The United States, January 1990 – November 2015" released by the USDA on November 10, 2010. Between 2010 and 2012 (the most recent publication available), instances of bird strike were sourced from "Wildlife Strikes to Civil Aircraft in the United States 1990–2012," released by the FAA in September 2013.

January 8, 1996 – Shortly after takeoff, a Boeing 737 ingested a bird in #2 engine during climb. Vibration increased and crew throttled back and returned to land. One fan blade separated and other blades were damaged by re-ingestion of broken blade fragments. The engine was replaced.

November 22, 1996 - Several gulls were ingested just after takeoff causing the engine on a McDonnell Douglas MD-80 to lose power. The engine was shut down and an emergency was declared. The plane was forced to land much heavier than usual because of a full fuel load. There were no injuries and passengers were transferred to a replacement jet. Fan blades and engine were damaged. Runway was closed for approximately ½ hour.

February 25, 2000 – During a takeoff run, a Boeing 737 struck an unknown bird. The aircraft returned to the airport after a bird strike on takeoff. The pilots heard a loud bang and the plane suddenly yawed. The air cooler was plugged and 7 fan blades were damaged.

December 8, 2004 – A McDonnell Douglas MD-80 struck a Northern Pintail while climbing after takeoff. Passengers reported seeing a flock of geese at time of strike. The radome was dented, and over 1/3 of surface and wing was punctured and dented. Identification of the bird was performed by the Smithsonian, Division of Birds. Cost of repairs estimated at $200,000.

December 28, 2005 – While climbing after takeoff, a Boeing 737 struck an unknown bird. The pilot saw a large white bird fly by, heard a loud pop, then the left engine began vibrating. The aircraft returned to the airport. All fan blades were replaced. Passengers were put on other flights. Cost of repairs was $210,400.

December 22, 2009 – Four bird strikes in 14 hours were recorded at the Sacramento Airport. The weekend may have been the bumpiest on record at the Sacramento International Airport. Each of the strikes hit four different airline carriers, and two of the planes had to be grounded for repairs. Sacramento has a staff of wildlife biologists that try to prevent strikes, even shooting birds when necessary in accordance with the provisions of a depredation permit issued by the United States Fish and Wildlife Service, but many of the strikes happened beyond the airport's property. All of the weekend's strikes occurred while pilots were on their approach for landing; one plane was five miles out, another was nine miles out, and a third was 13 miles out. The California Fish and Game states that every year at this time, roughly four million birds fly through the skies surrounding the Sacramento Airport.

January 5, 2010 - Two bird-aircraft strikes were reported at the Sacramento airport. Airport officials in Sacramento say birds hit two passenger jets in separate incidents but caused no damage to the planes. The first bird strike was reported around noon Tuesday after birds hit the nose of a Southwest Airlines flight during landing. The plane arrived safely. The second incident happened around 1 p.m. after birds flew into the windshield of another Southwest Airlines flight en route to Las Vegas. The plane returned to Sacramento for inspection. A windshield wiper was replaced and the plane departed.

January 14, 2010 - A US Airways flight leaving from Sacramento International Airport struck a bird while departing Thursday. An airport spokeswoman said two fan blades on the plane were damaged as the plane was departing to Phoenix. No passengers were injured and the plane landed safely in Sacramento.

February 18, 2010 – A Cessna 208 hit a large bird during approach. The aircraft briefly rolled to the right but landed safely. Significant damage was done to the leading edge of right wing. The landing light housing and skin of the wing showed damage. Some control loss due to the aileron control cables being pushed out of position. The aircraft was taken out of service for 80 hours and the cost of repairs was $80,000.

September 1, 2010 – An Airbus A-320 was struck by a bird immediately after takeoff. A great blue heron was ingested in #1 engine at rotation and aircraft returned to land. A piece of plastic from the engine was found on the runway. The runway was closed for full sweep for foreign object damage (FOD). Only small pieces of bird were found. Engine had damage to two fan blades.

January 21, 2012 – Two engines of a Boeing 737 were damaged when geese were struck during climb out. The aircraft returned to land after declaring an emergency. Fan blades were damaged in both engines Passengers were rebooked on other flights.

January 24, 2013 – The aircraft had multiple strikes on climb-out, declared an emergency due to vibration in the #2 engine. They returned to land safely. The #2 engine had significant fan blade damage and the #1

engine had bird remains. ID by Smithsonian, Division of Birds. Time out of service was 24 hours. Cost of repairs reported as $20,000 and other costs $25,000.

November 22, 2014 – Pilot saw a flock of large birds on seven mile final. Strike occurred on right side of the radome just below the First Officer causing a 2- foot dent. Engine ingestion. Aircraft was out of service for one day.

December 3, 2014 – Major bird strike while on approach. Blood smears, feathers and bird remains were visible on the nose, windshield, leading edge of both wings, flaps and in both engines. Remains were embedded in the nose. Time out of service was 8 days.

December 12, 2014 – Hit a flock of birds on approach. Ingested at least one bird into the #2 engine. Emergency declared due to compressor stalls, asymmetrical thrust and flames coming from back of engine.

HMPC Events

The HMPC noted that since 2011 Sacramento County Department of Airports facilities have recorded 868 wildlife strikes in the FAA Wildlife Strike Database. Sacramento International Airport had 779 wildlife strikes and 51 have been damaging. Sacramento Executive Airport had 10 wildlife strikes and three were damaging. Mather Airport had 63 wildlife strikes and one was damaging. McClellan Airfield had 16 wildlife strikes and one was damaging. Franklin Field has not had a wildlife strike since 2011.

There have been no injuries reported from the strikes and no deaths have occurred.

Department of Airports estimates the cost to repair damaged aircraft during that period has been in the tens of millions of dollars, mostly due to damage caused to commercial aircraft engines. Those costs are borne entirely by the aircraft operators and are not customarily reported to the department.

Likelihood of Future Occurrence

Highly Likely— Based on FAA data, 2,812 bird strike incidents over a 26-year period (1990-2015) equates to 108.2 reported bird strikes in Sacramento County each year. This equates to a 100 percent chance of a bird strike event in any given year.

Climate Change and Bird Strike

According to the US Fish and Wildlife Service, changes in climate shift bird migratory patterns. According to the Office of Environmental Health Hazard Assessment's Indicators of Climate Change Report in California, climate change is shifting the timing of bird migration in California, with some bird species arriving earlier in the springtime. Sacramento is currently in the Pacific Flyway bird migration route.

4.2.9. Climate Change

Hazard/Problem Description

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5 billion year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate – until recently.

This LHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began in the19th century, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. Data suggests that the effects of climate change have already been felt in the Sacramento region.

Past Occurrences

Disaster Declaration History

Climate change has never been directly linked for any declared disasters.

NCDC Events

The NCDC does not track climate change events

HMPC Events

Past flooding, wildfire, levee failure, and drought disasters may have been exacerbated by climate change, but it is impossible to make direct connections to individual events. Unlike earthquake and floods that occur over a finite time period, climate change is a slow onset, long term hazard, the effects of which some communities may already be already experiencing, but for which little empirical data exists. Further, given the science, it is likely that measurable effects may not be seriously experienced for years, decades, or may be avoided altogether by mitigation actions taken today.

However, the 2013 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. This data suggests that the effects of climate change has been occurring in the Sacramento region.

Likelihood of Future Occurrence

Climate change is virtually certain to continue without immediate and effective global action. According to NASA, 2016 is on track to be the hottest year on record, and 15 of the 17 hottest years ever have occurred since 2000. Without significant global action to reduce greenhouse gas emissions, the Intergovernmental Panel on Climate Change (IPCC) concludes in its Fifth Assessment Synthesis Report (2014) that average global temperatures is likely to exceed 1.5 C by the end of the 21st century, with consequences for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges.

Climate Scenarios

The United Nations IPCC developed several greenhouse gas (GHG) emissions scenarios based on differing sets of assumptions about future economic growth, population growth, fossil fuel use, and other factors. The emissions scenarios range from "business-as-usual" (i.e., minimal change in the current emissions trends) to more progressive (i.e., international leaders implement aggressive emissions reductions policies). Each of these scenarios leads to a corresponding GHG concentration, which is then used in climate models to examine how the climate may react to varying levels of GHGs. Climate researchers use many global climate models to assess the potential changes in climate due to increased GHGs.

Key Uncertainties Associated with Climate Projections

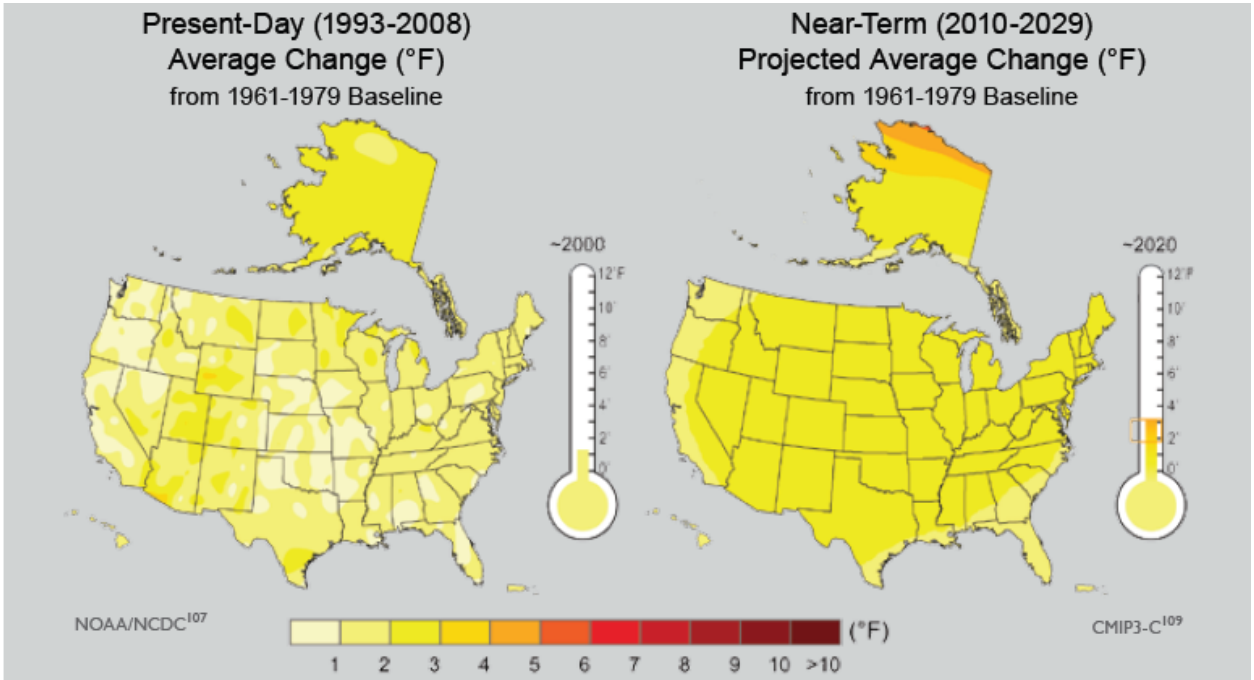
- Climate projections and impacts, like other types of research about future conditions, are characterized by uncertainty. Climate projection uncertainties include but are not limited to:
  - ✓ Levels of future greenhouse gas concentrations and other radiatively important gases and aerosols,
  - ✓ Sensitivity of the climate system to greenhouse gas concentrations and other radiatively important gases and aerosols,
  - ✓ Inherent climate variability, and

- ✓ Changes in local physical processes (such as afternoon sea breezes) that are not captured by global climate models.

Even though precise quantitative climate projections at the local scale are characterized by uncertainties, the information provided can help identify the potential risks associated with climate variability/climate change and support long term mitigation and adaptation planning.

The following maps (shown in Figure 4-20 and Figure 4-21) are excerpts from the Global Climate Change Impacts report that show the magnitude of the observed and projected changes in annual average temperature. It is important to discuss these projected temperature changes, as heat is a major driver of climate and climate related phenomena. The map for the period around 2000 shows that most areas of the United States have warmed 1 to 2°F compared to the 1960s and 1970s. Although not reflected in these maps of annual average temperature, this warming has generally resulted in longer warm seasons and shorter, less intense cold seasons. The average warming for the country as a whole is shown on the thermometers adjacent to each map. By the end of the century, the average U.S. temperature is projected to increase by approximately 7 to 11°F under the higher emissions scenario and by approximately 4 to 6.5°F under the lower emissions scenario.

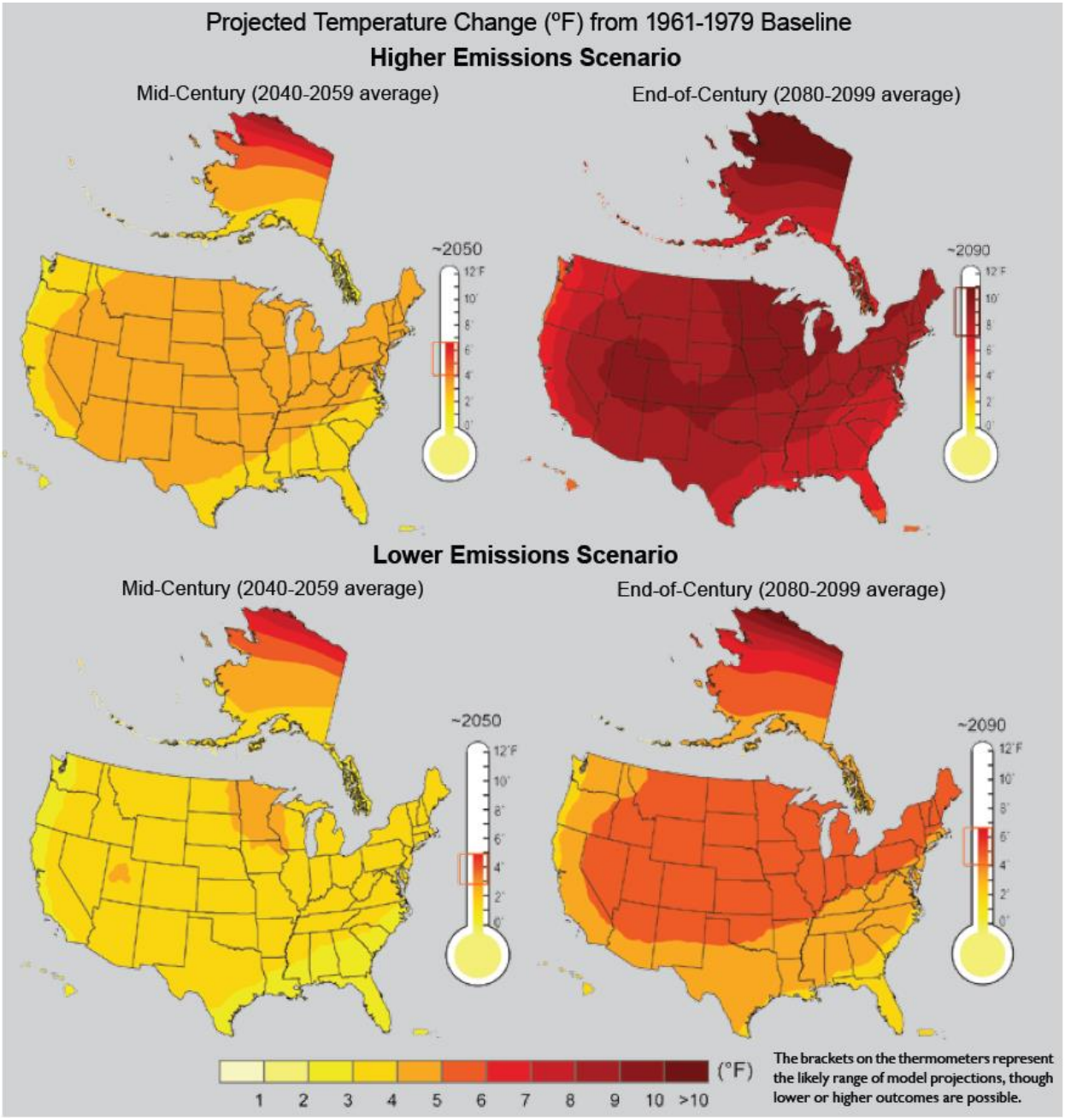
Figure 4-20 Present and Near Term Average Temperature Changes



The maps and thermometers on this page and the next page show temperature differences (either measured or projected) from conditions as they existed during the period from 1961-1979. Comparisons to this period are made because the influence on climate from increasing greenhouse gas emissions has been greatest during the past five decades. The present-day map is based on the average observed temperatures from 1993-2008 minus the average from 1961-1979. Projected temperatures are based on results from 16 climate models for the periods 2010-2029, 2040-2059, and 2080-2099. The brackets on the thermometers represent the likely range of model projections, though lower or higher outcomes are possible. The mid-century and end-of-century maps show projections for both the higher and lower emission scenarios.[91] The projection for the near-term is the average of the higher and lower emission scenarios[91] because there is little difference in that timeframe.

Source: Source: USGCRP (2009). Global Climate Change Impacts in the United States

Figure 4-21 Projected Average Temperature Changes



Source: (USGCRP (2009). Global Climate Change Impacts in the United States

Local Climate Change Projections

According to the California Natural Resource Agency (CNRA), Climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, seal level rise, a reduced winter snowpack altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts can

result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services.

The CNRA's 2009 Climate Adaptation Strategy (CAS) delineated how climate change may impact and exacerbate natural hazards in the future, including wildfires, extreme heat, floods, drought, and levee failure:

- Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in Sacramento and the rest of California, which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions. Those most at risk and vulnerable to climate-related illness are the elderly, individuals with chronic conditions such as heart and lung disease, diabetes, and mental illnesses, infants, the socially or economically disadvantaged, and those who work outdoors.
- Higher temperatures will melt the Sierra snowpack earlier and drive the snowline higher, resulting in less snowpack to supply water to California users.
- Droughts are likely to become more frequent and persistent in the 21st century.
- Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and/or more extensive flooding.
- Storms and snowmelt may coincide and produce higher winter runoff from the landward side, while accelerating sea-level rise will produce higher storm surges during coastal storms. Together, these changes may increase the probability of floods and levee and dam failures in the Sacramento-San Joaquin Delta, along with creating issues related to salt water intrusion.
- Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations, both of which affect forest health and reduce forest resilience to wildfires. An increase in wildfire intensity and extent will increase public safety risks, property damage, fire suppression and emergency response costs to government, watershed and water quality impacts, vegetation conversions and habitat fragmentation.
- Sea-level rise will increase erosion, threatening public and private property and structures and causing social, economic, and resource losses.

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. The APG: Understanding Regional Characteristics provides environmental and socioeconomic information for 11 climate impact regions. The Sacramento County Planning Area falls within the northern portion of the Bay-Delta Region. Cal-Adapt Projections for the Bay Delta Region are shown in Table 4-23.

Table 4-23 Summary of Cal-Adapt Climate Projections for the Bay-Delta Regions

Effect	Ranges
Temperature Change 1990 - 2100	Winter: 6° to 7°F increase in average temperatures Summer: 7° to 9°F increase in average temperatures (Modeled high temperatures – average of all models; high carbon emissions scenario)

Effect	Ranges
Precipitation	Precipitation across the region is projected to decline by approximately 3 to 5". The most dramatic decline of 5" is projected around Richmond while most other areas are projected to experience a decline of 4", although Stockton may only experience a 3" decline in precipitation. (CCSM3 climate model; high carbon emissions scenario)
Sea Level Rise	The portions of the Delta Region in close proximity of the San Francisco Bay are projected to be increasingly susceptible to 1.4---meter sea level rise. Solano County is anticipated to experience a 13% increase in estimated acreage of land vulnerable to a 100---year flood event. This indicator rises to 40% in Contra Costa County and 59% in Sacramento Count. Most flooding is projected to occur in areas around Suisun City, Pittsburg, Benicia, Richmond, and Vallejo.
Wildfire Risk	Portions of western and northern Yolo County, north western Solano, southern Contra Costa and eastern San Joaquin and Sacramento Counties are projected to experience limited increases in potential area burned by wildfire. There are moderately high increases projected for the far eastern areas of San Joaquin County. (GFDL model, high carbon emissions scenario)

Source: Public Interest Energy Research (2011). Cal---Adapt. Retrieved from: http://cal---adapt.org]

The Preliminary Draft – Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP) developed by Ascent Environmental, utilized Cal Adapt a climate change scenario planning tool developed by the California Energy Commission (CEC) and the University of California Berkeley Geospatial Innovation Facility. Cal-Adapt downscales global climate stimulation model data to local and regional resolution under two emissions scenarios: the A-2 scenario represents a high, future global greenhouse gas (GHG) emissions scenario, and the B-1 scenario represents a lower future GHG emissions scenario. This CAP includes information on both emissions scenarios in developing a vulnerability assessment for the Sacramento County Planning Area. Climate Change vulnerability data from the vulnerability assessment conducted by Ascent Environmental is included in each of the hazard specific sections, where applicable.

4.2.10. Dam Failure

Hazard/Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can also result from any one or a combination of the following causes:

- Earthquake;
- Inadequate spillway capacity resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity;
- Improper design;
- Improper maintenance;
- Negligent operation; and/or
- Failure of upstream dams on the same waterway.

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously; the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach; a flood wave will build gradually to a peak and then decline until the reservoir is empty. And, a concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

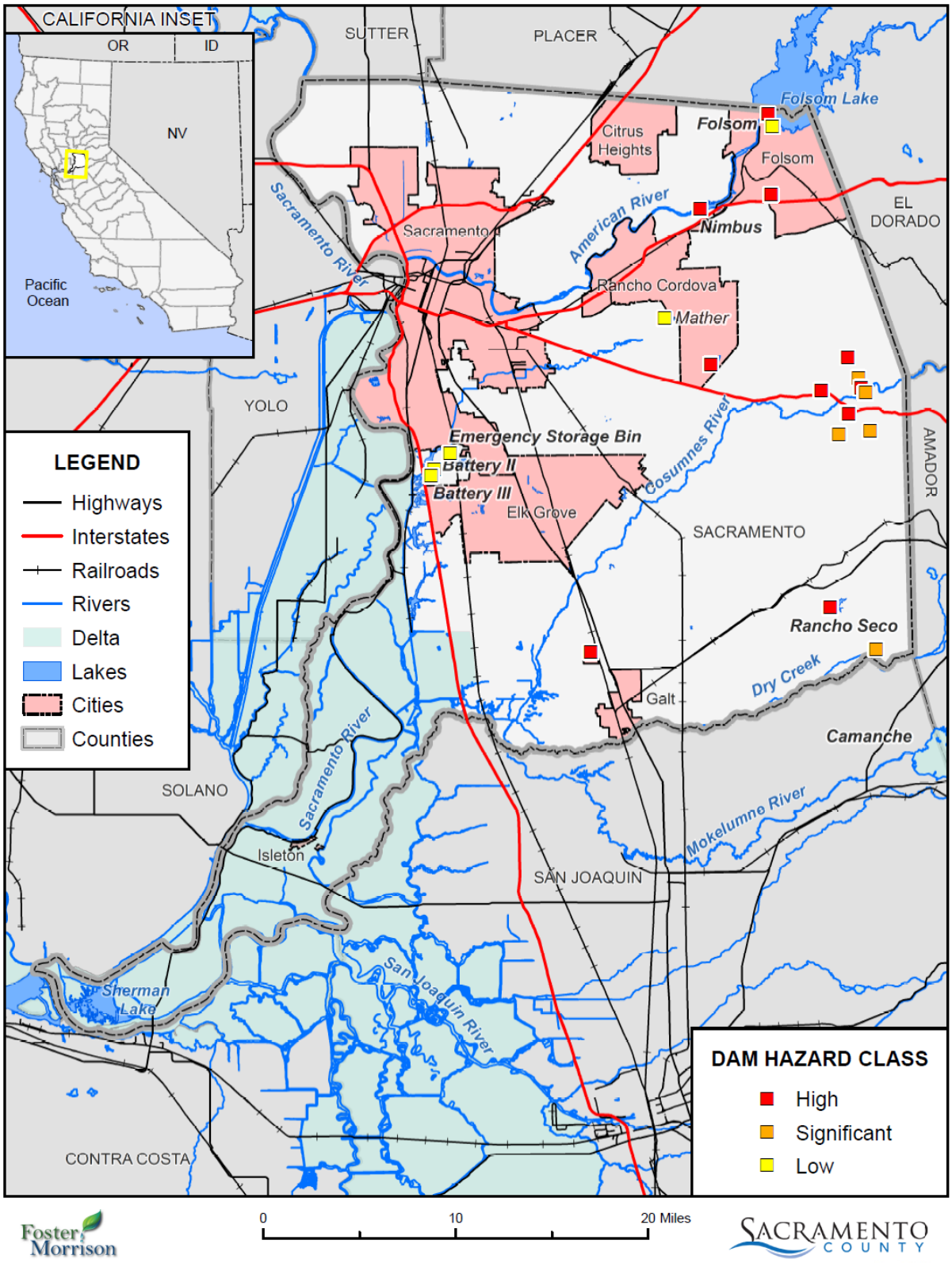
The California Department of Water Resources Division of Safety of Dams has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The California Department of Water Resources (Cal DWR) Division of Safety of Dams assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- High hazard indicates that a failure would most probably result in the loss of life
- Significant hazard indicates that a failure could result in appreciable property damage
- Low hazard indicates that failure would result in only minimal property damage and loss of life is unlikely

According to data provided by Sacramento County, Cal DWR, and Cal OES, there are 27 dams in Sacramento County constructed for flood control, storage, electrical generation, and recreational purposes. Of the 27 dams, 16 are rated as High Hazard, 5 as Significant Hazard, 5 as Low Hazard, and 1 was not rated.

Table 4-24 identifies the 27 dams located in the Sacramento County Planning Area. Figure 4-22 illustrates the locations of identified dams.

Figure 4-22 Sacramento County Dam Inventory



Data Source: Sacramento County GIS, Cal-Atlas, National Inventory of Dams; Map Date: 05/2016.

Table 4-24 Sacramento County Dam Inventory

Name	Significance	Owner	River	Nearest City/ Distance (mi)	Mapped	Structural Height (ft)	Maximum Storage (acre-ft)
Battery I	Low	Sacramento Regional County Sanitation District	Unnamed	N/A	Y	N/A	N/A
Battery II	Low	Sacramento Regional County Sanitation District	Unnamed	N/A	Y	15	315
Battery III	Low	Sacramento Regional County Sanitation District	Unnamed	N/A	Y	12	847
Blodgett	High	Private	Laguna Creek	Mather AFB 2 miles	Y	24	599
Calero	High	Private	Crevis Creek	Rancho Murieta 3 miles	Y	55	3,375
Chesbro	Significant	Private	Consumnes River	Rancho Murieta 2 miles	Y	79	1,500
Clementia	High	Private	Tributary of Consumnes River	Rancho Murieta 0 miles	Y	33	1,510
Emergency Storage Basin	Low	Sacramento Regional County Sanitation District	Laguna Creek	N/A	Y	13	629
Folsom	High	Department of Interior	American River	Folsom 1 mile	Y	340	1,120,000
Folsom Mormon Island Auxiliary Dam	High	Department of Interior	Blue Ravine	Folsom 2 miles	N	110	1,120,000
Folsom Dike 7	High	Department of Interior	Green Valley	Folsom 1 mile	N	25	1,120,000
Folsom Dike 8	High	Department of Interior	Green Valley	Folsom 1 mile	N	15	1,120,000
Folsom Left Wing	High	Department of Interior	American River	Folsom 1 mile	N	145	1,120,000

Name	Significance	Owner	River	Nearest City/ Distance (mi)	Mapped	Structural Height (ft)	Maximum Storage (acre-ft)
Folsom Right Wing	High	Department of Interior	American River	Folsom 1 mile	N	145	1,120,000
Galt	High	City of Galt	Consumnes River	Rancho Murieta 2 miles	Y	16	155
Granlees	Significant	Consumnes Irrigation Association	Tributary of Dry Creek	N/A	Y	17	75
Hamel	Significant	Private	Morrison Creek	N/A	Y	26	350
Mather	Low	USAF	Tributary of Consumnes River	Rancho Murieta 2 miles	Y	N/A	N/A
Michigan Bar No. 1	High	Private	Tributary of Consumnes River	Rancho Murieta 2 miles	Y	17	897
Michigan Bar No. 2	High	Private	Consumnes River	Rancho Murieta 1 miles	Y	36	56
Mills	High	Private	Consumnes River	Rancho Murieta 2 miles	Y	23	315
Mount Stoneman	Low	Folsom Prison	Tributary of American River	Folsom 2 miles	Y	73	40
Nimbus	High	Department of Interior	American River	Fair Oaks 3 miles	Y	87	8,800
Rancho Seco	High	Sacramento Municipal Utilities	Hadselville Creek	Clay 4 miles	Y	58	4,350
Schneider	Significant	Private	Tributary of Arkansas Creek	Rancho Murieta 4 miles	Y	22	226
Van Vleck	Significant	Private	Arkansas Creek	Rancho Murieta 7 miles	Y	30	2,600
Willow Hill	High	City of Folsom	American River	Folsom 3 miles	Y	24	175

Source: Cal OES and the National Performance of Dams Program

*One Acre Foot=326,000 gallons

There are 25 additional facilities located outside of Sacramento County, shown in Table 4-25, classified as high or significant hazard dams. Of these, there are 8 high hazard dams located in neighboring counties with the potential to impact the Sacramento County Planning Area.

Table 4-25 High and Significant Hazard Dams Outside Sacramento County

Dam Name Dam ID County	Hazard Class	Owner	Dam Height	Storage (acre-feet)*	Stream	Nearest Community/Distance
Oroville CA00035 Butte	High	California Department of Water Resources	770	3,540,000	Feather River	Oroville 3 miles
Miner's Ranch CA00275 Butte	High	Oroville Wyandotte Irrigation District	90	815	Kelly Ridge Canal	Kelly Ridge 1 mile
Camanche Main CA00 73 San Joaquin	High	East Bay Municipal Utility District	171	431,000	Mokelumne River	Clements 4 miles
Shasta CA10186 Shasta	High	Department of the Interior	602	4,661,860	Sacramento River	Redding 9 miles
Pardee CA00164 Border of Calaveras and Amador Counties	High	East Bay Municipal Utility District	350	198,000	Mokelumne River	Jackson 8 miles
CSP Mule Creek CA01195 Amador	High	State Department of Corrections	51	630	Offstream	Ione 2 miles
Jackson Creek CA00867 Amador	High	Jackson Valley Irrigation District	168	24,000	Jackson Creek	Buena Vista 1 mile
Camp Far West CA00227 Yuba	High	South Sutter Water District	185	104,000	Bear River	Sheridan 5 miles
Preston CA00012 Amador	Significant	Amador Reg. Sanit. Authority	40	37	Tributary of Mule Creek	Ione 1 mile
Preston Forebay CA00006 Amador	Significant	Amador Reg. Sanit. Authority	40	37	Offstream	Ione 2 miles
Wallace CA01314 Calaveras	Significant	Private	19	700	Tributary of Bear Creek	Wallace 0 miles
Ferrario CA00626 Calaveras	Significant	Private	25	384	Tributary of Bear Creek	Wallace 4 miles

Dam Name Dam ID County	Hazard Class	Owner	Dam Height	Storage (acre-feet)*	Stream	Nearest Community/Distance
Cameron Park CA01199 El Dorado	Significant	Cameron Park Community Services District	29	880	Deer Creek	Cameron Park 1 mile
Barnett CA00998 El Dorado	Significant	Private	18	187	Barnett Creek	Shingle Springs 2 miles
Williamson #1 CA00608 El Dorado	Significant	Private	42	260	Tributary of Weber Creek	Shingle Springs 6 miles
Holiday Lake CA00910 El Dorado	Significant	Holiday Lake Community Service District	39	220	Sawmill Creek	Frenchtown 2 miles
Crystal Lake CA01282 El Dorado	Significant	Private	32	296	Tributary of Deer Creek	Shingle Springs 4 miles
Schubin CA01045 El Dorado	Significant	Private	55	315	Tributary of Webber Creek	Shingle Springs 7 miles
Indian Creek CA00997 El Dorado	Significant	Private	36	757	Indian Creek	Rescue 4 miles
Hinkle CA01192 Placer	Significant	San Juan Suburban Water District	20	200	Tributary of American River	Orangevale 2 miles
Kokila CA00544 Placer	Significant	Pacific Gas and Electric	42.5	1,520	Tributary of South Yuba River	Washington 25 miles
Vicini CA01093 Amador	Significant	Private	19	290	Tributary of Willow Creek	Indian Hill 8 miles
Woodbridge CA00285 San Joaquin	Significant	Woodbridge Irrigation District	35	5,064	Mokelumne River	Woodbridge 0 miles
Davis #2 CA00656 San Joaquin	Significant	Private	26	2,220	Tributary of Calaveras River	Linden 4 miles

Source: National Performance of Dams Database

*One Acre Foot=326,000 gallons

Cal OES provides local jurisdictions with hazard information based on data from the U.S. Bureau of Reclamation and the Department of Water Resources. Included in this information is a series of dam inundation maps for Sacramento County. Detailed inundation maps from Cal OES and County mapping projects are available at the Sacramento County Department of Water Resources

The American River Flood Control System and Folsom Dam

The American River Flood Control System consists of the Folsom Dam, Nimbus Dam, an auxiliary dam at Mormon Island, eight earth-filled dikes, and four miles of levees on the north bank of the American River (from Howe Avenue to Arden Way). The System receives runoff from the American River Watershed which contains about 2,100 square miles of the western slope in the Sierra Nevada. Since its completion in 1956, Folsom Dam has stopped three potentially catastrophic floods from occurring. The Flood of 1986 exceeded Folsom's design for flooding by almost 20 percent. An initial reconnaissance report, "American River Investigation, January 1988" concluded that Folsom Dam and the American River levees are only capable of handling a 70-year flood event. Recommendations were to increase the carrying capacity of the American River below Nimbus Dam, modifying the Folsom Dam spillage, increasing storage capacity at Folsom Lake and for greatest protection (200-year level) construct a new upstream storage facility. Work on that project is underway, and is actually ahead of the scheduled 2020 completion. This is primarily due to the drought conditions that lowered lake levels during construction.

Mercury and Dams

In addition, the HMPC noted that a problem with methylated mercury that could be tied to dam failure in Sacramento County. Of note was the Alder Creek Miners Dam. This dam was built in about 1890-1910 in Alder Creek upstream of Folsom Blvd and is owned by the City of Folsom enveloped by property now owned by AeroJet. In order to develop upstream, the dam must be refurbished or removed. The dam is considered to be below certification standards. While not a high or medium significance dam, the Alder Creek dam would pose risk to downstream communities should it fail. More information on mercury can be found in Section 4.2.14.

Past Occurrences

Disaster Declaration History

There have been no disasters declarations related to dam failure in Sacramento County.

NCDC Events

There have been no NCDC dam failure events in Sacramento County.

HMPC Events

A search of the National Performance of Dams database data shows two dam failure incidents for Sacramento County since 1994, both related to the Folsom Dam. However, these incidents were not actually dam failures, were quite limited in scope, and since the incidents occurred, improvements to the Folsom Dam system have been made and are continuing. These two events are further described below:

July 17, 1995 – At the Folsom Dam, a spillway gate (gate #3 – see Figure 4-23) of Folsom Dam failed, increasing flows into the American River significantly. The spillway was repaired and the U.S. Bureau of Reclamation carried out an investigation of the water flow patterns around the spillway using numerical

modeling. No flooding occurred as a result of the partial failure, but due to the location of the dam in proximity to the City of Folsom, possible flooding was a major concern.

Figure 4-23 July 17, 1995 Folsom Dam Incident

Source: US Bureau of Reclamation

May 15, 1997 – Cavitation damage to river outlet works occurred at Folsom Dam. Damage was discovered just downstream of gate #3. The damage consisted of a hole in the floor of the conduit measuring approximately 42 feet long, 15 feet wide, and 6 feet deep. Subsequent inspections of the other conduits revealed similar damage downstream of gate #4. Also, the beginning of cavitation damage was found downstream of gate #2. Minor damage was found in the other five conduits. No flooding was associated with this damage.

Likelihood of Future Occurrence

Unlikely—The County remains at risk to dam breaches/failures from numerous dams under a variety of ownership and control and of varying ages and conditions. Given the number and types of dams in the County, the potential exists for future dam issues in the Sacramento County Planning Area.

Climate Change and Dam Failure

Increases in the volume and intensity of precipitation, as well as warmer and earlier springs accelerating the timing and rate of snow melt, could increase the potential for dam failure and uncontrolled releases in Sacramento County.

4.2.11. Drought and Water Shortage

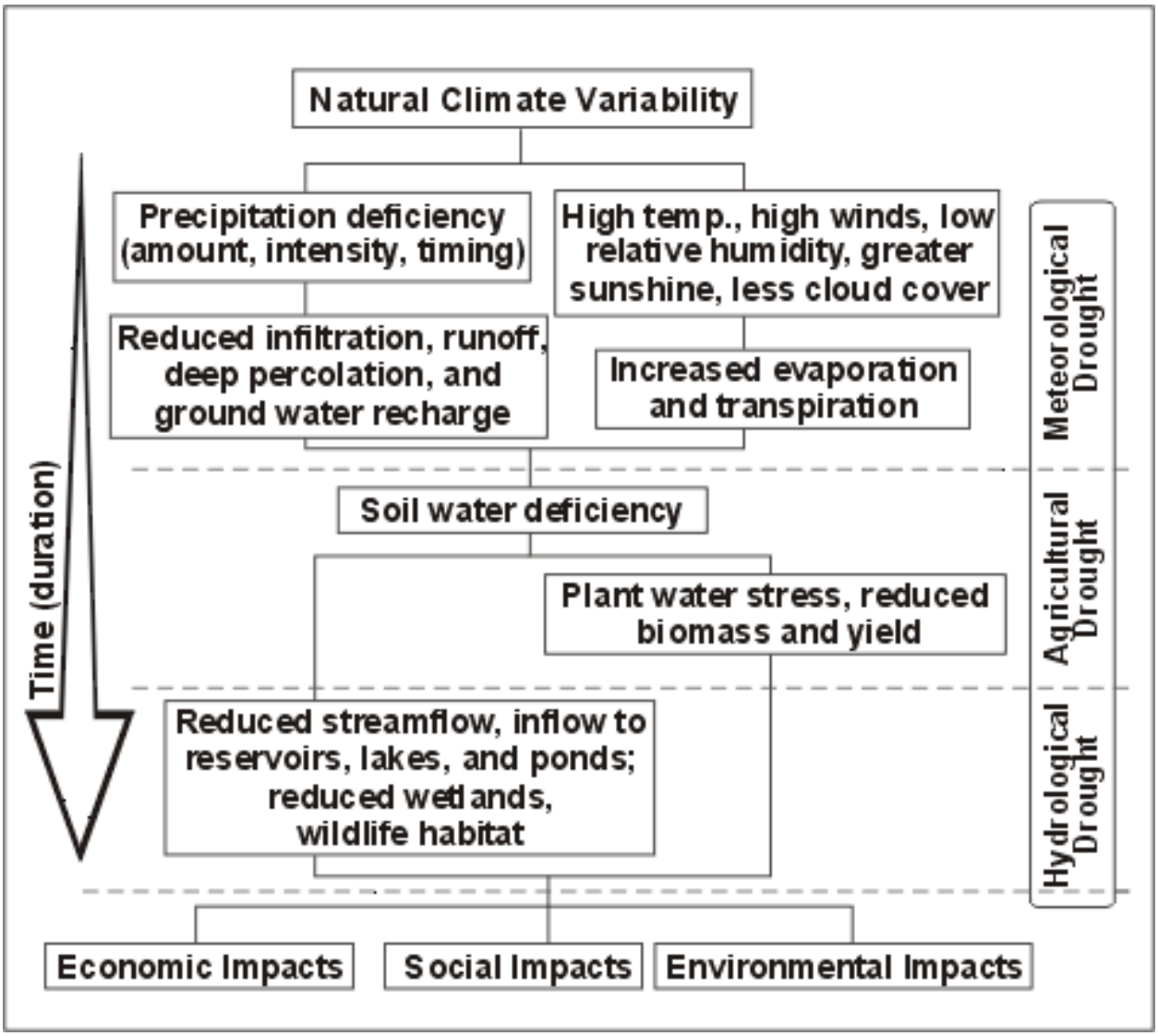
Hazard/Problem Description

Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Water districts normally require at least a 10-year planning horizon to implement a multiagency improvement project to mitigate the effects of a drought and water supply shortage.

Drought is a complex issue involving (see Figure 4-24) many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

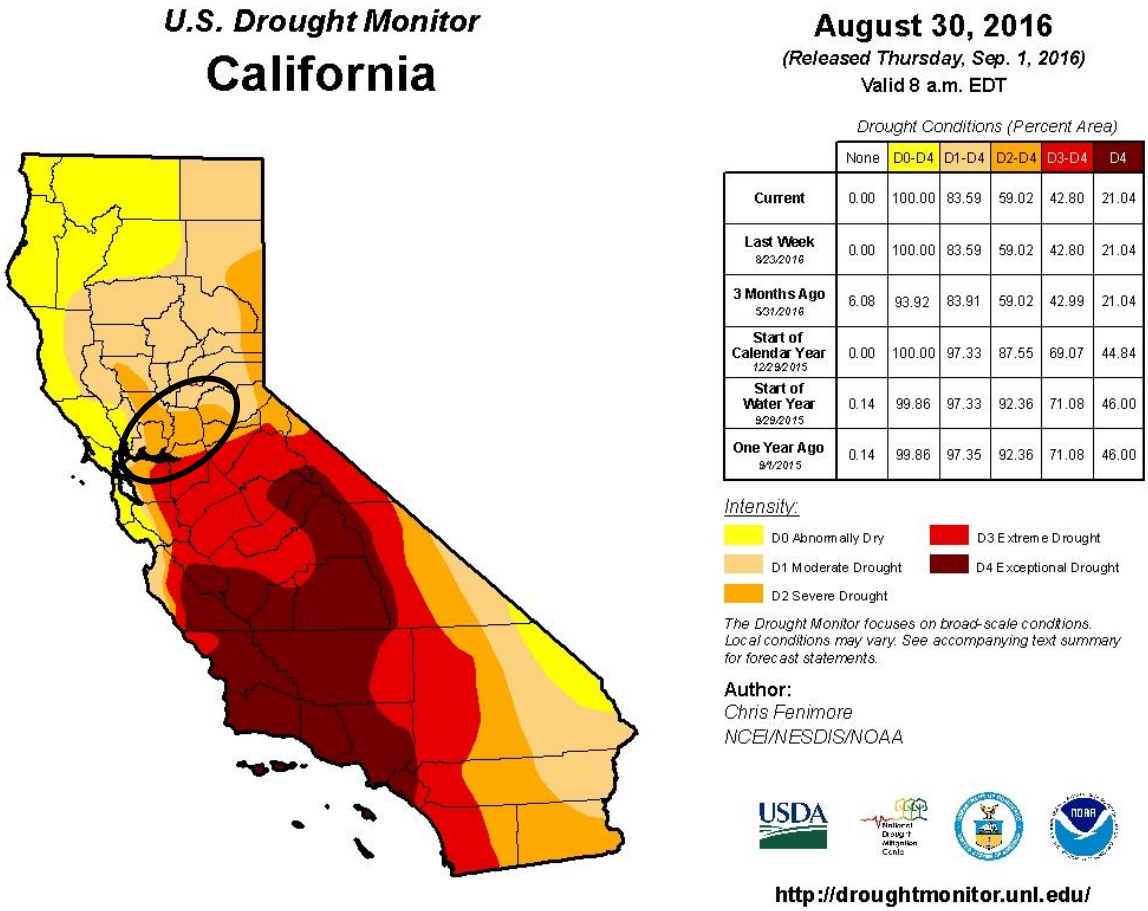
Figure 4-24 Causes and Impact of Drought



Source: National Drought Mitigation Center

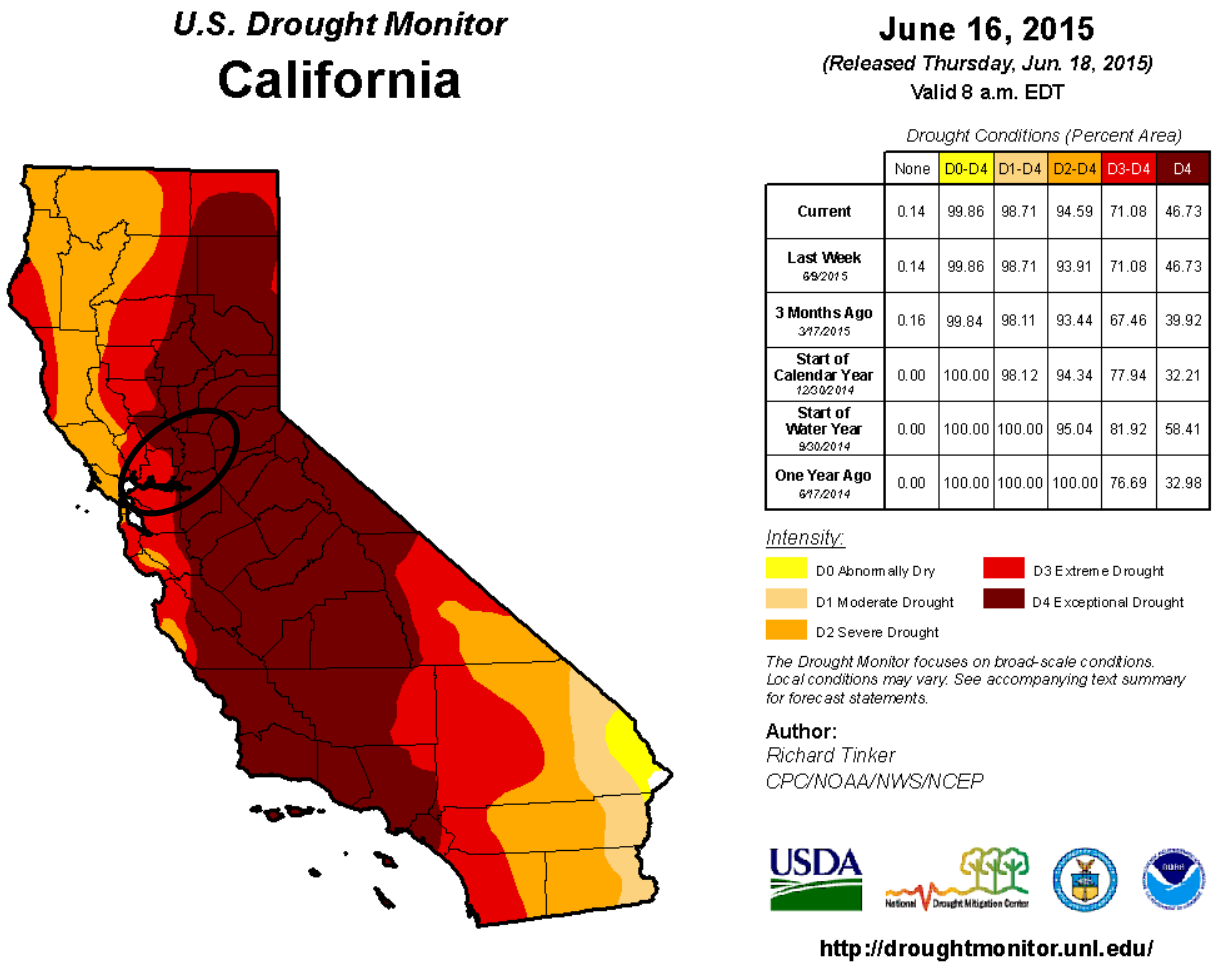
Drought in the United States is monitored by the National Integrated Drought Information System (NIDIS). A major component of this portal is the U.S. Drought Monitor. The Drought Monitor concept was developed jointly by the NOAA's Climate Prediction Center, the NDMC, and the USDA's Joint Agricultural Weather Facility in the late 1990s as a process that synthesizes multiple indices, outlooks and local impacts, into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state, and academic scientists who are intimately familiar with the conditions in their respective regions. A snapshot of the drought conditions in California and the Planning Area can be found in Figure 4-25. Drought snapshots in 2015 and early 2016 are shown in Figure 4-26.

Figure 4-25 Current Drought Status in Sacramento County



Source: US Drought Monitor

Figure 4-26 Previous Drought Status in California



Source: US Drought Monitor

The California Department of Water Resources (DWR) says the following about drought:

> *One dry year does not normally constitute a drought in California. California's extensive system of water supply infrastructure—its reservoirs, groundwater basins, and inter-regional conveyance facilities—mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions.*

The drought issue in California is further compounded by water rights. Water is a commodity possessed under a variety of legal doctrines. The prioritization of water rights between farming and federally protected fish habitats in California contributes to this issue

Drought is not initially recognized as a problem because it normally originates in what is considered good weather, which typically includes a dry late spring and summer in Mediterranean climates, such as in California. This is particularly true in Northern California where drought impacts are delayed for most of the population by the wealth of stored surface and ground water. The drought complications normally appear more than a year after a drought begins. In most areas of California, ranchers that rely on rainfall to support forage for their livestock are the earliest and most affected by drought. Even below normal water years could affect ranchers depending on the timing and duration of precipitation events. It is difficult to quantitatively assess drought impacts to Sacramento County because not many county-specific studies have been conducted. Some factors to consider include the impacts of fallowed agricultural land, habitat loss and associated effects on wildlife, and the drawdown of the groundwater table. The most direct and likely most difficult drought impact to quantify is to local economies, especially agricultural economies. The State has conducted some empirical studies on the economic effects of fallowed lands with regard to water purchased by the State's Water Bank; but these studies do not quantitatively address the situation in Sacramento County. It can be assumed, however, that the loss of production in one sector of the economy would affect other sectors.

The drawdown of the groundwater table is one factor that has been recognized to occur during repeated dry years. Lowering of groundwater levels results in the need to deepen wells, which subsequently lead to increased pumping costs. These costs are a major consideration for residents relying on domestic wells and agricultural producers that irrigate with groundwater and/or use it for frost protection. Some communities in higher elevations with shallow bedrock do not have a significant source of groundwater.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. The most significant impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Also, during a drought, allocations go down and water costs increase, which results in reduced water availability. Voluntary conservation measures are a normal and ongoing part of system operations and actively implemented during extended droughts. A reduction of electric power generation and water quality deterioration are also potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding and erosion.

Water Shortage

Sacramento County relies on a combination of surface and groundwater for their water supply. Snowmelt originating from the Sierra Nevada Mountains is a key source of surface water for the Sacramento planning area. The Sacramento, American, Consumnes, and Mokeleume rivers provide municipal, agricultural, and recreational uses to Sacramento County and depend on the spring and summer snowmelt in the Sierra Nevada for their flows. The network of dams constructed in Northern California to support the State Water Project and the Central Valley Project help provide California and Sacramento with water security during droughts. Sacramento County also sits over the north central portion of the California's Great Valley Groundwater Basin, which provides approximately 50 percent of all municipal and agricultural water supply in the County. Groundwater recharge occurs primarily from the American and Cosumnes rivers, with additional recharge from the Sacramento River and local streams. Groundwater stores are directly linked to surface water in the County and snowmelt in the Sierra Nevada.

Thus, Sacramento County, generally has sufficient groundwater and surface water supplies to mitigate even the severest droughts of the past century. Many other areas of the State, however, also place demands on these water resources during severe drought. For example, Northern California agencies, including those from Sacramento County, were major participants in the Governor's Drought Water Bank of 1991, 1992 and 1994.

Past Occurrences

Drought Disaster Declaration History

There has been one state declaration and one federal declaration related to drought and water shortage in Sacramento County since 1950.

- Drought State of Emergency – Governor's Proclamation January 17, 2014 (details below)
- 2008 Central Valley Drought (California State Declaration GP 2008-03)
- 1977 Drought (Federal Emergency Management Declaration EM-3023)

There have also been 12 were USDA Secretarial Disaster Declarations since 1982. The USDA declarations are included in Table 4-21 in Section 4.2.7.

2014 Governor's Drought Declaration

California's ongoing response to its five-year drought has been guided by a series of executive orders issued by Governor Edmund G. Brown Jr. that are listed below beginning with the most recent and continuing in reverse chronological order:

- Executive Order B-37-16, May 9, 2016: The Governor's latest drought-related executive order established a new water use efficiency framework for California. The order bolstered the state's drought resilience and preparedness by establishing longer-term water conservation measures that include permanent monthly water use reporting, new urban water use targets, reducing system leaks and eliminating clearly wasteful practices, strengthening urban drought contingency plans and improving agricultural water management and drought plans.
- Executive Order B-36-15, November 13, 2015: This executive order called for additional actions to build on the State's ongoing response to record dry conditions and assist recovery efforts from 2015's devastating wildfires.
- Executive Order B-29-15, April 1, 2015: Key provisions included ordering the State Water Resources Control Board (Board) to impose restrictions to achieve a 25-percent reduction in potable urban water usage through February 28, 2016; directing the California Department of Water Resources (DWR) to lead a statewide initiative, in partnership with local agencies, to collectively replace 50 million square feet of lawns and ornamental turf with drought tolerant landscapes, and directing the California Energy Commission to implement a statewide appliance rebate program to provide monetary incentives for the replacement of inefficient household devices.
- Executive Order B-28-14, December 22, 2014: The order cited paragraph 9 of the January 17, 2014 Proclamation and paragraph 19 of the April 25, 2014 Proclamation (both are linked below) and extended the operation of the provisions in these paragraphs through May 31, 2016.
- Executive Order B-27-14, October 6, 2014: The order directed State agencies to assist local governments in their response to wildfires during California's drought conditions.

- Executive Order B-26-14, September 18, 2014: The order facilitated efforts to provide water to families in dire need as extreme drought continued throughout California.
- Proclamation of a Continued State of Emergency, April 25, 2014: The order strengthened the State's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water.
- Drought State of Emergency, January 17, 2014: The Governor proclaimed a State of Emergency and directed State officials to take all necessary actions to make water immediately available. Key measures in the proclamation included:
  - ✓ Asking all Californians to reduce water consumption by 20 percent and referring residents and water agencies to the Save Our Water campaign – www.saveourwater.com – for practical advice on how to do so;
  - ✓ Directing local water suppliers to immediately implement local water shortage contingency plans;
  - ✓ Ordering the Board to consider petitions for consolidation of places of use for the State Water Project and Central Valley Project, which could streamline water transfers and exchanges between water users;
  - ✓ Directing DWR and the Board to accelerate funding for projects that could break ground in 2014 and enhance water supplies;
  - ✓ Ordering the Board to put water rights holders across the state on notice that they may be directed to cease or reduce water diversions based on water shortages;
  - ✓ Asking the Board to consider modifying requirements for releases of water from reservoirs or diversion limitations so that water may be conserved in reservoirs to protect cold water supplies for salmon, maintain water supplies and improve water quality.

NCDC Drought Events

There has been 19 NCDC drought events in Sacramento County. These are shown on Table 4-26. All of these events were from January 2014 to the end of 2015.

Table 4-26 Sacramento County Drought Events, 1993 to 12/31/2015

Date	Event Type	Deaths Direct	Injuries Direct	Property Damage	Crop Damage	Injuries Indirect	Deaths Indirect
1/1/2014	Drought	0	0	0	0	0	0
3/1/2015	Drought	0	0	0	0	0	0
4/1/2015	Drought	0	0	0	0	0	0
5/1/2015	Drought	0	0	0	0	0	0
5/1/2015	Drought	0	0	0	0	0	0
6/1/2015	Drought	0	0	0	0	0	0
6/1/2015	Drought	0	0	0	0	0	0
7/1/2015	Drought	0	0	0	0	0	0
7/1/2015	Drought	0	0	0	0	0	0
8/1/2015	Drought	0	0	0	0	0	0
8/1/2015	Drought	0	0	0	0	0	0

Date	Event Type	Deaths Direct	Injuries Direct	Property Damage	Crop Damage	Injuries Indirect	Deaths Indirect
9/1/2015	Drought	0	0	0	0	0	0
9/1/2015	Drought	0	0	0	0	0	0
10/1/2015	Drought	0	0	0	0	0	0
10/1/2015	Drought	0	0	0	0	0	0
11/1/2015	Drought	0	0	0	0	0	0
11/1/2015	Drought	0	0	0	0	0	0
12/1/2015	Drought	0	0	0	0	0	0
12/1/2015	Drought	0	0	0	0	0	0

Source: NCDC

HMPC Drought Events

Historically, California has experienced multiple severe droughts. According to the DWR, droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large northern California reservoirs. Table 4-27 compares the 1929-34 drought in the Sacramento and San Joaquin Valleys to the 1976-77, 1987-92, and 2007-09 droughts. Figure 4-27 depicts California's Multi-Year Historical Dry Periods, 1850-2000. Figure 4-28 depicts runoff for the State from 1900 to 2015. This gives a historical context for the 2014-2015 drought to past droughts.

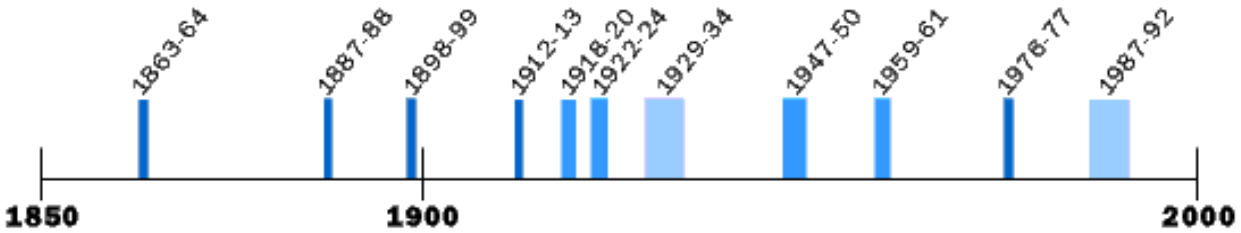
Table 4-27 Severity of Extreme Droughts in the Sacramento and San Joaquin Valleys

Drought Period	Sacramento Valley Runoff		San Joaquin Valley Runoff	
	(maf*/yr)	(percent Average 1901-96)	(maf*/yr)	(percent Average 1906-96)
1929-34	9.8	55	3.3	57
1976-77	6.6	37	1.5	26
1987-92	10.0	56	2.8	47
2007-09	11.2	64	3.7	61

Source: California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources. Available at: http://www.water.ca.gov/drought/docs/DroughtReport2010.pdf

*maf=million acre feet

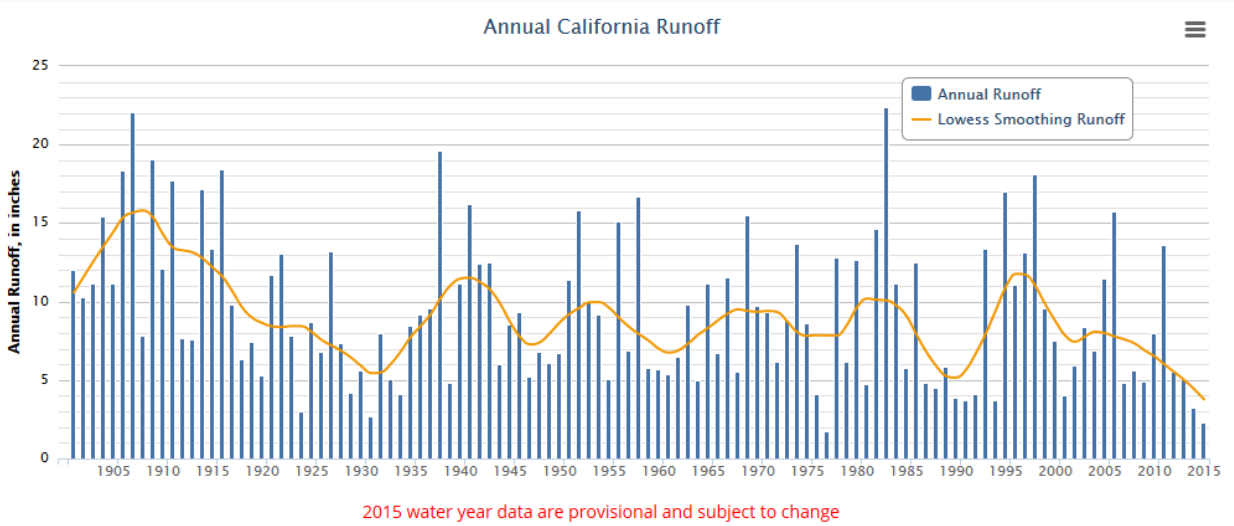
Figure 4-27 California's Multi-Year Historical Dry Periods, 1850-2000



Source: California Department of Water Resources, www.water.ca.gov/

Notes: Dry periods prior to 1900 estimated from limited data; covers dry periods of statewide or major regional extent

Figure 4-28 Annual California Runoff –1900 to 2015



Source: California DWR

The HMPC identified the following droughts as having significant impacts on the Planning Area:

- **2011 through to current.** Significant crop loss and loss of jobs related to agriculture. See agriculture hazards for specific information on damages.
- Construction of a $40 million temporary barrier at West False River in the Sac-San Joaquin Delta was installed to keep salt water from contaminating drinking water to Bay Area residents.
- **2014** – On January 17, 2014 the governor declared a State of Emergency for drought throughout California. This declaration came on the heels of a report that stated that California had the least amount of rainfall in its 163-year history. Californians were asked to voluntarily reduce their water consumption by 20 percent. Drought conditions worsened through 2014 and into 2015. On April 1, 2015, following the lowest snowpack ever recorded, Governor Brown announced actions that will save water, increase enforcement to prevent wasteful water use, streamline the State's drought response, and invest in new technologies that will make California more drought resilient. The Governor directed the State Water Resources Control Board to implement mandatory water reductions in cities and towns across California to reduce water usage by 25 percent. This savings amounts to approximately 1.5 million acre-feet of water through the end of 2015.
- **March 2015 –** An extremely dry March followed a below normal February for most areas. This continued the 4th consecutive year of drought for the region. Mountain snowfall was very limited for the month. This along with record warmth over the area resulted in the lowest snow pack levels on record for the time of year. By the end of March, the snow pack was only about 5 percent of normal levels. Melting snow pack supplies about a third of the annual water supply for California. Reservoirs across the area by the end of March were already well below normal levels.
- **April 2015** – The long term drought continues as April was yet another below normal month for precipitation for much of the area. There was some mountain snowfall, but this did little to improve the snow pack, which remained at the lowest levels on record. By the end of April, the snow pack was only about 4 percent of normal levels. As a result, reservoirs across the area by the end of April remained well below normal levels with little or no spring rise, due to the lack of snow melt.

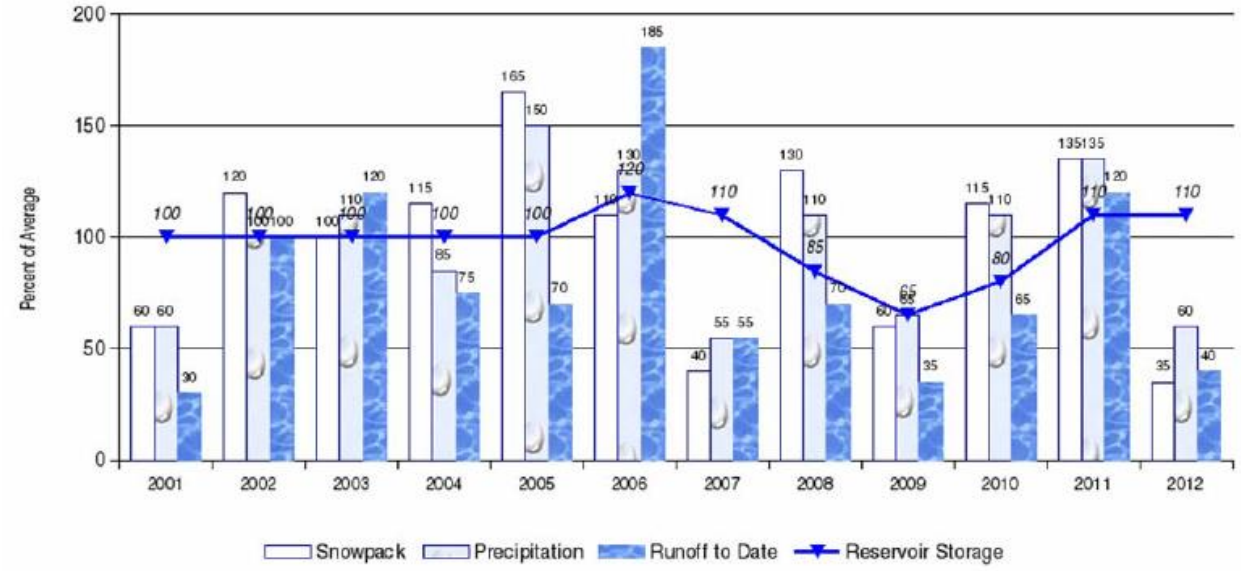
- **May 2015** – The long term drought continues as May was yet another below normal month for precipitation for much of the area. There was some mountain precipitation in the form of rain, but much of it was focused along and east of the crest. Snow pack was at the lowest levels on record and by the end of the month was virtually nonexistent. As a result, reservoirs across the area by the end of the month were at well below normal levels and were already beginning to drop.
- **June 2015** – The long term drought continued through June with yet another below normal month for precipitation for much of the area. There was some mountain rain, but much of it was focused along and east of the crest. Without a snow pack, reservoirs across the area by the end of the month were at well below normal levels and were continuing to drop. NOAA – As a result of continuing drought, emergency legislation appropriated over $1 Billion in additional funds for drought related projects".
- **July 2015** – The long term drought continued through July. While quite a few mountain locations received greater than normal precipitation due to moisture from the monsoon and from ex-hurricane Dolores, this made little impact on the drought overall. The main affects were in decreasing fire activity in areas where locally heavy rain fell. Without a snow pack, reservoirs across the area by the end of the month were continuing to drop well below normal levels.
- **August 2015 –** The long term drought continued through August with little change. Without a snow pack for late spring/early summer, reservoirs across the area by the end of the month were continuing to drop well below normal levels. All major reservoirs across the state were less that 40% of capacity by the end of the month. Folsom Lake was down to 20% of capacity, approaching near-record low levels for August, seen last in 1977. A UC Davis Center for Watershed Sciences report – (due to drought) showed statewide drought impact in 2015 at $2.7 Billion and loss of more than 21,000 jobs. Approx. 743,642 boxes of food distributed to 300k households that suffered unemployment from the drought.
- **September 2015 –** The long term drought continued through September with little change. Reservoirs across the area were continuing to drop well below normal levels. All major reservoirs across the state were less that 40% of capacity. Folsom Lake was down to 18% of capacity, approaching near-record low levels for September, seen last in 1977.
- **October 2015 –** The long term drought continued through October with little change. Reservoirs across the area were continuing to drop well below normal levels. All major reservoirs across the state were less that 40% of capacity. Folsom Lake was down to 16% of capacity, approaching near all time record low levels, set in 1977.
- **November 2015 –** The long term drought continued through November. Widespread precipitation returned to the area with several events, but reservoirs across the area continued to drop well below normal levels. All major reservoirs across the state were 30% or less of capacity. Folsom Lake was down to 14% of capacity, breaking the all-time record low set in 1977. Lake Oroville came close to a record low, but did not reach it.
- **December 2015 –** The long term drought continued through December, though there was near normal precipitation in the mountains and above normal snow pack by the end of the month. Reservoirs across the area began to slowly fill but continued to be well below normal levels.
- **January 2016 –** The long term drought continued through January, though precipitation amounts for the month were much better than in recent years, about 150-200% of normal. This built an above normal snow pack for the northern Sierra and southern Cascades by the end of the month. Reservoirs across the area continued to increase but generally remained below normal levels. Folsom Lake was an exception to this, rising to 104% by the end of January after a record low late in the fall. The Department of Water Resources increased water delivery projections from 10 percent early in the month to 15 percent of full water allotments by the end of the month, due to the increased reservoir levels.

- **February 2015 –** Long term drought continued through the month of February. After a relatively wet January, a period of extremely dry and warm conditions returned for most of February. This prevented the snow pack for the northern Sierra and southern Cascades from growing much, and actually decreased it in some locations by the end of the month, down to around 90% of normal, 85% for the whole state. Reservoirs across the area continued to increase but generally remained below normal levels. Folsom Lake was an exception to this, rising to 111% by the end of February. The Department of Water Resources increased water delivery projections to 30% of requests, up from a 15% estimate in late January. However, the dry conditions through the month prevented a larger anticipated increase.
- **March 2015 –** Long term drought continued through the month of March, but with significant improvements in mountain snow pack and most reservoir levels. After a period of extremely dry and warm conditions for most of February, a pattern of moist westerly flow brought a series of unusually wet storms in March. This added significantly to the snow pack for the northern Sierra and southern Cascades. Snow pack increased to around 97% of normal for those areas, while on average the whole state was 86%. Reservoirs across interior northern California continued to increase, with the two largest rising to above normal levels. Lake Shasta was 109% of normal by the end of the month, Lake Oroville was 114%. Folsom Lake was 110% of normal and had to make flood control releases. In contrast, Don Pedro and New Melones remained below normal. The Department of Water Resources increased water delivery projections to 45% of requests, up from a 30% estimate in late February.
- **April 2015 –** Long term drought impacts continued through the month of April, but near seasonal values for Northern and Central Sierra mountain snow pack and the "Big 3" northern reservoir levels meant some good news. The very active March resulted in much above average precipitation numbers which helped top off the reservoirs. In fact, they had to do some flood control releases on Folsom as it was above historical levels. Reservoirs across interior northern California continued to increase, with the three largest rising to above normal levels. Lake Shasta was 108% of normal by the end of the month, Lake Oroville was 118% and Folsom Lake was 113% of normal. In contrast, Don Pedro and New Melones remained below normal at 67% and 26% respectively. On April 21st, the Department of Water Resources increased water delivery projections to the State Water Project to 60%, up from a 45% estimate in late March.
- **May 2015** – Long term drought impacts continued through the month of May, though the largest of the reservoirs in northern interior California were at or above normal levels due to a significant mountain snowpack melting. Lake Shasta was 107% of normal by the end of the month, Lake Oroville was 111%, Folsom Lake was 101%, and Don Pedro was 99%. New Melones continued to lag behind the other significant area reservoirs and was only 41% of normal. On April 21st, the Department of Water Resources increased water delivery projections to the State Water Project to 60%, up from the 45% estimate in late March. Groundwater aquifers recharged much more slowly than the surface reservoirs, with many in the Central Valley still falling toward record levels.

Water Shortage Events

Figure 4-29 illustrates several indicators commonly used to evaluate water conditions in California. The percent of average values are determined by measurements made in each of the ten major hydrologic regions. The chart describes water conditions in California between 2001 and 2012. The chart illustrates the cyclical nature of weather patterns in California. Snow pack and precipitation increased between 2005 and 2006, began decreasing in late 2006, and began to show signs of recovery in 2009.

Figure 4-29 Water Supply Conditions, 2001 to 2012



Source: 2013 State of California Hazard Mitigation Plan

Since 2012, snowpack levels in California have dropped dramatically. 2015 estimates place snowpack as 5 percent of normal levels. Snowpack measurements have been kept in California since 1950 and nothing in the historic record comes close to 2015's severely depleted level. The previous record for the lowest snowpack level in California, 25 percent of normal, was set both in 1976-77 and 2013-2014. In "normal" years, the snowpack supplies about 30 percent of California's water needs, according to the California Department of Water Resources.

With a reduction in water, water supply issues based on water rights becomes more evident. Some agricultural uses, such as grapes and walnuts, are severely impacted through limited water supply. Drought and water supply issues will continue to be a concern to the Planning Area. Irrigation of agricultural lands continues to be a concern in the Planning Area.

Likelihood of Future Occurrence

Drought

Likely—Historical drought data for the Sacramento County Planning Area and region indicate there have been 6 significant droughts in the last 89 years. This equates to a drought every 14.8 years on average or a 6.7 percent chance of a drought in any given year. However, based on this data and given the multi-year length of droughts, the HMPC determined that future drought occurrence in the Planning Area are likely.

Water Shortage

Occasional – Recent historical data for water shortage indicates that Sacramento County may at some time be at risk to both short and prolonged periods of water shortage. Based on this it is possible that water shortages will affect the County in the future should extreme drought conditions continue. However, to date, most of Northern California and Sacramento County have continued to have good, consistent water

supply. Most of the Planning Area's supply comes from surface water, with groundwater resources also being used in some areas.

Climate Change and Drought and Water Shortage

Climate scientists studying California find that drought conditions are likely to become more frequent and persistent over the 21st century due to climate change. The experiences of California during recent years underscore the need to examine more closely the state's water storage, distribution, management, conservation, and use policies. The CAS stresses the need for public policy development addressing long term climate change impacts on water supplies. The CAS notes that climate change is likely to significantly diminish California's future water supply, stating that:

> *California must change its water management and uses because climate change will likely create greater competition for limited water supplies needed by the environment, agriculture, and cities.*

The regional implications of declining water supplies as a long-term public policy issue are recognized in a Southern California Association of Governments July 2009 publication of essays examining climate change topics. In one essay, Dan Cayan observes:

> *In one form or another, many of Southern California's climate concerns radiate from efforts to secure an adequate fresh water supply…Of all the areas of North America, Southern California's annual receipt of precipitation is the most volatile – we only occasionally see a "normal" year, and in the last few we have swung from very wet in 2005 to very dry in 2007 and 2008….Southern California has special challenges because it is the most urban of the California water user regions and, regionwide, we import more than two-thirds of the water that we consume.*

Members of the HMPC noted a report published in Science magazine in 2015 that stated:

> *Given current greenhouse gas emissions, the chances of a 35+ year "megadrought" striking the Southwest by 2100 are above 80 percent.*

The HMPC also noted a report from the Public Policy Institute of California that thousands of Californians – mostly in rural, small, disadvantaged communities – already face acute water scarcity, contaminated groundwater, or complete water loss. Climate change would make these effects worse.

Preliminary Draft - Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP), Ascent Environmental 2016 Analysis

According to the 2016 Preliminary Draft CAP, based on historical data and modeling, under the low- and high-emissions scenarios, Cal DWR projects that the Sierra Nevada snowpack will decrease by 25-40 percent from its historic April 1st average of 28 inches of water content by 2050 and 48 to 65 percent by 2100, respectively. With a projected decrease in overall precipitation, including precipitation falling as snow and increased average temperatures, drought conditions may increase and both groundwater and surface water supplies may be impacted.

4.2.12. Earthquake

Hazard/Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales. One of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter Magnitude Scale is used to quantify the magnitude or strength of the seismic energy released by an earthquake. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface (see Table 4-28). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-28 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors; by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, and great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.

MMI	Felt Intensity
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: Multi-Hazard Identification and Risk Assessment, FEMA 1997

California is seismically active because it sits on the boundary between two of the earth's tectonic plates. Most of the state - everything east of the San Andreas Fault - is on the North American Plate. The cities of Monterey, Santa Barbara, Los Angeles, and San Diego are on the Pacific Plate, which is constantly moving northwest past the North American Plate. The relative rate of movement is about two inches per year. The San Andreas Fault is considered the boundary between the two plates, although some of the motion is taken up on faults as far away as central Utah.

Earthquake Hazards

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, hazmat incidents, fires, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction. This section briefly discusses issues related to types of seismic hazards.

Ground Shaking

Groundshaking is motion that occurs as a result of energy released during faulting. The damage or collapse of buildings and other structures caused by groundshaking is among the most serious seismic hazards. Damage to structures from this vibration, or groundshaking, is caused by the transmission of earthquake vibrations from the ground to the structure. The intensity of shaking and its potential impact on buildings is determined by the physical characteristics of the underlying soil and rock, building materials and workmanship, earthquake magnitude and location of epicenter, and the character and duration of ground motion. Much of the County is located on alluvium which increases the amplitude of the earthquake wave. Ground motion lasts longer and waves are amplified on loose, water-saturated materials than on solid rock. As a result, structures located on alluvium typically suffer greater damage than those located on solid rock.

Seismic Structural Safety

Older buildings constructed before building codes were established, and even newer buildings constructed before earthquake-resistance provisions were included in the codes, are the most likely to be damaged during an earthquake. Buildings one or two stories high of wood-frame construction are considered to be the most structurally resistant to earthquake damage. Older masonry buildings without seismic reinforcement (unreinforced masonry) are the most susceptible to the type of structural failure that causes injury or death.

The susceptibility of a structure to damage from ground shaking is also related to the underlying foundation material. A foundation of rock or very firm material can intensify short-period motions which affect low-rise buildings more than tall, flexible ones. A deep layer of water-logged soft alluvium can cushion low-rise buildings, but it can also accentuate the motion in tall buildings. The amplified motion resulting from softer alluvial soils can also severely damage older masonry buildings.

Other potentially dangerous conditions include, but are not limited to: building architectural features that are not firmly anchored, such as parapets and cornices; roadways, including column and pile bents and abutments for bridges and overcrossings; and above-ground storage tanks and their mounting devices. Such features could be damaged or destroyed during strong or sustained ground shaking.

Liquefaction Potential

Liquefaction is a process whereby soil is temporarily transformed to a fluid form during intense and prolonged ground shaking. Due to the damage liquefaction poses to the levees in Sacramento County, a separate, more detailed discussion of liquefaction can be found in Section 4.2.13.

Settlement

Settlement can occur in poorly consolidated soils during ground shaking. During settlement, the soil materials are physically rearranged by the shaking to result in a less stable alignment of the individual minerals. Settlement of sufficient magnitude to cause significant structural damage is normally associated with rapidly deposited alluvial soils or improperly founded or poorly compacted fill. These areas are known to undergo extensive settling with the addition of irrigation water, but evidence due to ground shaking is not available.

Other Hazards

Earthquakes can also cause seiches, landslides, and dam and levee failures. A seiche is a periodic oscillation of a body of water resulting from seismic shaking or other factors that could cause flooding. Earthquakes may cause landslides, particularly during the wet season, in areas of high water or saturated soils. Finally, earthquakes can cause dams and levees to fail (see Section 4.2.9 Dam Failure and Section 4.2.17 Levee Failure).

Faults

A fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of

buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

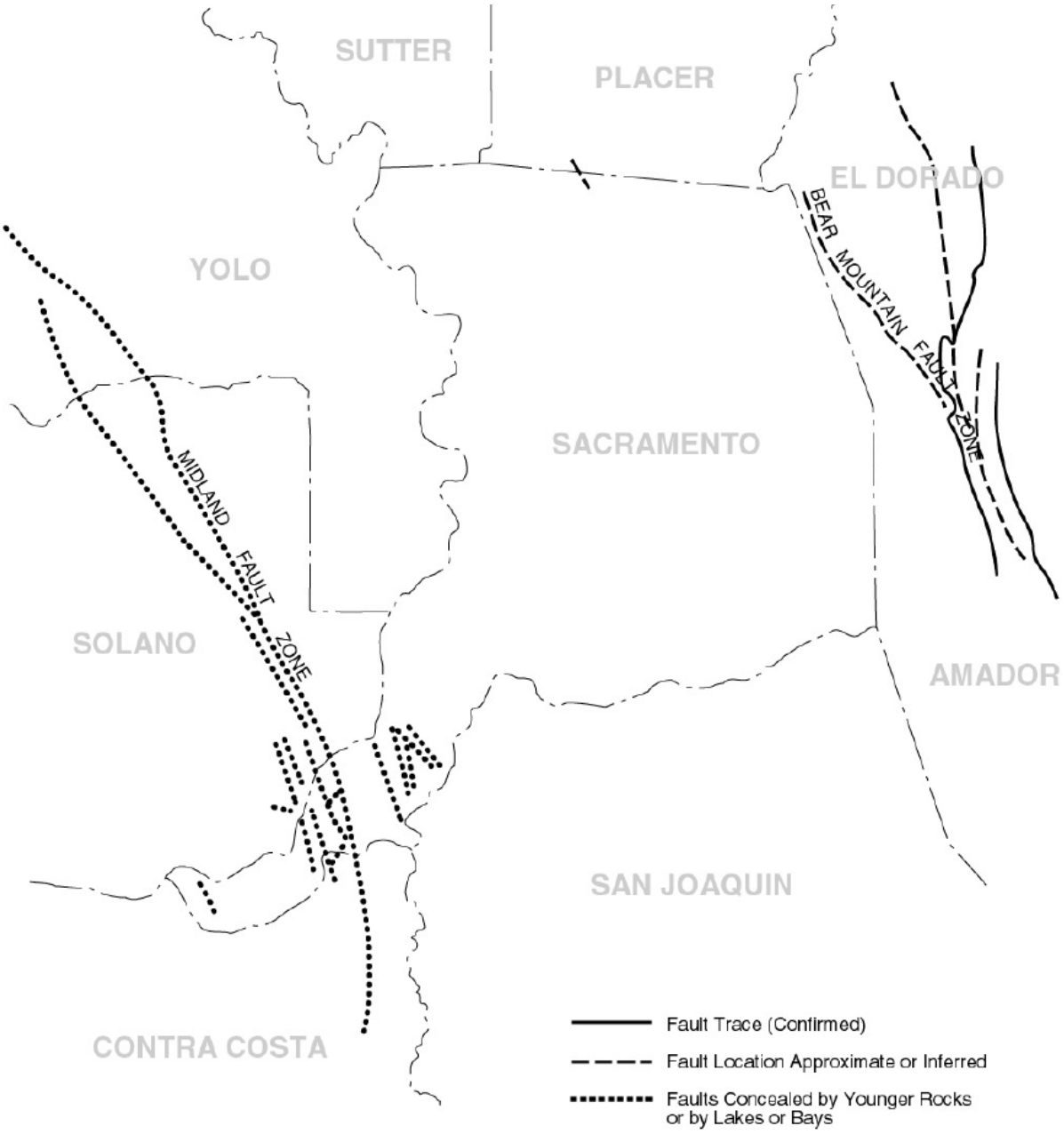
Geological literature indicates that no major active faults transect the County; however, there are several subsurface faults in the Delta. The Midland fault, buried under alluvium, extends north of Bethel Island in the Delta to the east of Lake Berryessa and is considered inactive but possibly capable of generating a near 7.0 (Richter Scale) earthquake. This figure is speculative based on a 1895 earthquake measuring 6.9 on the Richter Scale with an epicenter possibly in the Midland Fault vicinity. However, oil and gas companies exploring the area's energy potential have identified several subsurface faults, none of which show any recent surface rupture. A second, presumably inactive, fault is in the vicinity of Citrus Heights near Antelope Road. This fault's only exposure is along a railroad cut where offsetting geologic beds can be seen. Neither the lateral extent of the trace, the magnitude of the offset, nor the age of faulting has been determined. To the east, the Bear Mountain fault zone trends northwest-southeast through Amador and El Dorado Counties. Geologists believe this series of faults has not been active in historic time. Table 4-29 and Figure 4-30 identify the faults in close proximity to Sacramento County.

Table 4-29 Historically Active Faults in the Vicinity of Sacramento County

Maximum Richter Scale Reading	Approximate Distance from West Sacramento (Miles)	Historical Seismicity	Probable Intensity
San Andreas	80	1906 (8.25)*	7.5
Vaca	35	1892 (6.5-7)	6.0
Hayward	60	1836, 1868 (7.25)	6.5-7
Calaveras	50	1861 (6.5-7)	6.5-7
Concord-Green Valley	45	1955 (5.4; small events on Green Valley; creep on Concord)	6.0
Midland	20	Possible source of major historic earthquake (1895?)	6.9
Dunnigan Hills	18	Unknown	6.0
Foothill Fault System	25	Oroville 1975	6.0

Source: Lighthouse Marina EIR/EIS, by E D A W, Inc., November, 1985.

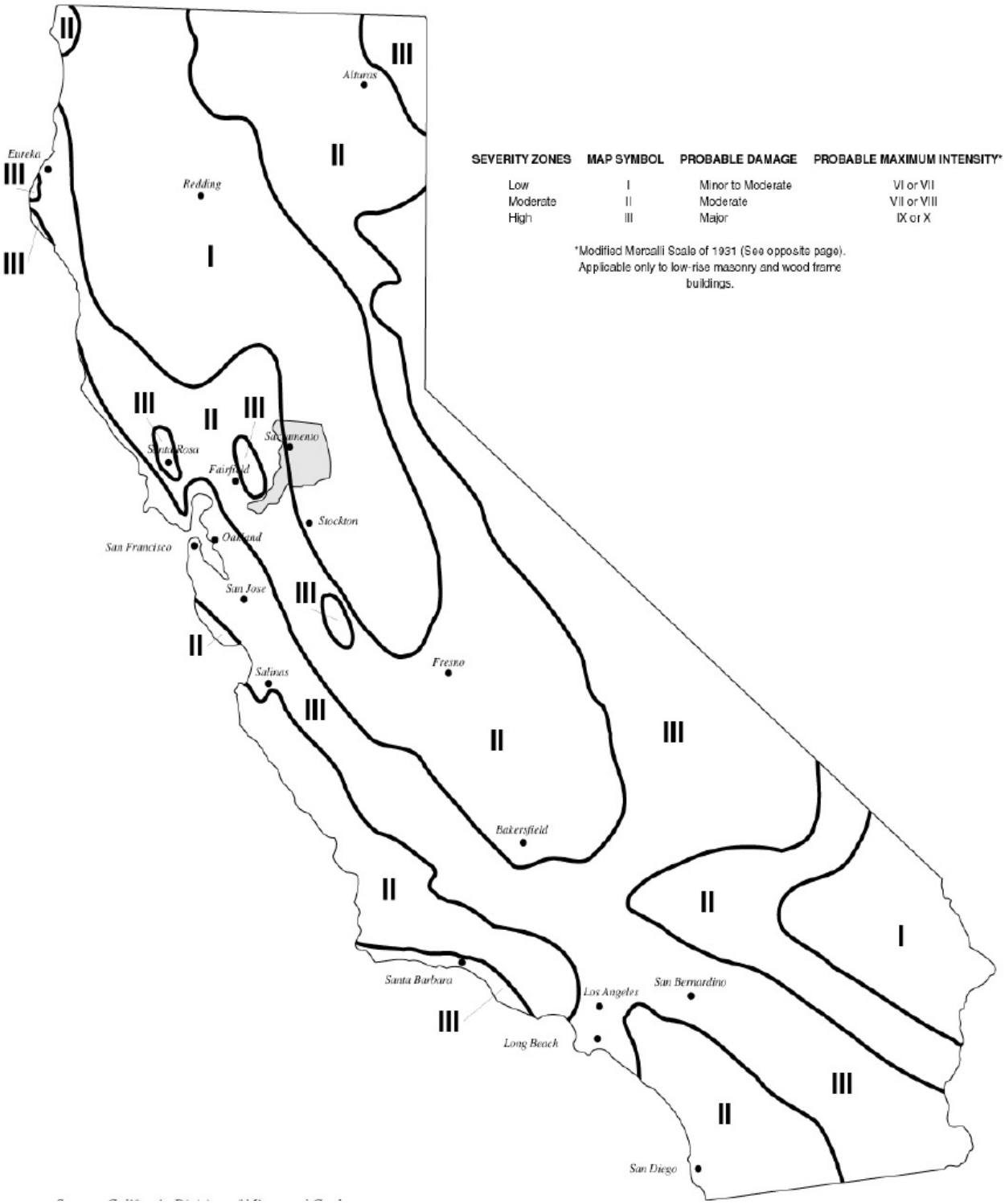
Figure 4-30 Faults in the Vicinity of Sacramento County



Source: Sacramento County General Plan Background Report

Maps indicating the maximum expectable intensity of groundshaking for the County are available through several sources. The California Division of Mines and Geology has prepared a map of the state showing the eastern and central portions of the County in a relatively low intensity groundshaking zone while the western portion of the County is in a relatively moderate groundshaking zone (Figure 4-31). More information on groundshaking can be found in the vulnerability discussion of earthquake in Section 4.3.8.

Figure 4-31 Maximum Expectable Earthquake Intensity



Source: California Division of Mines and Geology

The HMPC noted that Lake County's earthquake was on a previously unknown fault. While fault maps developed by the California Geological Survey and the US Geological Survey are thorough, a chance remains of an earthquake on an unknown fault in the County.

Past Occurrences

Disaster Declaration History

There have been two disaster declarations in the County related to earthquake:

- 2014 Earthquake (Federal Emergency Management Disaster Declaration EM 4193)
- 1989 Loma Prieta Earthquake (Federal Disaster Declaration DR-845; USDA Disaster Declaration M-845)

NCDC Events

Earthquake events are not tracked by the NCDC database.

USGS Events

The USGS National Earthquake Information Center database contains data on earthquakes in the Sacramento County area. Table 4-30 shows the approximate distances earthquakes can be felt away from the epicenter. According to the table, a magnitude 5.0 earthquake could be felt up to 90 miles away. The USGS database was searched for magnitude 5.0 or greater on the Richter Scale within 90 miles of the City of Sacramento. These results are detailed in Table 4-31.

Table 4-30 Approximate Relationships between Earthquake Magnitude and Intensity

Richter Scale Magnitude	Maximum Expected Intensity (MM)*	Distance Felt (miles)
2.0 - 2.9	I – II	0
3.0 - 3.9	II – III	10
4.0 - 4.9	IV – V	50
5.0 - 5.9	VI – VII	90
6.0 - 6.9	VII – VIII	135
7.0 - 7.9	IX – X	240
8.0 - 8.9	XI – XII	365

*Modified Mercalli Intensity Scale.
Source: United State Geologic Survey, Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977.

*Table 4-31 Magnitude 5.0 Earthquakes within 90 Miles of Sacramento County**

Date	Richter Magnitude	Location
8/1/1975	5.8	59 miles
8/2/1975	5.1	59 miles

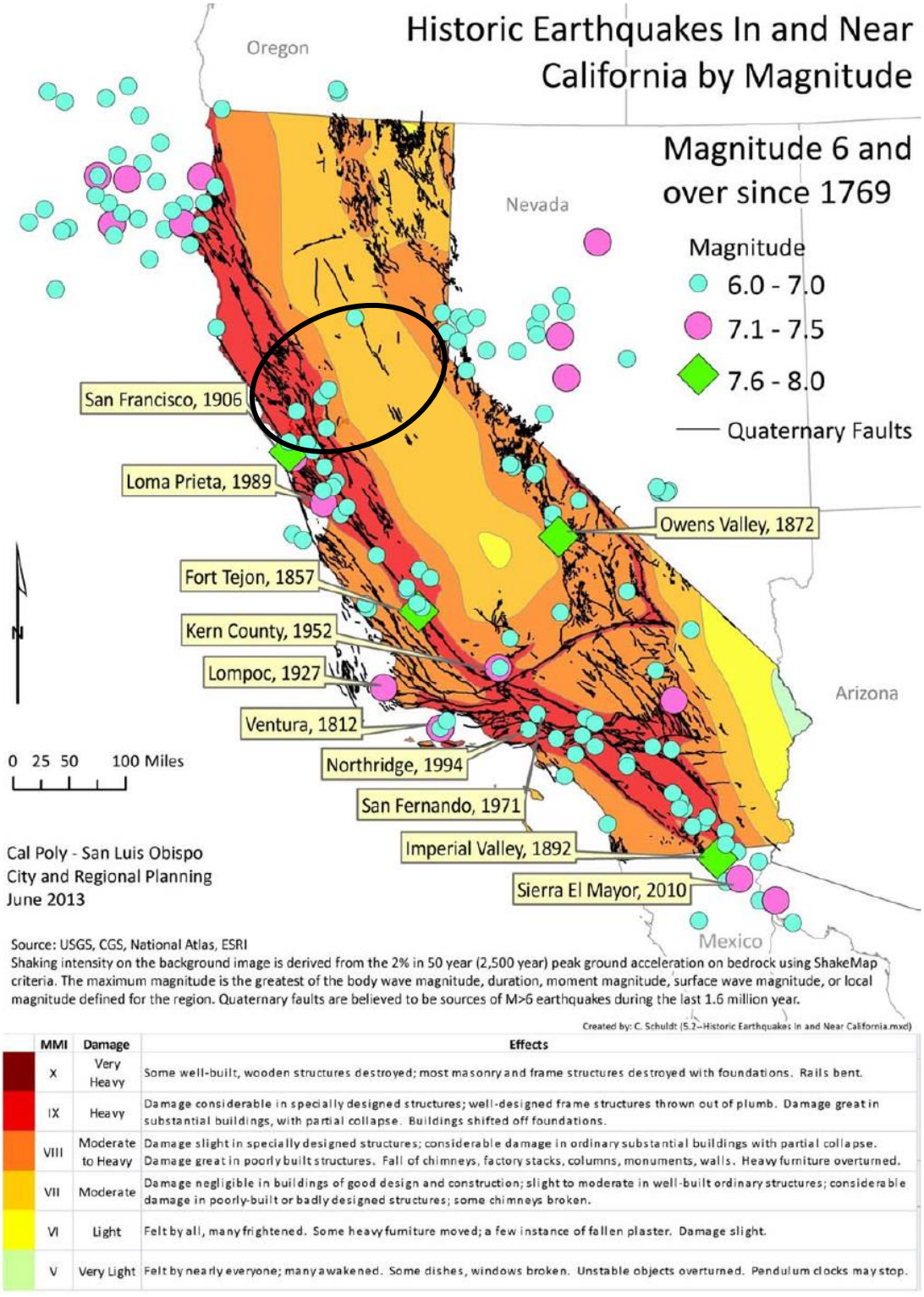
Date	Richter Magnitude	Location
8/2/1975	5.1	58 miles
9/4/1978	5.2	88 miles
1/24/1980	5.8	51 miles
1/27/1980	5.8	57 miles
11/28/1980	5.2	73 miles
4/24/1984	6.2	85 miles
3/31/1986	5.7	73 miles
6/13/1988	5.4	81 miles
9/3/2000	5.0	51 miles
10/31/2007	5.6	78 miles
8/24/2014	6.0	51 miles

Source: USGS

*Search dates 1/1/1950- May 1, 2016

Figure 4-32 shows major historical earthquakes in California from 1769 to 2013.

Figure 4-32 Historic Earthquakes in California and Sacramento County



MMI	Damage	Effects
X	Very Heavy	Some well-built, wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
IX	Heavy	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
VIII	Moderate to Heavy	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
VII	Moderate	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly-built or badly designed structures; some chimneys broken.
VI	Light	Felt by all, many frightened. Some heavy furniture moved; a few instance of fallen plaster. Damage slight.
V	Very Light	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

Source: 2013 State of California Multi-Hazard Mitigation Plan

HMPC Events

Historically, major earthquakes have not been an issue for Sacramento County. However, minor earthquakes have occurred in or near the County in the past. The HMPC has identified several earthquakes that were felt by area residents and/or caused damaging shaking in the County. Details on some of these events follow.

- The greatest amount of groundshaking experienced in the County occurred on **April 21, 1892**, when an earthquake shook Yolo County between Winters and Vacaville. While the damage in Yolo County was severe, the damage in Sacramento County was substantially less. Damage to buildings in Sacramento was limited to statuary falling from building tops and cracks in chimneys.
- The **1906** San Francisco earthquake generated little shaking in Sacramento County and damage locally was limited to minor cracks in a local post office and jail.
- A **December 16, 1954** earthquake near Fairview Peak, Nevada measured 7.1 on the Richter Scale. The earthquake caused some damage in Sacramento, while virtually no damage occurred in Reno, Nevada.
- On **August 1, 1975**, a moderate earthquake (magnitude 5.7) occurred near Oroville on the Cleveland Hills fault. This earthquake was felt in Sacramento County, although no direct damage was reported.
- Sacramento County suffered little damage from the **October 17, 1989** Loma Prieta earthquake, which was felt over an area covering 400,000 square miles from Los Angeles to the California-Oregon border. The earthquake measured 7.1 on the Richter Scale; the epicenter was located along the San Andreas fault beneath the Santa Cruz Mountains, about 60 miles southeast of San Francisco. In contrast to Sacramento County, the San Francisco Bay region suffered over $6 billion in property damage and 62 lives were lost. The Loma Prieta earthquake resulted in a federal disaster declaration (DR-845) for the area around San Francisco, including Sacramento County.
- **2014 Napa Earthquake** – A magnitude 6.0 earthquake occurred 51.1 miles west/southwest of the City of Sacramento. Damage estimates in the County were negligible. The County was included in a disaster declaration for this earthquake.

There have been many earthquakes in Northern California since 2011. Most were at a magnitude of 1.5 – 3.0. those closest to Sacramento Valley were; 1.8 magnitude in Antioch, 2.4 in Rio Vista and 6.0 magnitude in American Canyon.

Likelihood of Future Occurrence

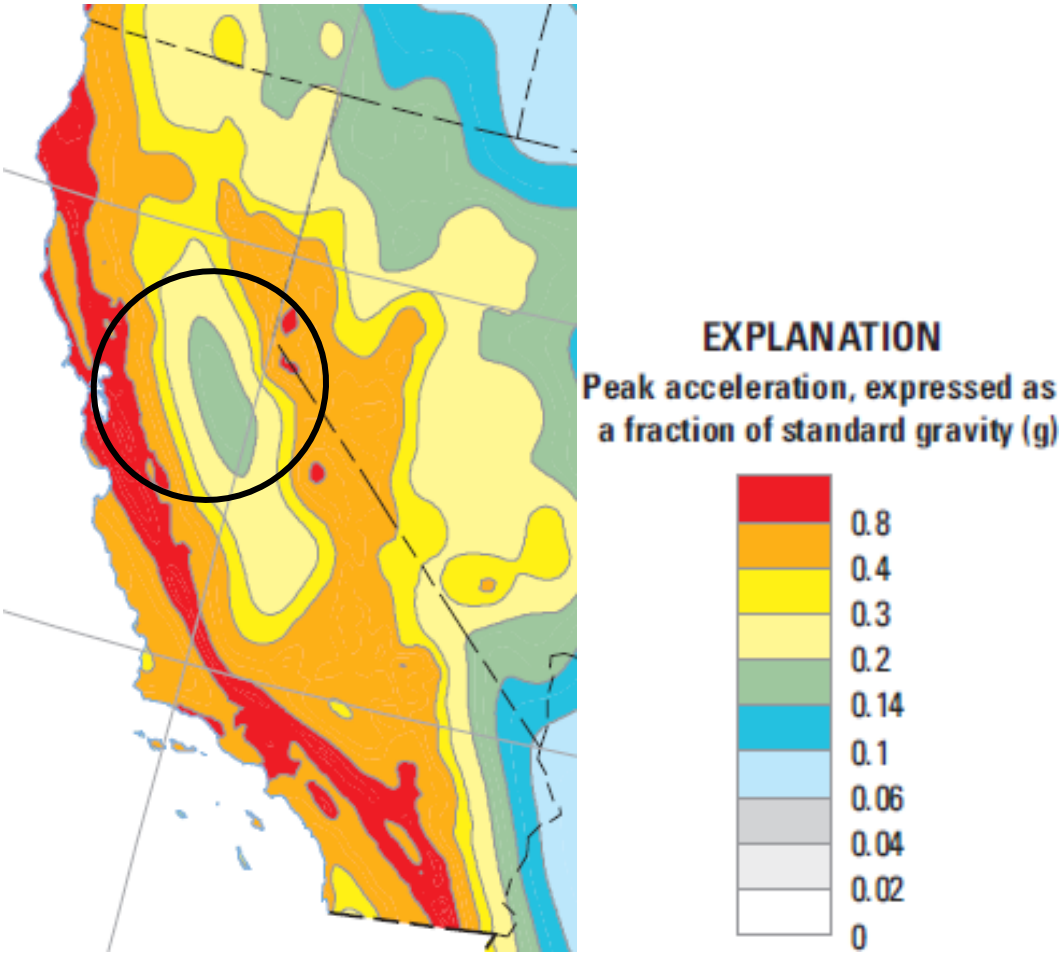
Occasional—No major earthquakes have been recorded within the county; although the county has felt ground shaking from earthquakes with epicenters located elsewhere. Based on historical data and the location of the Sacramento County Planning Area relative to active and potentially active faults, the Planning Area will experience an earthquake occasionally.

Mapping of Future Occurrences

Maps indicating the maximum expectable intensity of groundshaking for the County are available through several sources. The USGS issues National Seismic Hazard Maps as reports every few years. These maps provide various acceleration and probabilities for time periods. Figure 4-33 depicts the peak horizontal acceleration (%g) with 10% probability of exceedance in 50 years (a 500-year event) for the planning region. The figure demonstrates that the County falls in the 14%g (grey) to 20%g area. This data indicates

that the expected severity of earthquakes in the region is somewhat limited, as damage from earthquakes typically occurs at peak accelerations of 30%g or greater.

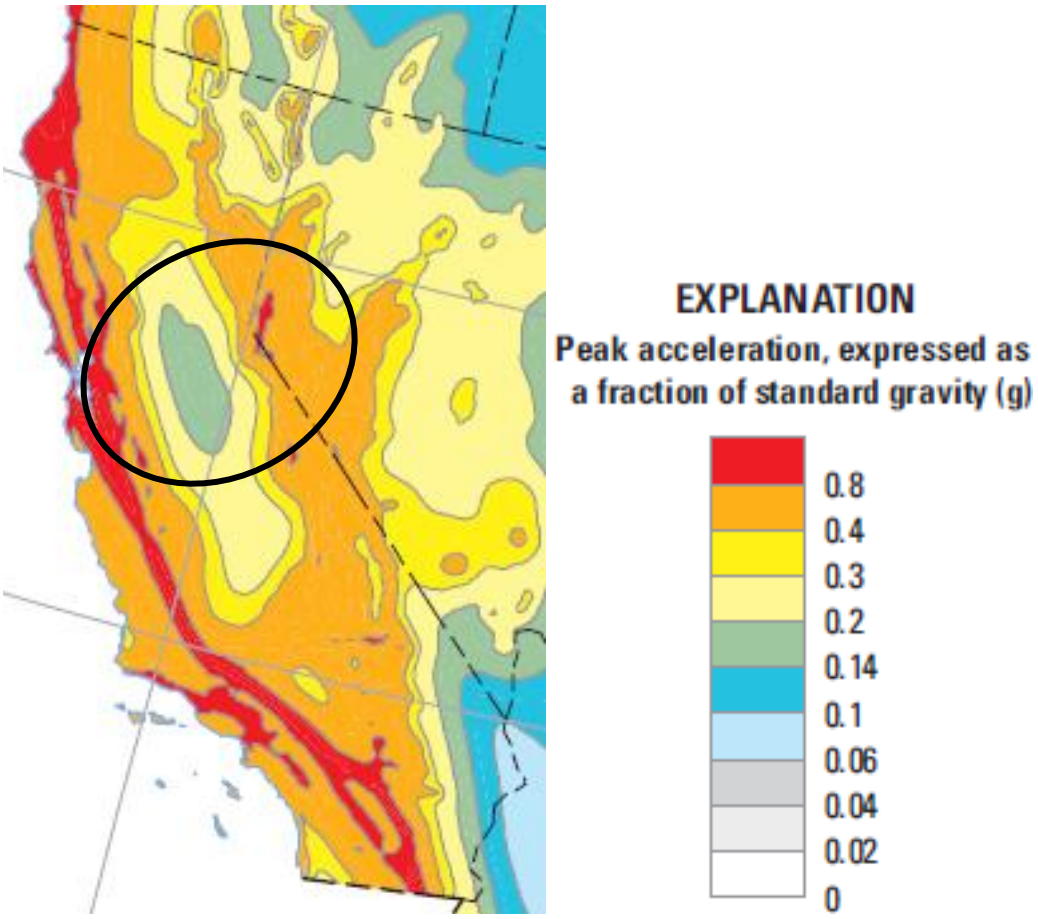
Figure 4-33 Peak Horizontal Acceleration with 10% Probability of Occurrence in 50 Years



Source: USGS National Seismic Hazard Maps

Figure 4-34 depicts the peak horizontal acceleration (%g) with 2% probability of exceedance in 50 years (a 2,500-year event) for the County. The figure demonstrates that the County falls in the 14%g (grey) to 20%g area. This data indicates that the expected severity of earthquakes in the region is moderate, as damage from earthquakes typically occurs at peak accelerations of 30%g or greater.

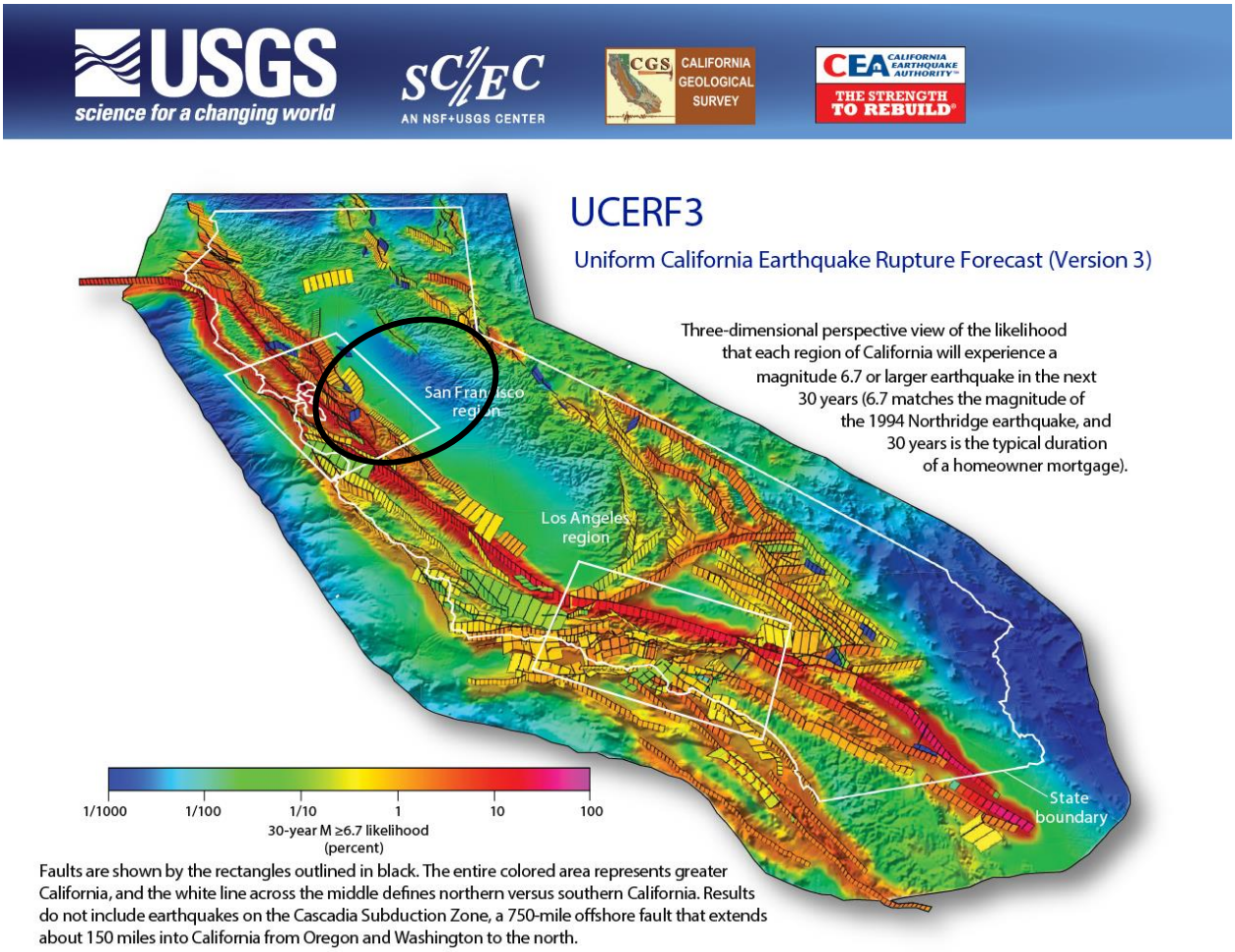
Figure 4-34 Peak Horizontal Acceleration with 2% Probability of Occurrence in 50 Years



Source: USGS National Seismic Hazard Maps

In 2014, the United States Geological Survey (USGS) and the California Geological Survey (CGS) released the time-dependent version of the Uniform California Earthquake Rupture Forecast (UCERF III) model. The UCERF III results have helped to reduce the uncertainty in estimated 30-year probabilities of strong ground motions in California. The UCERF map is shown in Figure 4-35 and indicates that Sacramento County has a low to moderate risk of earthquake occurrence, which coincides with the likelihood of future occurrence rating of occasional.

Figure 4-35 Probability of Earthquake Magnitudes Occurring in 30 Year Time Frame



Source: United States Geological Survey Open File Report 2015-3009

Climate Change and Earthquake

Climate change is unlikely to increase earthquake frequency or strength.

4.2.13. Earthquake: Liquefaction

Hazard/Problem Description

Liquefaction can be defined as the loss of soil strength or stiffness due to a buildup of pore-water pressure during a seismic event and is associated primarily with relatively loose, saturated fine- to medium-grained unconsolidated soils. Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. If this layer is at the surface, its effect is much like that of quicksand for any structure located on it. If the liquefied layer is in the subsurface, the material above it may slide laterally depending on the confinement of the unstable mass. Liquefaction is caused by a sudden temporary increase in pore-water pressure due to seismic densification or other displacement of submerged granular soils. Liquefiable soil conditions are not uncommon in

alluvial deposits in moderate to large canyons and could also be present in other areas of alluvial soils where the groundwater level is shallow (i.e., 50 feet below the surface). Bedrock units, due to their dense nature, are unlikely to present a liquefaction hazard.

Liquefaction during major earthquakes has caused severe damage to structures on level ground as a result of settling, titling, or floating. Such damage occurred in San Francisco on bay-filled areas during the 1989 Loma Prieta earthquake, even though the epicenter was several miles away. If liquefaction occurs in or under a sloping soil mass, the entire mass may flow toward a lower elevation. Also of particular concern in terms of developed and newly developing areas are fill areas that have been poorly compacted.

Typical effects of liquefaction include:

- Loss of bearing strength—the ground can liquefy and lose its ability to support structures.
- Lateral spreading—the ground can slide down very gentle slopes or toward stream banks riding on a buried liquefied layer.
- Sand boils—sand-laden water can be ejected from a buried liquefied layer and erupt at the surface to form sand volcanoes; the surrounding ground often fractures and settles.
- Flow failures—earth moves down steep slope with large displacement and much internal disruption of material.
- Ground oscillation—the surface layer, riding on a buried liquefied layer, is thrown back and forth by the shaking and can be severely deformed.
- Flotation—light structures that are buried in the ground (like pipelines, sewers and nearly empty fuel tanks) can float to the surface when they are surrounded by liquefied soil.
- Settlement—when liquefied ground re-consolidates following an earthquake, the ground surface may settle or subside as shaking decreases and the underlying liquefied soil becomes more dense.

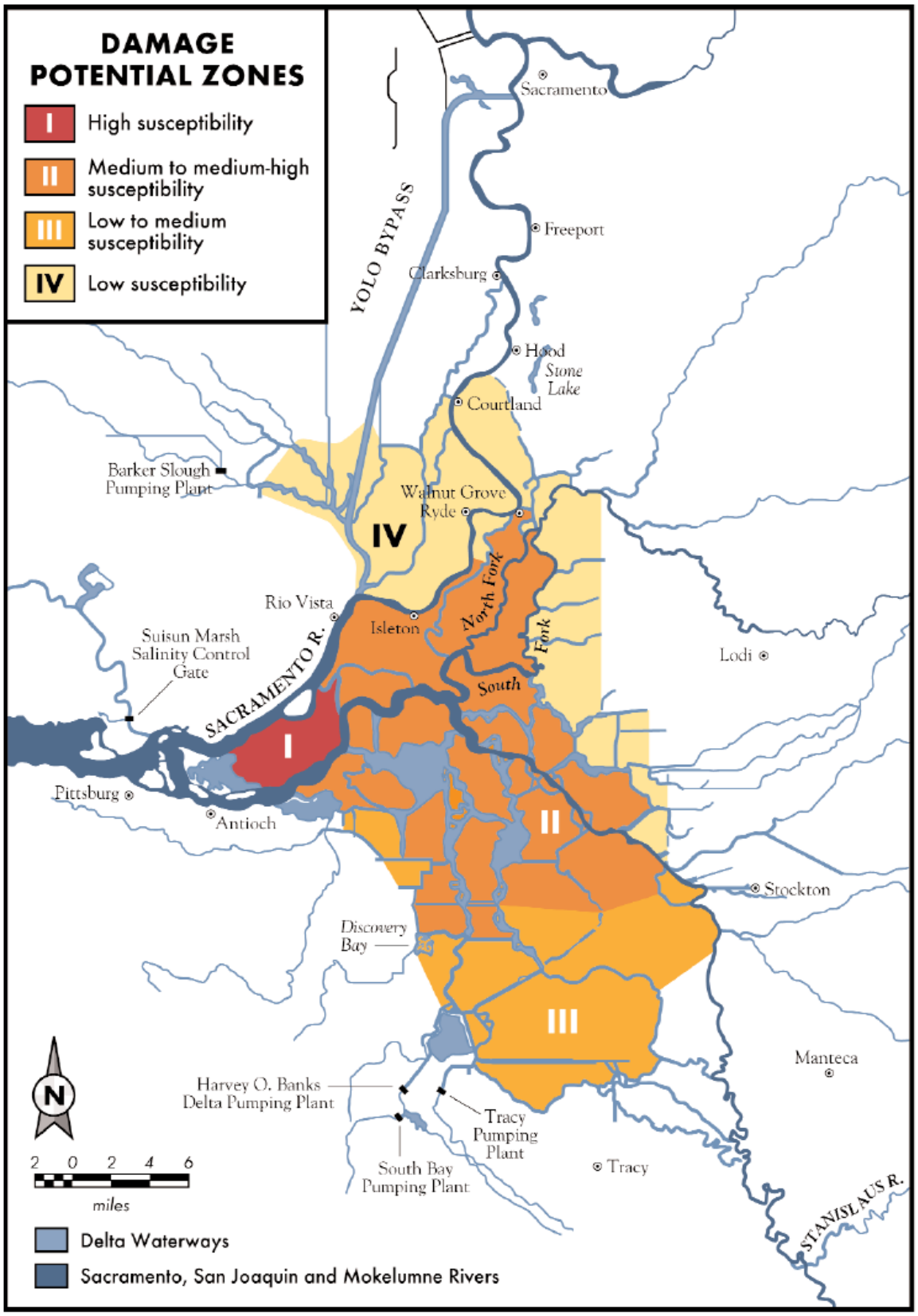
In Sacramento County, the Delta and areas of downtown Sacramento are at risk to liquefaction. The Delta sits atop a blind fault system on the western edge of the Central Valley. Moderate earthquakes in 1892 near Vacaville and in 1983 near Coalinga demonstrate the seismic potential of this structural belt. The increasing height of the levee system has prompted growing concern about the seismic stability of the levees. The concern is based on the proximity of faulting, the nature of the levee foundations, and the materials used to build the levees. Many levees consist of uncompacted weak local soils that may be unstable under seismic loading. The presence of sand and silt in the levees and their foundations indicates that liquefaction is also a possibility.

Although there have been no significant quakes in or closely adjacent to the Delta since high levees were originally constructed, there are at least five major faults within the vicinity of the Delta capable of generating peak ground acceleration values that would likely lead to levee failures. More information on earthquakes and the faults affecting the Sacramento County area can be found in Section 4.2.12.

A preliminary analysis of the risk of levee failure due to seismicity was prepared for the CALFED Levee System Integrity Program. Based on standard methods and local expertise, it was estimated the magnitude and recurrence intervals of peak ground accelerations throughout the Delta. Two competing fault models were evaluated for this study, producing a wide range of potential accelerations. Then, based on local knowledge and limited geotechnical information, Damage Potential Zones were established for the Delta

(Figure 4-36). The zones of highest risk lie in the central and west Delta where tall levees are constructed on unstable soils that are at high risk of settling or liquefaction during an earthquake.

Figure 4-36 Delta Area - Potential Damage Due to Liquefaction and Levee Collapse



This report estimated recurrence intervals for ground accelerations and the number of potential levee failures in each Damage Potential Zone. It is useful to examine their estimates of the number of failures that might occur during a 100-year event, or an event with a 0.01 probability of being equaled or exceeded in any given year. Based on their estimates, it is a roughly 50-50 chance that 5 to 20 levee segments will fail during a 100-year event in the Delta. This does not imply that 5 to 20 islands will flood, but just that 5 to 20 levee segments will fail. The loss of 5 to 20 levee segments in the Delta constitutes considerable and abrupt landscape change, since island flooding is likely to be widespread and persistent for a long period of time.

In sum, liquefaction may pose a serious threat to levees, especially as levees are built larger and higher to deal with continuing island subsidence. Levee failure, depending on the extent, could have disastrous effects on agriculture, natural gas supply, fisheries, and salt water intrusion of the San Francisco Bay. Water supply to California could be affected for years. A greater discussion of levee failure can be found in Section 4.2.15.

Past Occurrences

Disaster Declarations

There have been no disaster declarations due to earthquake based liquefaction.

NCDC Events

The NCDC does not track earthquakes.

HMPC Events

Sacramento County has two areas that have been suggested as posing potential liquefaction problems - the downtown area and the Delta. While there is little published geologic information on the liquefaction potential of Delta soils, a geological and seismological study in 1972 indicated that the Housing and Redevelopment Agency building site located downtown at the intersection of 7th and I Streets has a potential for liquefaction. This study also concluded that potential liquefaction problems may exist throughout the downtown area where loose sands and silts are present below the ground water table.

Although no historic examples of seismically induced levee failure are known in the Delta, the modern levee network has not been subjected to strong shaking. Levees were either smaller or non-existent in 1906 when the region was strongly shaken by the great San Francisco earthquake.

Likelihood of Future Occurrences

Occasional – Due to the presence of faults in the area, and the ever increasing height of levees protecting the Delta, there is concern that liquefaction could be a cause of levee failure. Embankment and foundation materials for most Delta levees are substandard, adding to the risk of failure during seismic events. The U.S. Geological Survey estimates that an earthquake of magnitude 6.7 or greater has a 62 percent probability of occurring in the San Francisco Bay Area between 2003 and 2032. Such an earthquake is

capable of causing multiple levee failures in the Delta Region which could result in fatalities, extensive property damage and the interruption of water exports from the Delta for an extended period of time.

4.2.14. Flood: 100/200/500-year

Hazard/Problem Description

Flooding is the rising and overflowing of a body of water onto normally dry land. History clearly highlights floods as one of the most frequent natural hazards impacting Sacramento County. Floods are among the most costly natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. A car will float in less than two feet of moving water and can be swept downstream into deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Floodwaters can transport large objects downstream which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be of critical importance to reduce life and safety impacts from any type of flooding.

Health Hazards from Flooding

Certain health hazards are also common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where cattle and other livestock are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e. coli and other disease causing agents.

The second type of health problem arises after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated

throughout the building and breathed in by the occupants. If a city or county water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

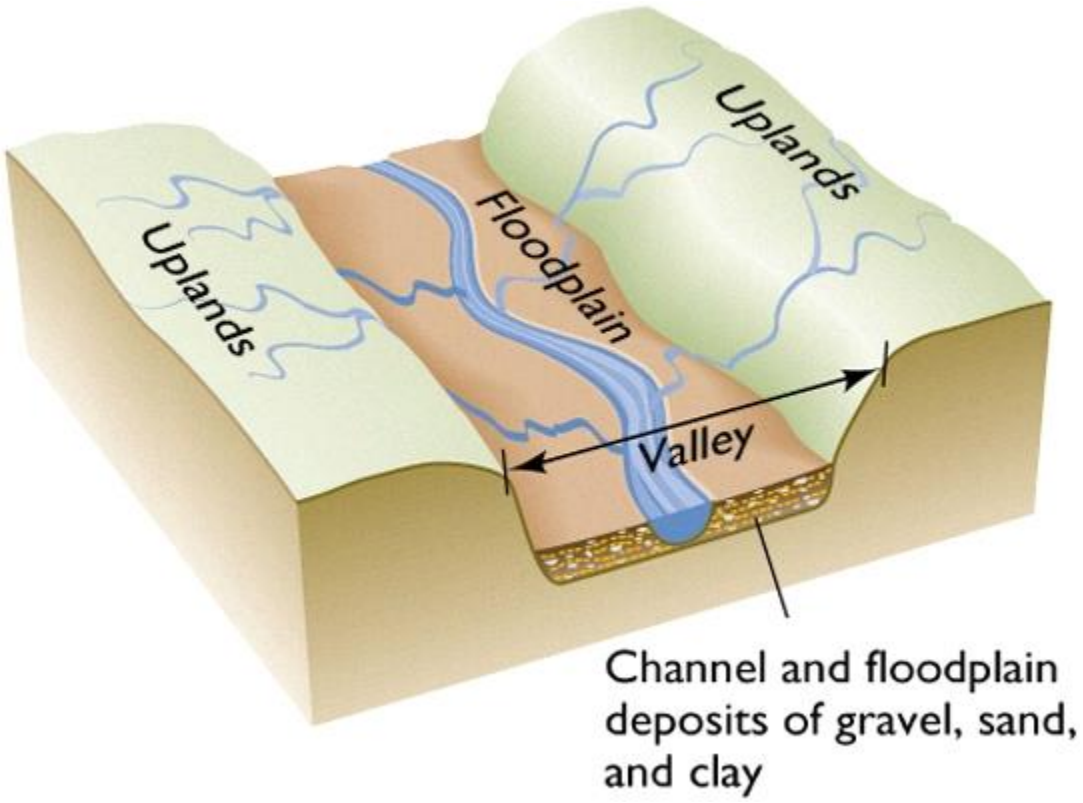
Warning and Evacuation Procedures

Sacramento County and its incorporated communities have a variety of systems and procedures established to protect its residents and visitors to plan for, avoid, and respond to a hazard event including those associated with floods and wildfires. This includes Pre-Disaster Public Awareness and Education information which is major component in successfully reducing loss of life and property in a community when faced with a potentially catastrophic incident. Much of this information is not specific to a given hazard event and is always accessible to the public on local County and City websites. Specific warning and evacuation systems and procedures include information relative to: Flood Forecasting (e.g., California Data Exchange Center), ALERT System, Warning Systems, dam protocols, evacuation procedures, and sheltering in place. Additional information on these warning and evacuation procedures as well as post-disaster mitigation policies and procedures can be found in Section 4.4, Capabilities, of this Risk Assessment and in the Emergency Management discussions in Appendix C.

Floodplains

The area adjacent to a channel is the floodplain (see Figure 4-37). Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Figure 4-37 Floodplain Schematic



Source: FEMA

The Sacramento County Planning Area is susceptible to various types of flood events as described below.

- **Riverine flooding** – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events.. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Sacramento County Planning Area, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection
- **Flash flooding** – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

- **Localized/Stormwater flooding** – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in Section 4.2.9 of this document; Levee failure flooding are discussed separately in Section 4.2.17 of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

Mercury in Waterways in Sacramento County

As a result of historical releases of mercury associated with gold mining in Sacramento County, as well as in areas throughout watersheds upstream of Sacramento County, mercury contamination is a significant hazard to County residents and visitors, as well as wildlife. The State Resources Agency, as well as Cal EPA and US EPA, have recognized this contamination. The Sacramento-San Joaquin Delta, the American River, Lake Natoma, and numerous water bodies that are tributaries to them, are designated through the Clean Water Act 303d listing process as impaired water bodies due to mercury levels found in fish that so high that they are hazardous both to the human population and to wildlife. Additional water bodies in and near Sacramento are likely to be added to the 303d list in the future due to mercury contamination. Fish consumption advisories developed by the State Dept. of Public Health and the Office of Environmental and Health Hazard Assessment warn people not to eat certain types of fish caught in these waters.

Various factors in the Sacramento region can affect the amount of mercury that enters the food chain and poses a hazard to human health and the environment. Some of these factors may be subject to some level of influence by human activity. Factors that affect the hazard caused by mercury include but are not limited nutrient levels, sediment transport, streambed modification, food chain and ecological effects, fish consumption practices, management of water levels, water exports and diversions, irrigation practices, salinity, oxygen concentrations, wetland restoration and management practices, flooding of Delta islands, dredging, reservoir management, stormwater and wastewater discharges and treatment processes, source control and pollution prevention activities, and levels of mercury in sediments, water bodies, and discharges.

Major Sources of Flooding

California has 10 hydrologic regions. Sacramento County sits in the Sacramento and San Joaquin hydrologic region.

- The Sacramento River hydrologic region covers approximately 17.4 million acres (27,200 square miles). The region includes all or large portions of Modoc, Siskiyou, Lassen, Shasta, Tehama, Glenn, Plumas, Butte, Colusa, Sutter, Yuba, Sierra, Nevada, Placer, Sacramento, El Dorado, Yolo, Solano, Lake, and Napa counties. Small areas of Alpine and Amador counties are also within the region. Geographically, the region extends south from the Modoc Plateau and Cascade Range at the Oregon border, to the Sacramento-San Joaquin Delta. The Sacramento Valley, which forms the core of the region, is bounded to the east by the crest of the Sierra Nevada and southern Cascades and to the west by the crest of the Coast Range and Klamath Mountains. The Sacramento metropolitan area and

surrounding communities form the major population center of the region. With the exception of Redding, cities and towns to the north, while steadily increasing in size, are more rural than urban in nature, being based in major agricultural areas.

- The San Joaquin River hydrologic region covers approximately 9.7 million acres (15,200 square miles) and includes all of Calaveras, Tuolumne, Mariposa, Madera, San Joaquin, and Stanislaus counties, most of Merced and Amador counties, and parts of Alpine, Fresno, Alameda, Contra Costa, Sacramento, El Dorado, and San Benito counties. Significant geographic features include the northern half of the San Joaquin Valley, the southern part of the Sacramento-San Joaquin Delta, the Sierra Nevada and Diablo Range. The region is home to about 1.6 million people.

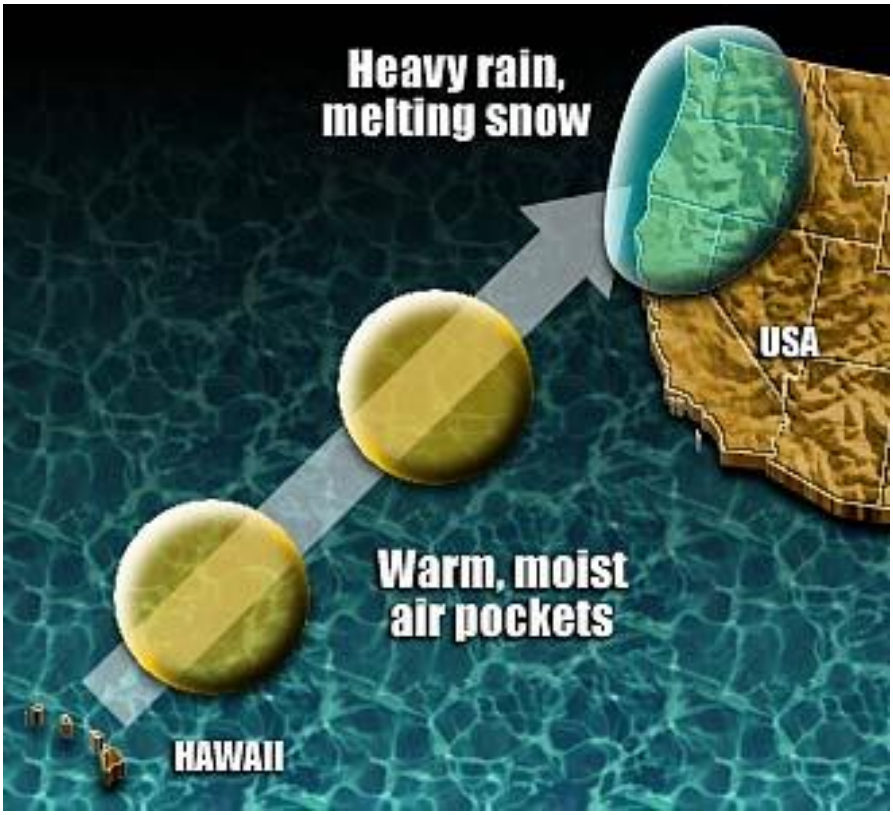
A map of the California's hydrological regions is provided in Figure 4-38.

Figure 4-38 California Hydrologic Regions

Source: California Department of Water Resources

A weather pattern called the "Pineapple Express" contributes to the flooding potential of the area. A pineapple express brings warm air and rain to West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snow pack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. This is shown in Figure 4-39.

Figure 4-39 Pineapple Express Weather Pattern



Source: USA TODAY research by Chad Palmer http://www.usatoday.com/weatherwpinappl.htm

The Sacramento County Waterway System

In the Sierra Nevada Mountains, small creeks and high streams are fed by underground springs, storm run-off, and melting snow. Descending from the upper watershed, these creeks and streams form large rivers such as the Sacramento, American, Feather, Yuba, San Joaquin, Mokelumne, and Consumnes. These waterways are characterized by: small river beds conveying normal flow from the mountains and wide overbank floodplains carrying flood flows cause by heavy mountain rainfall. The Sacramento River Watershed, which includes the American River, encompasses some 27,000 square mile and drains most of Northern California.

The watersheds of Sacramento County include numerous watersheds contained within the County as well as several watersheds that drain into Sacramento County from Placer, El Dorado, or Amador Counties. Figure 4-40 illustrates the watersheds of Sacramento County. Table 4-32 details the watersheds in Sacramento County.

Figure 4-40 Sacramento County Watersheds

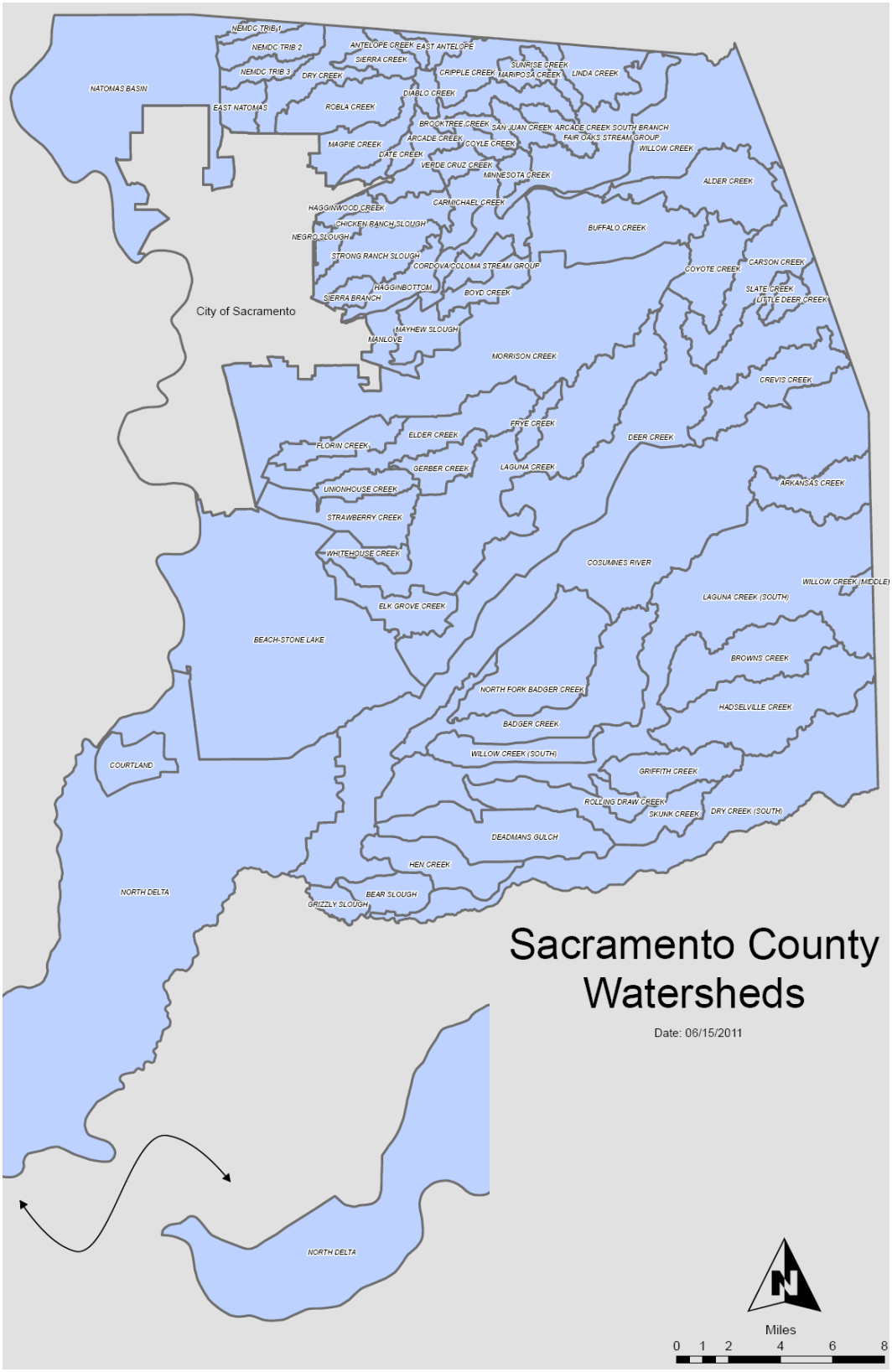


Table 4-32 Watersheds in Sacramento County

Watershed Name	Area (acres)	Watershed Name	Area (acres)
Alder Creek	7,226	Hadselville Creek	11,759
Antelope Creek	973	Hagginbottom	2,571
Arcade Creek	6,508	Hagginwood Creek	885
Arcade Creek South Branch	1,657	Hen Creek	4,759
Arkansas Creek	4,768	Laguna Creek	21,176
Badger Creek	11,109	Laguna Creek (South)	32,471
Beach-Stone Lake	40,118	Linda Creek	3,580
Bear Slough	2,699	Little Deer Creek	1,040
Boyd Creek	2,201	Magpie Creek	3,789
Brooktree Creek	1,180	Manlove	1,987
Browns Creek	8,077	Mariposa Creek	812
Buffalo Creek	9,167	Mayhew Slough	2,954
Carmichael Creek	2,726	Minnesota Creek	1,095
Carson Creek	6,811	Morrison Creek	34,502
Chicken Ranch Slough	3,722	Natomas Basin	26,449
Cordova/Coloma Stream Group	1,728	Negro Slough	285
Cosumnes River	45,130	NEMDC Trib 1	865
Courtland	3,099	NEMDC Trib 2	2,744
Coyle Creek	987	NEMDC Trib 3	1,567
Coyote Creek	4,625	North Delta	100,143
Crevis Creek	5,940	North Fork Badger Creek	10,423
Cripple Creek	4,327	Robla Creek	5,141
Date Creek	694	Rolling Draw Creek	1,128
Deadmans Gulch	8,641	San Juan Creek	1,334
Deer Creek	26,125	Sierra Branch	978
Diablo Creek	893	Sierra Creek	1,743
Dry Creek	4,138	Skunk Creek	6,744
Dry Creek (South)	20,158	Slate Creek	510
East Antelope	1,118	Strawberry Creek	5,588
East Natomas	1,816	Strong Ranch Slough	4,573
Elder Creek	7,632	Sunrise Creek	636
Elk Grove Creek	4,019	Unionhouse Creek	2,194
Fair Oaks Stream Group	7,819	Unnamed	51,157
Florin Creek	2,857	Verde Cruz Creek	1,226
Frye Creek	1,286	Whitehouse Creek	1,585

Watershed Name	Area (acres)	Watershed Name	Area (acres)
Gerber Creek	2,579	Willow Creek	15,207
Griffith Creek	4,806	Willow Creek (Middle)	359
Grizzly Slough	1,374	Willow Creek (South)	3,843

Source: Sacramento County GIS

Sacramento County encompasses multiple rivers, streams, creeks, and associated watersheds. Figure 4-41 illustrates the major waterways of Sacramento County. The following streams in Table 4-33, listed by stream groups, exist in Sacramento County.

Figure 4-41 Sacramento County Major Waterways

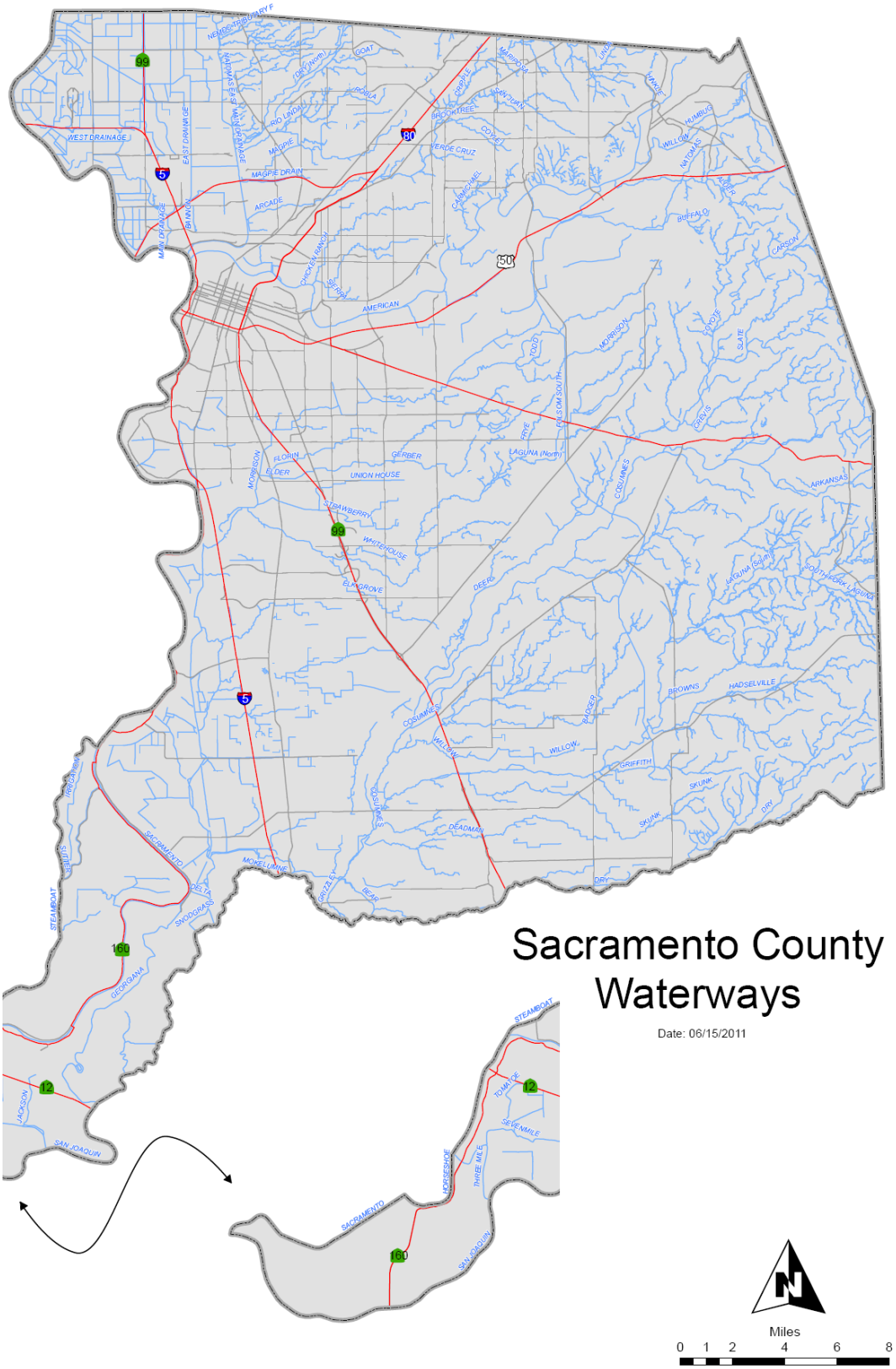


Table 4-33 Waterways and Streams in Sacramento County

Stream Group and Stream	
American River Stream Group	
American River	Magpie Creek
Arcade Creek	Mariposa Creek
Arcade Creek (South Branch)	Natomas East Main Drainage Canal
Brooktree Creek	Natomas East Main Drainage Canal Tributary 1
Carmichael Creek	Natomas East Main Drainage Canal Tributary 2
Chicken Ranch Slough	Natomas East Main Drainage Canal Tributary 3
Cripple Creek	Robla Creek
Coyle Creek	San Juan Creek
Dry Creek	Sierra Creek
Dry Creek (North Branch)	Strong Ranch Slough
Linda Creek	Verde Cruz Creek
Morrison Creek Stream Group	
Elder Creek	Morrison Creek
Elk Grove Creek	North Fork Laguna Creek
Florin Creek	Strawberry Creek
Gerber Creek	Unionhouse Creek
Laguna Creek	Whitehouse Creek
Laguna Creek Tributary 1	
Sacramento River And Delta Slough Group	
Georgiana Slough	Steamboat Slough
Sacramento River	Sutter Slough
Sevenmile Slough	Three Mile Slough
San Joaquin River Stream Group	
Delta Cross Canal	San Joaquin River
Mokelumne River	Snodgrass Slough
North Mokelumne River	
Natomas Area Stream Group	
Natomas East Drainage Canal	Deer Creek
Natomas Main Drainage Canal	Dry Creek
Natomas North Drainage Canal	Hadselville Creek
Natomas West Drainage Canal	Hen Creek
Arkansas Creek	Laguna Creek
Badger Creek	North Fork Badger Creek
Browns Creek	North Stone Lake Tributary

Stream Group and Stream	
Carson Creek	Skunk Creek
Cosumnes River	South Stone Lake-North Tributary
Cosumnes River Overflow	South Stone Lake-South Tributary
Crevis Creek	Willow Creek
Deadman Gulch	

Source: Sacramento County Flood Insurance Study, 2008

In Sacramento County, there are three main rivers, the Sacramento, American and Cosumnes Rivers. The Sacramento and American Rivers and several tributaries to the east, north, and west all flow toward the City of Sacramento. The watersheds of these two main rivers drain most of northern California and part of southern Oregon for a total of some 26,000 square miles. The third, the Cosumnes River, flows southwesterly through the southern portion of the County and into the Delta.

The Sacramento River extends north to Mount Shasta and the Shasta Reservoir. Many other rivers are tributary to the Sacramento, including (immediately north of Sacramento) the Bear and Feather Rivers. The American River extends to the Sierra Nevada foothills in three branches (South, North and Middle). Folsom Reservoir is at the eastern boundary of Sacramento County and serves to control the American River.

The Cosumnes River is a wild and natural river originating in the Sierra Nevada foothills, flowing into southern Sacramento County. This area is mostly rural farmland. Levees were constructed by agricultural interests, and they are inadequate for containing record storm flows such as those experienced in February 1986 and again in January 1997. These two storms left the levee system sorely damaged. Each time, the levee breaks were repaired, but the overall system sits in wait of another flood event.

Another river, the Mokelumne River is the southernmost river in the County and is controlled by a dam in the neighboring county and a series of levees.

All of the watersheds converge at the Sacramento River Delta, the flood issues in the Delta are of concern as the agricultural interests continue to farm the land which is subsiding annually, making the levee systems more vulnerable to breaching.

When the Sacramento River reaches its peak capacity, the American River and other tributaries that flow into the Sacramento River, cannot flow at a normal rate. These conditions result in “backflows’ which cause tributaries to overflow and flood local areas. The Sacramento River is also affected by ocean tides that periodically raise and lower the water level. High tides that occur simultaneously with flooding conditions could increase the rate of flooding.

All surface water originating in or passing through Sacramento County discharges to the ocean via the Sacramento and San Joaquin Rivers, which join at the head of Suisun Bay, the easternmost arm of San Francisco Bay. With a combined tributary drainage area of approximately 60,000 square miles, these rivers provide most of the freshwater inflow to San Francisco Bay.

High water levels along the Sacramento and American Rivers are a common occurrence in the winter and early spring months due to increased flow from storm runoff and snowmelt. An extensive system of dams,

levees, overflow weirs, drainage pumping plants, and flood control bypass channels strategically located on the Sacramento and American Rivers has been established to protect the area from flooding. These facilities control floodwaters by regulating the amount of water passing through a particular reach of the river. The amount of water flowing through the levee system can be controlled by Folsom Dam on the American River and the reserve overflow area of the Yolo Bypass on the Sacramento River. However, flood problems in Sacramento County are still quite a concern, especially since the flood of 1986. Numerous areas of the county are still subject to flooding by the overtopping of rivers and creeks, levee failures, and the failure of urban drainage systems that cannot accommodate large volumes of water during severe rainstorms. However, with the implementation of multiple improvements to the area's flood control structures, including those designed to provide a 200+ level of flood protection, flood risk is being reduced including the potential for devastating floods in the Planning Area.

High flows on the Cosumnes River are less frequent, as the river is essentially dam free and has little in the way of flow regulation. Flooding along the river, such as in 1997, has been due to high water coupled with the failure of non-standard, poorly constructed private levees.

The Sacramento County Flood Control System and Associated Flood Issues

Sacramento County is protected from the American River and Sacramento River by a comprehensive system of dams, levees, overflow weirs, and flood bypasses. Local creeks are often controlled by detention basins that attenuate peak flow by allowing flood water to spill over a weir, detained, and released when the creek subsides. Sacramento County maintains a system of ALERT Flood Warning gages throughout the County that provide real time monitoring information on current flood conditions (www.stormready.org).

In the aftermath of the 1986 and 1997 floods, multiple flood control projects were identified to address flood risks in the Sacramento area. Many of these projects were designed to correct structural deficiencies, others to address levee conditions, while additional projects were intended to increase the level of flood protection provided by the system. The Sacramento River improvements would focus predominantly on rehabilitating the existing system, while the American River required a significant increase in the system's flood control capacity.

Established in 1989, SAFCA is a regional joint-exercise-of-powers agency consisting of Sacramento and Sutter counties, the City of Sacramento, Reclamation District 1000, and the American River Flood Control District. SAFCA's long-term goal is to provide the urbanized portions of Sacramento with a minimum 200-year level of flood protection in order to reduce the risk of catastrophic damages and loss of life associated with a failure of the flood control system in the Sacramento area. SAFCA initiated a number of studies to determine the best implementable approach to address the area's flood problems. These flood control projects are in various stages of implementation; some have been completed, others are under construction, and a number are still being planned.

American River Flood Control System

The American River flood control system consists of the Folsom Dam, an auxiliary dam at Mormon Island, eight earth-filled dikes, Nimbus Dam, and levees on either side of the downstream river. The system

receives runoff from the American River watershed, which contains about 2,100 square miles of the western slope in the Sierra Nevada.

An initial reconnaissance report, "American River Investigation, January 1988" concluded that Folsom Dam and the American River levees were only capable of handling a 70-year flood event. Recommendations were to increase the carrying capacity of the American River below Nimbus Dam, modifying the Folsom Dam spillage, increasing storage capacity at Folsom Lake, and for greatest protection (200-year level), construct a new upstream storage facility. Immediately after the Folsom Dam was completed in 1956, a huge flood filled the reservoir, saving Sacramento. Recently, the dam protected the county from at least four potentially catastrophic floods in 1986, 1995, 1997, and 2005.

American River Common Features and Folsom Dam

SAFCA and the Central Valley Flood Protection Board (CVFPB), working with USACE, identified an American River project to address the low level of flood protection provided by the existing system. Unable to gain support for construction of an expandable flood control dam near Auburn, SAFCA identified a series of American River Common Features and Folsom Dam improvement projects. The Common Features projects focused on the identification of features that were "common" to any project associated with controlling flood flows at Folsom Dam. These projects focused on the conveyance of higher flood flows through the leveed portion of the American River. Once completed, these improvements, along with additional American River improvement projects described below, allow passage of 160,000 cfs through the American River levee system. The Folsom Dam Raise and Auxiliary Spillway Project identified an auxiliary spillway alternative with a 3.5 foot dam raise that would provide at least a 200-year level of protection for the community.

American River-Related Projects

Additional projects have significantly improved the capacity and flows of the American River levee system. These include:

- Mayhew levee Improvements – This entailed raising and widening the levee and constructing a slurry wall, providing for 160,000 cfs to pass and providing 100-year level of protection. The Mayhew Drain Closure Structure project completed in 2009 prevents water from the American River from backing up the drain and putting additional strain on drain levees.
- Upper Levee Slope Protection – Levee slope protection measures were implemented in the area between Cal Expo to Rio Americano High School, the narrowest portion of the American River Parkway to prevent high scour velocities on the upper face of the levee during flood events.
- Slurry Wall Construction – Approximately 23 miles of slurry walls were constructed to prevent underseepage from affecting the levee foundation due to sand layers under the levee.
- Bank Protection – Portions of the American River are subject to extremely high velocities during a major flood event, eroding banks and levee toes, leading to levee failure. Several projects have been completed preserving levee integrity and providing additional protection during floods.
- Regional Sanitation Perimeter Levee – In order to protect the regional sanitation plan from flooding, a perimeter levee was required.

The Sacramento River Flood Control System

The Sacramento River flood control system consists of the several dams including Shasta and Oroville (on the Feather River), the Fremont Weir, Sacramento Weir, Yolo Bypass, and levees along the Sacramento River, and the Sacramento Bypass Channels. The Corps report "Sacramento River System Evaluation, June 1988" revealed that levees on both the Sacramento and American Rivers have inadequate freeboard and/or stability problems.

Sacramento River Projects

Several projects have been identified to rehabilitate the existing flood control system and work towards providing a minimum of 200-year level of flood protection in the urbanized portions of the Sacramento County Planning Area. Key projects include:

- Sacramento Urban Area Levee Reconstruction Project (SUALRP) – This project addressed through-levee seepage problems (ie., landside sloughing of the levee in Natomas and seepage boils along the landside toe in the Pocket) within the Sacramento River Flood Control System (SRFCS) due to porous levee materials and poor compaction. This project improved flood protection but did not increase the design level of flood protection.
- The Sacramento Riverwall - A project feature of the SRFCS, is a concrete floodwall adjacent to old Sacramento. Due to erosion issues on the waterside toe and design deficiencies found with original construction, reconstruction of the Riverwall was addressed and improves flood protection to Old Sacramento, downtown, and portions of Interstate 5.
- Levee Slump on Garden Highway south of I-6 – To correct settling in an area of the levee near an agricultural well, a Slurry cutoff wall was constructed to prevent levee seepage and to raise the levee back to its original height. This seepage fix was designed to provide 200-year level of protection.
- Little Pocket and Sump 132 Underseepage Remediation – This project entailed construction of an approximately 2,400 feet of a levee underseepage cutoff wall in the Little Pocket area and 400-feet of levee underseepage cutoff wall construction at Sump 132 in the Pocket area. To address know underseepage problems. The project was designed to protect against the 200-year storm event.
- Pocket Underseepage – Reach 2 and Reach 9 – This project entailed construction of an approximately 2,500 feet of cutoff wall to address underseepage issues. Completion of this project along with erosion repairs provided a minimum of 100-year level of flood protection.
- Sacramento River Bank Protection Program (Sac bank) – this is an ongoing effort to address systematic erosion issues along the Sacramento River and its tributaries, including the American River. Erosion, primarily caused by high water events, which lead to scour and high bank erosion and summer boat traffic, which creates wave induced erosion at the levee toe.
- Pioneer Reservoir – Pioneer Reservoir is located along the Sacramento River just upstream of the California Auto Museum. This project constructed a seepage berm and six relief wells to address high seepage pressures in the area.

South Sacramento Streams Group (SSSG)

USACE, in cooperation with SAFCA and the City and County of Sacramento completed a study of alternatives, including both upstream detention and modifications to the downstream levee system. Results of the study supported work to be done to the existing Morrison Creek levees as well as to the Unionhouse,

Florin, and Elder Creek levees. The County is also collecting development impact fees from upstream developers, which will be used to build detention basins to hold the additional run-off generated as new development occurs.

The Morrison Creek System

In 1987, the USACE in a study concluded that the levees and channels lacked adequate capacity to handle the 100-year storm. In 2005, USACE completed construction of nearly four miles of levee from Freeport Boulevard/Sacramento River Levee on the west to the Union Pacific Railroad to the east, raising the existing levee system to protect against a 200-year storm. USACE also constructed floodwalls along the four creeks (Elder, Unionhouse Florin, and Morrison) up to Franklin Boulevard.

Unionhouse Creek Channel Improvements

Channel improvements completed in 2012 increased the amount of water that can be contained I the channel, resulting in 100-year flood protection.

Florin Creek Improvements

Channel improvements in this area, combined with plans to construct a detention basin along Florin Creek will provide FEMA level of flood protection along much of Florin Creek.

The Natomas Area

After the 1986 flood demonstrated the inadequacy of the levee system in this area, efforts ensued to implement a series of levee improvements and other flood control improvements designed to address through-levee seepage and work in tandem with increased storage on the American River to provide affected areas with increased flood protection. This project provided a minimum 100-year level of flood protection to the Natomas Basin and to the lower Dry and Arcade Creek watersheds, including portions of Rio Linda and North Sacramento.

A huge development effort followed including residential in the incorporated City and commercial/industrial in the unincorporated County of Sacramento. The Natomas area includes about 70,000 residents, both Interstates 5 and 80, Sacramento Airport, and significant commercial and industrial development. Natomas is protected from flooding by levees on all sides. Some believe Natomas to be threatened by high probability flood events, but the fact remains that the area has never suffered a levee breach.

December 2008, FEMA remapped the Natomas Area as not having protection from the 1% annual recurrence flood event, and SAFCA kicked off a massive effort to improve the levees. SAFCA's efforts have been to restore at a minimum a 100-year level of protection, while working toward 200-year level of protection.

The Delta Region

The Delta Region lies within a floodplain and is faced with a major flooding problem because of inadequate levee construction and maintenance, subsidence, seepage, erosion and seismicity. Flood fighting has occurred in some part of the Delta on the average of once every four years. While most of the Delta levees in Sacramento County have stood the test of time, they defy engineering logic. Their foundations are soft and uncertain, they have a great deal of vegetation including large trees, and they suffer erosion and sloughing due to river velocity and wind wave wash. Nevertheless, they have served the county very well over many years.

The Delta Islands are subsiding due to lower groundwater, aeration of peat soils, and loss of soil to wind. While some believe the rate has been curbed over the past years due to conservation protocols, the fact is that some islands are 15' below sea level. The levees work much harder than they did a hundred years ago.

Some of the Delta levees essentially serve as a dam repressing hydrostatic pressure every day of the year. This leads some researchers to conclude that the potential for catastrophic failure of the Delta levees due to a seismic event has a concerning probability.

Ongoing and Planned Improvements to the Existing Flood Control Systems

There are currently six federally authorized projects that are being implemented to reduce flood risk to the Sacramento area:

- Natomas Levee Improvement Project
- American River Common Features
- Folsom Dam Modifications/Join Federal Project
- Folsom Dam Raise project
- South Sacramento Streams Group Project
- Sacramento River Bank Protection Program

Other ongoing projects include:

- SAFCA levee accreditation for FEMA level of protection
- Regional planning as part of the Central Valley Flood Protection Plan
- USACE-CVFPB-SAFCA General Reevaluation Report (GRR) planning for 200-year flood protection for Sacramento area
- SAFCA and local community plan development for 200-year flood protection to meet state requirements for urban Level of Protection and Urban Levee design Criteria.

Details on these projects are provided in Section 4.4.1, Capabilities.

Sacramento County Flood Mapping and Flood Protection Measures

As part of the County's ongoing efforts to identify and manage their flood prone areas, Sacramento County relies on a variety of different mapping efforts. What follows is a brief description of FEMA and State of California DWR mapping efforts and related flood protection measures covering the Sacramento County Planning Area.

FEMA Floodplain Mapping

FEMA established standards for floodplain mapping studies as part of the National Flood Insurance Program (NFIP). The NFIP makes flood insurance available to property owners in participating communities adopting FEMA-approved local floodplain studies, maps, and regulations. Floodplain studies that may be approved by FEMA include federally funded studies; studies developed by state, city, and regional public agencies; and technical studies generated by private interests as part of property annexation and land development efforts. Such studies may include entire stream reaches or limited stream sections depending on the nature and scope of a study. A general overview of floodplain mapping is provided in the following paragraphs. Details on the NFIP and mapping specific to the County and participating jurisdictions are in Section 4.3 Vulnerability Assessment and in the jurisdictional annexes.

Flood Insurance Study (FIS)

The FIS develops flood-risk data for various areas of the community that will be used to establish flood insurance rates and to assist the community in its efforts to promote sound floodplain management. The current Sacramento County FIS is dated June 16, 2015. This study covers both the unincorporated and incorporated areas of the County.

Flood Insurance Rate Map (FIRM)

The FIRM is designed for flood insurance and floodplain management applications. For flood insurance, the FIRM designates flood insurance rate zones to assign premium rates for flood insurance policies. For floodplain management, the FIRM delineates 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analysis and local floodplain regulation. The County FIRMs have been replaced by digital flood insurance rate maps (DFIRMs) as part of FEMA's Map Modernization program, which is discussed further below.

Letter of Map Revision (LOMR) and Map Amendment (LOMA)

LOMRs and LOMAs represent separate floodplain studies dealing with individual properties or limited stream segments that update the FIS and FIRM data between periodic FEMA publications of the FIS and FIRM.

Digital Flood Insurance Rate Maps (DFIRM)

As part of its Map Modernization program, FEMA is converting paper FIRMS to digital FIRMs, DFIRMS. These digital maps:

- Incorporate the latest updates (LOMRs and LOMAs);
- Utilize community supplied data;
- Verify the currency of the floodplains and refit them to community supplied basemaps;
- Upgrade the FIRMs to a GIS database format to set the stage for future updates and to enable support for GIS analyses and other digital applications; and
- Solicit community participation.

DFIRMs for Sacramento County have been developed. The most recent DFIRMs, dated June 16, 2015, was used for the flood analysis for this LHMP Update.

Mapping of Levees

Also as part of FEMA's Map Modernization program, FEMA is mapping levees within communities, with a primary focus on maps determined to provide a 100-year level of flood protection.

In August of 2005, FEMA Headquarters' issued Memo 34 Interim Guidance for Studies Including Levees. This memo recognizes the risk and vulnerability of communities with levees. The memo mandates the inclusion of levee evaluations for those communities that are undergoing map changes such as the conversion to DFIRMs. No maps can become effective without an evaluation of all levees within a community against the criteria set forth in 44 CFR 65.10 Mapping of Areas Protected by Levee Systems. Generally, these levee certification requirements include evaluations of freeboard, geotechnical stability and seepage, bank erosion potential due to currents and waves, closure structures, operations and maintenance, and wind wet and wave run-up. In short, these guidelines require certification of levees before crediting any levee with providing protection from the 1 percent annual event (e.g., the 100-year flood).

In Sacramento County similar to other locations in California, levees and flood control facilities have been built and are maintained variously by public and private entities, including water, irrigation and flood control districts, other state and local agencies, and private interests. Some of these facilities were constructed with flood control as secondary or incidental to their primary purpose, so are not considered as providing protection from the 100-year or greater flood. Levees in the County are discussed in Section 4.2.17 of this plan.

Other Floodplain Maps and Measures: Department of Water Resources

Also to be considered when evaluating the flood risks in Sacramento County are various floodplain maps and measures implemented by the California Department of Water Resources (DWR) for various areas throughout California, and in the Sacramento-San Joaquin Valley cities and counties.

DWR Flood Awareness Maps

The Flood Awareness Maps, developed under the Flood Awareness Mapping Project, are designed to identify all pertinent flood hazard areas by 2015 for areas that are not mapped under the FEMA NFIP and to provide the community and residents an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. The awareness maps identify the 100-year flood hazard areas using approximate assessment procedures. The floodplains are shown on these maps simply as flood prone areas without specific depths and other flood hazard data. The Flood Awareness Maps can be accessed online at: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/awareness_floodplain_maps/. These maps are included in the levee profile in Section 4.2.17.

State Flood Protection Measures

Senate Bills (SB) 5 and 17 and Assembly Bills (AB) 5, 70, 156, and 162 (Legislation) were signed into law in 2007 to address flood problems, direct use of bond funds, and support local land-use planning. As part

of this Legislation, DWR was required to develop a Central Valley Flood Protection Plan (CVFPP). The CVFPP was adopted in 2012 and will be updated every 5 years. In 2012, SB1278 and AB1965 were enacted, revising provisions related to planning and zoning for flood protection.

In accordance with this legislation, communities will be required to make findings related to an urban level of flood protection as stipulated in California Government Code Sections 65865.5, 65962, and 66474.5, using criteria consistent with, or developed by DWR after July 2016. DWR has developed draft criteria, Urban Level of Flood Protection (ULOP) (November 2013).

The ULOP requires a minimum urban level of 200-year flood protection before a community can issue a building permit or approve a parcel map. This requirement affects areas in the Sacramento-San Joaquin Valley where flood depths are anticipated to exceed three feet and are in a watershed greater than 10 square miles for the 200-year flood event. If a ULOP plan is in place to reach 200-year flood protection and adequate progress is shown annually, then these requirements can be delayed until 2025.

The Legislation also requires DWR to propose updated requirements to the California Building Standards Code for adoption and approval by the California Building Standards Commission. These requirements apply to construction in the Sacramento and San Joaquin valleys, where flood levels are anticipated to exceed three feet for a 200-year flood event.

California Department of Water Resources Best Available Maps (BAM)

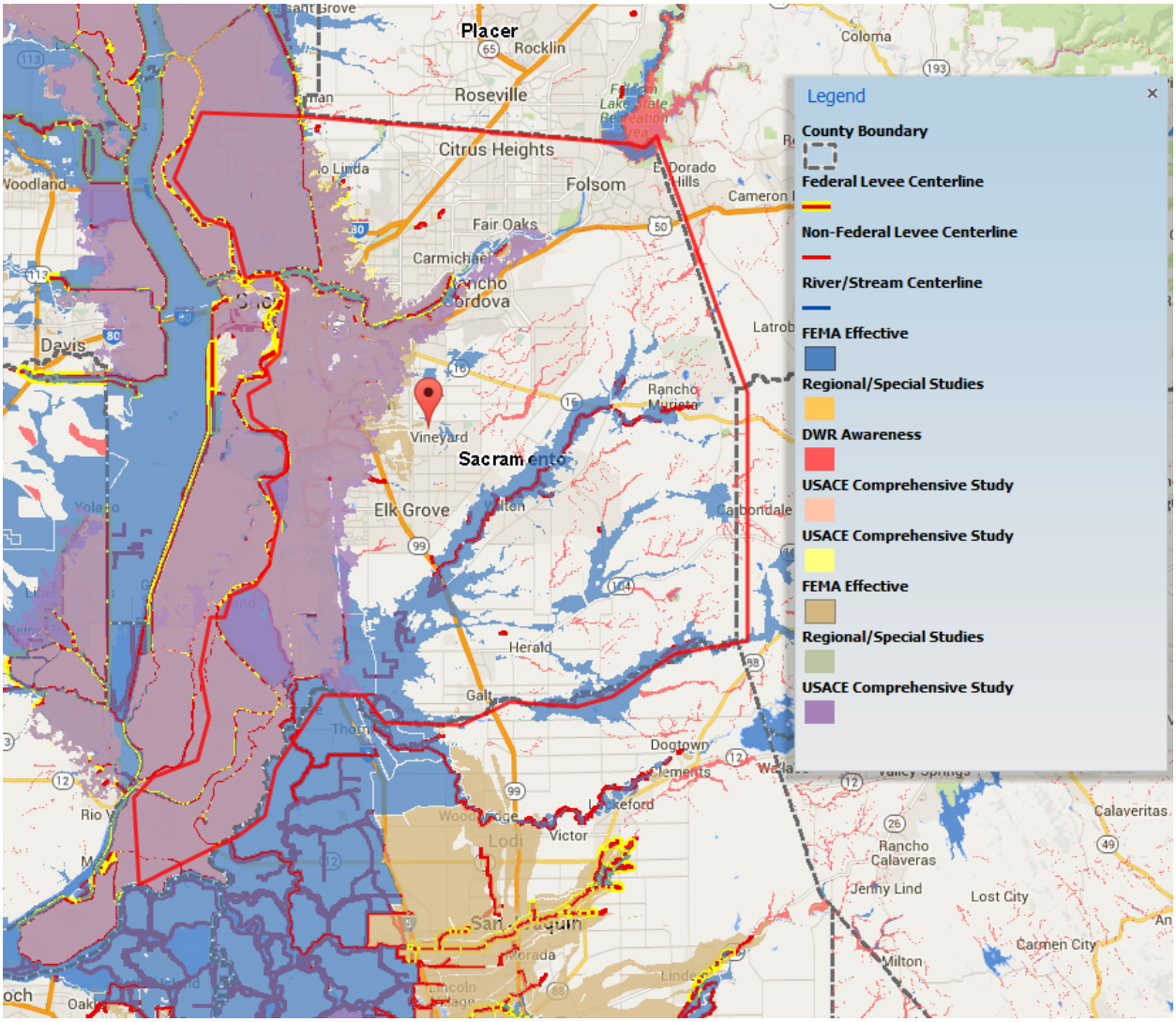
The FEMA regulatory maps provide just one perspective on flood risks in Sacramento County. Senate Bill 5 (SB 5), enacted in 2007, authorized the California DWR to develop the Best Available Maps (BAM) displaying 100- and 200-year floodplains for areas located within the Sacramento-San Joaquin (SAC-SJ) Valley watershed. SB 5 requires that these maps contain the best available information on flood hazards and be provided to cities and counties in the SAC-SJ Valley watershed. This effort was completed by DWR in 2008. DWR has expanded the BAM to cover all counties in the State and to include 500-year floodplains.

Different than the FEMA DFIRMs which have been prepared to support the NFIP and reflect only the 100-year event risk, the BAMs are provided for informational purposes and are intended to reflect current 100-, 200-, and 500-year event risks using the best available data. The 100-year floodplain limits on the BAM are a composite of multiple 100-year floodplain mapping sources. It is intended to show all currently identified areas at risk for a 100-year flood event, including FEMA's 100-year floodplains. The BAM are comprised of different engineering studies performed by FEMA, Corps, and DWR for assessment of potential 100-, 200-, and 500-year floodplain areas. These studies are used for different planning and/or regulatory applications. They are for the same flood frequency, however, they may use varied analytical and quality control criteria depending on the study type requirements.

The value in the BAMs is that they provide a bigger picture view of potential flood risk to the Sacramento County Planning Area than that provided in the FEMA DFIRMs. This provides the community and residents with an additional tool for understanding potential flood hazards not currently mapped as a regulated floodplain. Improved awareness of flood risk can reduce exposure to flooding for new structures and promote increased protection for existing development. Informed land use planning will also assist in identifying levee maintenance needs and levels of protection. By including the FEMA 100-year floodplain,

it also supports identification of the need and requirement for flood insurance. Figure 4-42 shows the BAM for the Sacramento County Planning Area. BAM maps for each jurisdiction are included in their respective annexes.

Figure 4-42 Sacramento County Planning Area – Flood Awareness (Best Available) Map



Source: California DWR

Central Valley Floodplain Evaluation and Delineation Maps (CVFED)

CVFED maps, required by Senate Bill 5, represent 100- and 200- year floodplains for urban and urbanizing areas within the Sacramento-San Joaquin Valley watershed. These maps are being developed based on more detailed hydrologic and hydraulic information, topographic data, and levee evaluations. CVFED maps are still in the development stage.

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations turned up multiple events. Most of the disaster declarations in the County have been related to flooding. Of the 17 federal declarations in the County, 12 were for flood. Of the 11 remaining state declarations, 8 were for flood. Many disasters in the Severe Weather: Heavy Rains profile in Section 4.2.5 also resulted in flood declarations.

NCDC Events

The NCDC tracks flooding events for the County. Events have been tracked for flooding since 1993. Table 4-34 shows events in Sacramento County since 1993. Events with damages, deaths, or injuries are detailed below the table. USDA Secretarial Disaster Declarations associated with drought are included in Table 4-21 in Section 4.2.7.

Table 4-34 NCDC Flood Events in Sacramento County 1993 to 12/31/2015

Date	Event	Deaths (direct)	Injuries (direct)	Property Damage	Crop Damage	Injuries (indirect)	Deaths (indirect)
1/2/1997	Flash Flood	1	0	$2400000	$0	0	0
1/22/1997	Flash Flood	0	0	$1500000	$0	0	0
1/26/1997	Flash Flood	0	0	$500000	$0	0	0
1/26/1997	Flash Flood	0	0	$0	$0	0	0
12/12/1996	Flood	0	0	$0	$0	0	0
1/1/1997	Flood	0	0	$0	$0	0	0
1/1/1997	Flood	0	0	$0	$0	0	0
2/2/1998	Flood	0	0	$0	$0	0	0
2/2/1998	Flood	0	0	$0	$0	0	0
2/2/1998	Flood	0	0	$4,300,000	$7,800,000	0	0
2/2/1998	Flood	1	0	$0	$0	0	0
2/7/1999	Flood	0	0	$0	$0	0	0
2/9/1999	Flood	0	0	$0	$0	0	0
1/23/2000	Flood	0	0	$25,000	$0	0	0
1/23/2000	Flood	0	0	$0	$0	0	0
1/23/2000	Flood	0	0	$0	$0	0	0
1/23/2000	Flood	0	0	$0	$0	0	0
1/23/2000	Flood	0	0	$0	$0	0	0
1/23/2000	Flood	0	0	$0	$0	0	0
1/30/2000	Flood	0	0	$0	$0	0	0
2/10/2000	Flood	0	0	$0	$0	0	0
2/11/2000	Flood	0	0	$0	$0	0	0

Date	Event	Deaths (direct)	Injuries (direct)	Property Damage	Crop Damage	Injuries (indirect)	Deaths (indirect)
2/11/2000	Flood	0	0	$0	$0	0	0
2/11/2000	Flood	0	0	$0	$0	0	0
2/22/2000	Flood	0	0	$0	$0	0	0
2/26/2000	Flood	0	0	$0	$0	0	0
1/1/2006	Flood	0	0	$4,500,000	$0	0	0
12/2/2012	Flood	0	0	$0	$0	0	0
5/6/2013	Flood	0	0	$0	$0	0	0
12/3/2014	Flood	0	0	$1,000	$0	0	0
12/3/2014	Flood	0	0	$0	$0	0	0
12/3/2014	Flood	0	0	$0	$0	0	0
12/3/2014	Flood	0	0	$0	$0	0	0
Totals		**2**	**0**	**$6,578,000**	**$7,800,000**	**0**	**0**

Source: NCDC

January 2, 1997 – The heavy rains brought the Cosumnes River to record flows above designed limits for the protective levees. Twenty breaks occurred, with the largest near the town of Wilton in the southern end of the County. The surging floodwaters inundated 33,000 acres of cropland and 84 homes. Emergency workers effected several roof-top and car-top rescues by boat and helicopter. The single death occurred at the Cosumnes River bridge near the town of McConnel.

January 22, 1997 – Localized heavy rain brought Chicken Ranch Slough out of its banks, flooding the Arden-Arcade area of the city. At least 1,000 homes and apartment buildings were flooded.

January 26, 1997 – Heavy showers and thunderstorms moved over the metro area, re-flooding the neighborhoods surrounding Chicken Ranch Slough, which had just experienced flooding the previous 22nd. The flooding was higher and caused additional damage to 500 more homes.

February 2, 1998 – In Sacramento County, the Consumnes River threatened the town of Wilton, where levees broken by the January, 1997, flooding had not been repaired. Fortunately, flooding impact was minor.

January 23, 2000 – Persistent rains which measured for 34 continuous hours swelled Dry Creek over its banks in Rio Linda. Cherry Lane, 6th Street, as well as Curved Bridge Road were flooded. Twelve homeowners had water over their property. Two of them sustained interior flooding while another five sustained flooded garages. The Grant Joint Union High School District closed Rio Linda junior and senior high schools in fear that students wouldn't get home safely. Approximately 2,500 students were sent home early

January 1, 2006 – A series of warm winter storms brought heavy rain, mudslides, flooding, and high winds to Northern California. Levee overtopping, breaching, and river flooding occurred along the Feather and Sacramento mainstem rivers as well as along numerous smaller rivers, creeks, and streams. Several urban areas had significant street flooding. The Sacramento weir was opened for the first time since 1997 with

twenty gates opened. Transportation throughout the area was difficult during the course of the storms as airports were closed due to the high winds and major road closures resulted from flooding and mudslides. Interstate 80...the main artery between Sacramento and the San Francisco Bay area...was closed near Fairfield in Solano County for several hours due to severe flooding. Additionally, Interstate 80 eastbound between Sacramento and Reno, NV, was closed for more than a day due to a massive mudslide, as was both directions of U.S. Highway 50 between Sacramento and South Lake Tahoe.

December 3, 2014 – Heavy rain showers and thunderstorms brought record rainfall and flooding issues to portions of the Central Valley and foothills. There were 2 berm levees which failed in Tehama County, flooding over 200 homes and damaging farms and orchards. Significant traffic delays were caused by road flooding across interior Northern California. Snow levels remained above 7500 feet, so snowfall was limited to higher Sierra peaks and Lassen Peak. Watt Ave. and Roseville Rd. number 1 lane flooded with 2 feet of water due to clogged drain.

FIS Events

The latest Flood Insurance Study for Sacramento County was released on June 16, 2015. The following discussion is sourced from this discussion.

In urbanizing areas, flood problems are intensified because rooftops of homes and other structures, streets, driveways, parking lots, and other paved areas all decrease the amount of open land available to absorb rainfall and runoff, thus increasing the volume of water that must be carried away by streams. As indicated earlier, the northern portion of the county is urbanizing at a fairly rapid rate.

Native American legends and historical records indicate that at least nine major floods occurred in the Sacramento River basin during the 19th century. A great flood (described in Native American legend as having swamped the entire Sacramento River basin) occurred in 1805. Indians also described floods that occurred in 1825 and 1826 as widespread in the basin. Extensive flooding in northern California took place in 1839, 1840, 1847, 1849-1850, 1852, 1861-1862, 1881, and 1890. The flood of 1861-1862 was the largest known flood in Sacramento County.

One of the earliest reports of flooding in Sacramento County was the graphic account of Professor William H. Brewer of Yale University, who described the floods of January-March 1862 in the Sacramento area:

> *"Nearly every house and farm over this immense region is gone. There is such a body of water-250 to 300 miles long and 20 to 60 miles wide, the water ice cold and muddy--that the winds high waves which beat the farm houses in pieces… The new Capitol is far out in the water—the Governor's house stands as in a lake—churches, public buildings, private buildings, everything is wet or in water. Not a road leading from the city is passable, business is at a dead standstill,"*

Substantial flooding in the County also occurred in 1928, 1937, 1938, 1940, 1943, 1945, 1950, 1952, 1955, 1956, 1958, 1962, 1963, 1964-1965, 1967 and 1969, 1972, 1980, 1982, 1983 and 1997. Newspaper accounts, rainfall and stream gage records and previous studies, indicate that the City of Sacramento has experienced significant flooding in 1928, 1950, 1962, 1967, 1986 and 1997.

American River Stream Group Flooding

The American River near the City of Sacramento overflowed in 1928, causing extensive flooding in the River Park and Industrial Park areas on the south bank. In 1950, the American River inundated extensive areas on the north bank, including the area in the vicinity of Fulton Avenue and Fair Oaks Boulevard.

Floods on Dry Creek (American River Stream Group) have occurred with regularity since 1937. Flooding also occurred on Dry and Robla Creeks near the Natomas East Main Drainage Canal. The October 1962 floods on Dry and Robla Creeks spread from approximately 800 feet to approximately 1 mile wide. The flood of October 1962, was the largest that has been recorded at the Roseville gaging station, located on Dry Creek upstream of Sacramento County. Damage in the October 1962 flood, was on the order of approximately $50,000. The resultant high water was within 2 feet of the top of the levee on the southern side of Robla Creek and along the Magpie Creek diversion channel. Floodwaters from Magpie Creek bypassed the upper portion of the diversion levee and flowed into lower Magpie Creek. Similar, less-severe floods, occurred in 1955, 1958, February 1962, 1967, 1969, 1970 and 1973.

Other creeks in the American River Stream Group have floodplain boundaries similar to that of Dry Creek. In December 1955, Arcade Creek overflowed its banks, inundating portions of Del Paso Park as well as areas upstream along Winding Way and portions of the Hagginwood District downstream.

Floods occurred twice in 1962. The largest recent floods on Strong Ranch and Chicken Ranch Sloughs occurred in February 1962.The February 1962 floods caused inundation along Arcade Creek in the vicinity of Del Paso Park. The park and the Haggin Golf Course were flooded, and the floodwaters forced the closing of Roseville Road. Dry and Robla Creeks caused flooding in the vicinity of the Natomas East Main Drainage Canal where Rio Linda Boulevard was threatened. Laguna Creek spread out over its floodplain. No damage estimates are available; however, runoff was too large for the channels and bridges, resulting in local flooding. The capacity of the American River pumping plant was exceeded for a short time, and floodwaters backed up and inundated areas in the vicinity of the nearby sewage treatment plant.

The largest flood on Arcade and Cripple Creeks occurred in October 1962. A severe, early season rainstorm occurred in October 1962, resulting in widespread flooding in the City of Sacramento. Arcade Creek overflowed from Marysville Road to past Del Paso Park. Six families on Verno Street had to evacuate because the flood threat was particularly severe in this area. Damages were estimated at $10,000 along Arcade Creek. Excess floodwaters from Dry Creek flowed southerly along the eastern side of the Western Pacific Railroad to Robla Creek and the Magpie Creek Diversion. The resultant high water was within 2 feet of the top of the southern levee of the diversion. Portions of floodwaters from Magpie Creek bypassed the upper portion of the diversion's levee and flowed into Lower Magpie Creek, causing flooding in the area between Dry Creek Road and Raley Boulevard. Dry and Robla Creeks again spread out over their common floodplain near the Natomas East Main Drainage Canal. An estimated $50,000 in flood-related damages was caused by the flood on Dry Creek. Many of these damages were caused in areas along Dry Creek upstream of the City of Sacramento.

Flooding in January 1967 was less severe than flooding in 1962. Arcade Creek overflowed its banks upstream of the City of Sacramento and flooding in the city was restricted to minor inundation in Del Paso

Park. Flooding that occurred in February 1973 on Arcade Creek had a recurrence interval of approximately 10-percent annual chance flood. Dry and Robla Creeks, however, overflowed inside the city.

The most recent flooding on the American River occurred in February 1986. The peak flow during this flood has been estimated to exceed the current 1-percent annual chance flood peak of 115,000 cubic feet per second (cfs).

Morrison Stream Group Flooding

Large portions of the Morrison Creek Stream Group area in Sacramento County were flooded in 1952, 1955, 1958, 1962-64, 1966-67 and 1969. During the 1955 flood, overflow from the Cosumnes and Mokelumne Rivers caused inundation of the Beach-Stone Lake area, thus creating high backwater conditions on streams of the Morrison Creek Stream Group. Damage was estimated at $213,000 in the Morrison Creek Stream Group area as a result of the 1955 floods and at $204,000 from the 1958 flood.

In October 1962, the Morrison Creek Basin was again flooded. A local newspaper called the Fruitridge-Florin area "the worst hit," with water "up to the tops of doors on cars" (Sacramento Bee, 1962). Floodwaters escaped from Morrison Creek near the Sacramento Army Depot. This overflow, along with other overflows from Morrison Creek upstream of Stockton Boulevard, caused widespread inundation of a primarily residential area east of Stockton Boulevard from the City of Sacramento corporate limits north to Fruitridge Road. The Glen Elder section east of Stockton Boulevard and south of Elder Creek Road, was the most severely flooded portion in the Morrison Creek Stream Group area. Laguna, Elder, Florin and Unionhouse Creeks, also overflowed their banks during this flood, adding to the flood problems in the area. A total of $161,000 in flood related damages was estimated to have occurred in the entire Morrison Creek Stream Group area during the October 1962 flood.

In 1964, Morrison Creek flooded a large region west of the Western Pacific Railroad tracks and south of Meadowview Road. Laguna Creek flooded an area adjacent to the stream that extended for about six miles from near the City of Elk Grove westerly to the Union Pacific Railroad tracks. The 1964 flooding in the basin inundated about 7,700 acres and caused an estimated $156,000 in damages. The majority of flooding in January 1969, occurred on agricultural lands in the City of Sacramento, predominantly on lands that lay west of the Union Pacific Railroad (UPRR) tracks in the Beach-Stone Lakes area. Minor flood losses (principally to farmland, crops, and improvements) were incurred east of the Union Pacific Railroad tracks. Floodwaters covered approximately 10,500 acres, and damages were estimated at $159,000.

The Morrison Creek Stream Group experienced lesser flooding in 1967 and 1969. The estimated damage for 1969 was $159,000. Moderate agricultural damages estimated at $104,000 were caused by the 1966-67 flooding, even though more acres were flooded (approximately 8,070 acres), particularly on Laguna Creek which again overflowed into its floodplain, than during the flooding of 1963 and 1964.

In the Morrison Creek Stream Group Basin in Sacramento County, the most recent flooding occurred in February 1986. That flood had the largest peak flow recorded on Morrison Creek (slightly higher than the January 1982 peak flow). Both the 1982 and 1986 floods have recurrence intervals of approximately a 4-percent annual chance flood. The estimated damage for 1982 was $500,000. Flooding had also occurred in February 1973 and has a recurrence interval of approximately a 10-percent annual chance flood.

Detailed flood damage surveys were not conducted after the 1973, 1983, 1986 and 1997 floods. However, it is estimated that approximately $500,000 in damages occurred in 1983. Only negligible damages occurred during the February 1986 flood. Peak flows in the last ten years may have been higher partly because of channel improvement work, enlarged channel capacity, and levee construction by local interests in that period.

The severity of flooding on all the streams studied during the July 6, 1998, restudy in the City of Sacramento, is intensified by backwater conditions between stream systems. Floodwater elevations are increased in the lower portions of tributary streams due to the backwater effect from main streams reducing hydraulic gradients and flow-storage areas. During this time, there will be a high degree of coincidental 1-percent annual chance flood flows on all the study area waterways.

San Joaquin River Stream Group Flooding

Historically, flooding along the Mokelumne River has been caused by general rainstorms in late fall and winter, and by snowmelt runoff in spring and early summer. The effects of cloudburst storms on an area as large as the Mokelumne River basin is negligible.

Flooding on the detailed study reach of the Mokelumne River has occurred in 1907, 1909, 1911, 1914, 1921, 1925, 1928, 1937, 1950, 1952, 1955-1956, 1963, 1964, 1967, 1969 and 1970. The most disastrous flood was that of November 1950, which caused about $1.1 million in damages. The December 1955-January 1956 floodwaters caused an estimated $750,000 in damages. The flood of December 1964 is the largest of record on the Mokelumne River. However, due to the completion of Camanche Dam in April 1964, most damages in the later flood had been prevented. Contemporary accounts of floods on the Mokelumne River are essentially nonexistent. Streamflow recorded for the study reach of the Mokelumne River were begun in 1904.

Delta Flooding

The lower reaches/delta of the Sacramento and San Joaquin Rivers are under the influence of the tides. The most severe flood conditions in the delta would result when very high tides and large volume of stream outflow occur coincidentally, and strong onshore winds generate wave action. It should be noted that precipitation over the delta does not materially affect local flood conditions. More information about past occurrences of flooding in the Delta can be found in the levee failure discussion in Section 4.2.17.

Natomas Area Stream Group Flooding

Floods on the Cosumnes River occurred in 1950, 1955, 1958, 1962 and 1964, with the events of 1955, 1958 and 1964, being most severe. In 1958, an estimated 38,000 acres of land were inundated along the Cosumnes River and the lower portions of Dry, Deer, and Laguna Creeks. In 1964, an estimated 30,000 acres of land were inundated.

The higher elevation tributary area of the Dry Creek watershed, near the City of Galt, subject to snowfall is too small to generate snowmelt flooding. Snowmelt during a flood-producing rainstorm would not increase runoff significantly. Due to the largely rural nature of the Dry Creek floodplain, and because flood damage has been predominantly agricultural, historical floods have not been documented in much detail.

The earliest major flood flow of record, 13,200 cubic feet per second (cfs), approximately an 11.1-percent annual chance (9-year) flood, occurred on February 2, 1945. From high-water marks known to long-time residents of the area, an estimated flood flow of 18,700 cfs (approximately a 5.8-percent annual chance [17-year] flood) occurred in February 1936 and a flood flow estimated to be approximately 24,000 cfs (approximately a 2.9-percent annual chance [35-year] flood) occurred in March 1907.

In December 1955, a 17,000 cfs flow (approximately a 7.1-percent annual chance [14-year] flood) on Dry Creek resulted from approximately 7 inches of antecedent rainfall over the tributary drainage. Although there was no Dry Creek overflow into the City of Galt, there was flooding from Hen Creek in the west-central part of the city where water was nearly knee deep along Lois Avenue, and at the Myrtle Avenue-Palin Street and Myrtle Avenue-Oak Avenue intersections. Damage, however, was minor and floodwater receded within 1 day. On April 3, 1958, the largest flood of record, 24,000 cfs (approximately a 2.9-percent annual chance flood), occurred on Dry Creek. Although approximately 9,000 acres of land were flooded along the creek, there was no overflow into the City of Galt. Antecedent rainfall, which was 12.5 inches over a period of several days, had created very wet ground conditions that influenced the magnitude of runoff. Rainfall on January 31 and February 1, 1963, a total of approximately 32 percent of the normal annual precipitation over the Dry Creek drainage, resulted in a flow of 9,800 cfs (approximately a 20-percent annual chance [5-year] flood) on Dry Creek. A small dam at one end of the golf course, which was under construction on the south side of the City of Galt, was breached, and part of the facility was inundated for a short time. During the height of the storm, many streets in the City of Galt were submerged due to lack of adequate storm drainage. In December 1964, approximately 8,200 acres were flooded by Dry Creek; however, overflow near the City of Galt was limited to a portion of the golf course, which was caused when a low levee was overtopped. The flow recorded at the Dry Creek stream gage was 14,500 cfs (approximately a 10-percent annual chance flood). Antecedent rainfall was not significant.

The severity of two areas within the unincorporated areas where the high flow of floodwaters on some channels has a great impact (causing backwater conditions) on the hydraulic regimen of other channels. High flows on the Sacramento River generate backwater conditions on the lower reaches of the American River and the Cross Canal. The American River peak 1-percent annual chance flows induce backwater conditions in the lower reach of the Natomas East Main Drainage Canal. Coincidentally, high flows on the Natomas East Main Drainage Canal cause backwater conditions on the lower reaches of Arcade and Dry Creeks.

Other Flooding

The floodplain areas of Willow, Humbug, and Hinkle Creeks near the City of Folsom have little existing structural development. The current and past land uses have been agricultural and open space. A thorough search of records has not uncovered any record of past floods. No records have been kept due to the past and current land uses and short duration of flood flows. The flooding events have not been considered significant problems, and the flood damages have not been recorded.

HMPC Events

The HMPC noted an event in February of 1986. A resident in the area noted that flooding occurred in South Sacramento County. A 35-year flood event flooded 15,000 acres, including areas around I-5. I-5

was closed for 4 weeks and was under 3' of water in areas. Substantial damages to homes and businesses in the area. No deaths or injuries were reported.

Likelihood of Future Occurrence

Riverine flooding is the most significant natural hazard that Sacramento County faces. The Sacramento area has a good working knowledge of the 100-year flood, however, the statistical outlier flood is not as well quantified. Sacramento is not just at high risk of flooding, but is at low risk of catastrophic flooding.

In addition, there are many urban streams, channels, canals, and creeks that serve the drainage needs of the County. There is significant threat of flooding in large areas of the County from several of these streams. Many of these streams are prone to rapid flooding with little notice.

100-Year Flood

Occasional—The term "100-year flood" is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood that has a 1- percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time.

200/500-Year Flood

Unlikely—The 200- and 500-year flood is the flood that has a 0.5 and 0.2 percent chance of being equaled or exceeded in any given year respectively.

Climate Change and Flood

According to the CAS, climate change may affect flooding in Sacramento County. While average annual rainfall may decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. It is possible that average soil moisture and runoff could decline, however, due to increasing temperature, evapotranspiration rates, and spacing between rainfall events.

Preliminary Draft - Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP), Ascent Environmental 2016 Analysis

According to the 2016 Preliminary Draft CAP, climate change is likely to lead to changes in frequency, intensity, and duration of extreme precipitation events. Increases in annual temperature may result in earlier and more rapid melting of the Sierra Nevada snowpack, which could lead to increased surface water flow rates and flood magnitude and frequency in Sacramento County.

Sea Level Rise. Another climate change issue is sea-level rise. The average global sea level rose approximately seven inches during the last century. Assuming that sea-level changes along the California coast reflects global trends, sea levels along the coastline could rise by 10-18 inches from its 2000 levels by 2050 and 31 to 55 inches higher by the end of the Century. The Cal-Adapt tool depicts sea level rise projections and existing storm-related flooding events using a "bathtub model", which shows the consequences of a 100-year flood event combined with up to 55 inches of sea level rise without taking into account protective flood control structures and levees or the increased flood risk from wave run-up. Based

on this model a small portion of Sacramento County near the Delta is vulnerable to the influences of sea-level rise. Under current conditions, Cal-Adapt shows 171 acres inundated by the 100-year flood, with a 240 percent increase of up to 411 acres under a 55 inch sea level rise scenario. The area affected by sea level rise projections is determined to constitute only 0.1% of the County, which is largely undeveloped land containing wetlands on Delta islands. Although by land mass, Sacramento County is not predicted to be directly affected by sea-level rise, rising sea levels in the Sacramento-San Joaquin Delta may result in indirect effects associated with saltwater intrusion to the lower reaches of the Sacramento River. The level of salinity of the Delta and Sacramento River is dependent on several variables and fluctuates depending on the season, snowpack, tides, temperature, weather conditions, and human-related demand, thus it is difficult to predict the severity of saltwater intrusion into the Sacramento River as a result of sea-level rise. However, it would be expected that rising sea levels would introduce saltwater further upstream the Sacramento River reducing the quality of fresh water supply. It is further expected that the salt water intrusion from sea level rise would be limited to the lower reaches of the Sacramento River and would not affect the water quality of the Mokelumne, American, and Cosumnes rivers.

4.2.15. Flood: Localized Flooding

Hazard/Problem Description

Localized, stormwater flooding also occurs throughout the County. Urban storm drainpipes and pump station have a finite capacity. When rainfall exceeds this capacity, or the system is clogged, water accumulates in the street until it reaches a level of overland release. This type of flooding may occur when intense storms occur over areas of development.

According to Sacramento County, numerous parcels and roads throughout the County not included in the FEMA 100- and 500-year floodplains are subject to flooding in heavy rains. In addition to flooding, damage to these areas during heavy storms includes pavement deterioration, washouts, mudslides, debris areas, and downed trees. The frequency and type of damage or flooding that occurs varies from year to year, depending on the quantity of runoff.

Table 4-35 identifies the number of parcels and roads by watersheds affected by localized flooding throughout the unincorporated County. Parcels were identified by the County based on those parcels historically affected by localized flooding issues. Affected roads are estimated based on those roads fully within 50 feet of a parcel with historical flooding problems. Maps of these localized flooding areas are still under development by the County. The Watershed Master Plan included as an appendix to this LHMP also addresses these flood prone areas falling outside of the established 100- and 500-year floodplains.

Table 4-35 Unincorporated Sacramento County Localized Flooding Areas

Watershed	# of Parcels Affected	# of Road Segments Affected
Buffalo Creek	63	686
Morrison Creek	1,102	366
Chicken Ranch Slough	421	221
Cosumnes River	335	211

Watershed	# of Parcels Affected	# of Road Segments Affected
Laguna Creek	1042	202
North Delta	769	199
Linda Creek	379	199
Florin Creek	715	191
Arcade Creek	347	182
Fair Oaks Stream Group	197	172
Dry Creek	308	166
Strong Ranch Slough	196	153
Sierra Creek	93	149
Carmichael Creek	176	128
Robla Creek	320	126
Antelope Creek	187	107
Minnesota Creek	212	105
Deadmans Gulch	223	102
Alder Creek	19	88
North Fork Badger Creek	232	86
NEMDC Trib 3	137	78
East Natomas	158	69
Badger Creek	194	62
Elder Creek	149	58
Arcade Creek South Branch	83	58
Magpie Creek	56	58
Diablo Creek	11	49
Sierra Branch	70	48
NEMDC Trib 2	118	47
Strawberry Creek	168	46
East Antelope	111	46
Unionhouse Creek	47	46
Skunk Creek	81	45
Laguna Creek (South)	52	45
Beach-Stone Lake	123	44
Hen Creek	94	44
Gerber Creek	75	42
Cripple Creek	38	39
Hagginbottom	38	38
Verde Cruz Creek	19	38
Dry Creek (South)	66	37

Watershed	# of Parcels Affected	# of Road Segments Affected
Hagginwood Creek	49	37
Courtland	157	31
Griffith Creek	125	29
Mayhew Slough	18	25
Date Creek	48	23
Deer Creek	61	21
Boyd Creek	40	20
Willow Creek (South)	64	19
NEMDC Trib 1	41	17
San Juan Creek	24	16
Hadselville Creek	43	15
Frye Creek	22	12
Manlove	13	12
Negro Slough	11	12
Rolling Draw Creek	10	11
Willow Creek	15	8
Coyle Creek	9	7
Natomas Basin	0	5
Crevis Creek	4	4
Coyote Creek	26	3
Arkansas Creek	4	3
Carson Creek	13	2
Bear Slough	3	2
Brooktree Creek	3	2
Browns Creek	6	1
Cordova/Coloma Stream Group	1	1
Elk Grove Creek	0	1
Little Deer Creek	0	1
Grizzly Slough	0	0
Mariposa Creek	0	0
Slate Creek	0	0
Sunrise Creek	0	0
Whitehouse Creek	0	0
Willow Creek (Middle)	0	0
Total	**10,034**	**5,216**

Source: Sacramento County

Past Occurrences

Disaster Declaration History

There have been no disasters declarations related specifically to localized flooding in Sacramento County, beyond those identified in the 100/200/500-year flood hazard section above.

NCDC Events

There have been no NCDC localized flooding events in Sacramento County, beyond those identified in the 100/200/500-year Flood Hazard section above.

HMPC Events

The Planning Team for the County noted the following localized flooding events that have occurred in the County since 2011.

- 2011 Mar 24 – High winds & 1 – 1.5" rain. 90 service calls, most for plugged drains. 1 structure flooded.
- 2012 Nov 30 – Dec 3. – High winds & 4" -6" rain. 800 service calls w/ 474 drainage service requests. 24 Mobile homes flooded at Auburn Blvd. & 15 other structures Countywide.
- 2014 Feb 10 - 2.5" – 4.5" rain. 72 drainage service calls.
- 2014 Dec 2 – 4 – 1.1 -5.5" rain. 321 drainage service calls. No structural flooding. Watt Ave. and Roseville Rd. number 1 lane flooded with 2 feet of water due to clogged drain. Roadway flooding in Sacramento on southbound Highway 99 near Sutterville Rd. Water was as deep as car doors and traffic was backed up. I-80 at Watt Ave. Eastbound Underpass had significant flooding due to heavy rain and pump failure. This resulted in major traffic backup, lasting several hours during evening rush hour.
- 2014 Dec 11 -12 – 2.3" – 3.5" rain. 179 drainage service calls.
- 2015 Feb 5 -9 – 1"-3" rain. 47 drainage service calls.
- January 5th & 19th, 2016 – A cool winter storm brought moderate rain, 1-2 inches across the Valley, with ponding on roads and small stream rises. There was roadway flooding with partial lane blockage reported on I80 and also on US Highway 50.

Likelihood of Future Occurrence

Highly Likely— With respect to the localized, stormwater flood issues, the potential for flooding may increase as storm water is channelized due to land development. Such changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels. Urban storm drainage systems have a finite capacity. When rainfall exceeds this capacity or systems clog, water accumulates in the street until it reaches a level of overland release. With increasing urbanization of the Sacramento County planning area, combined with older infrastructure, this type of flooding will continue to occur during heavy rains. Based on historical data, localized, stormwater flooding events less severe than a 100-year flood and those outside of the 100-year floodplain occur frequently (on an annual basis) during periods of heavy rains.

Climate Change and Localized Flood

While average annual rainfall may decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century, increasing the likelihood of overwhelming stormwater systems built to historical rainfall averages. This makes localized flooding more likely.

4.2.16. Landslides and Debris Flows

Hazard/Problem Description

Landslides refer to a wide variety of processes that result in the perceptible downward and outward movement of soil, rock, and vegetation under gravitational influence. Common names for landslide types include slump, rockslide, debris slide, lateral spreading, debris avalanche, earth flow, and soil creep. Landslides may be triggered by both natural and human-induced changes in the environment that result in slope instability.

A landslide is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. Their secondary effects can be far-reaching; such as catastrophic flooding due to the sudden release of river water impounded by landslide debris or slope failure of an earthen dam.

Landslide problems can be caused by land mismanagement, particularly in mountain, canyon, and coastal regions. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Land-use zoning, professional inspections, and proper design can minimize many landslide, mudflow, and debris flow problems.

The susceptibility of an area to landslides depends on many variables including steepness of slope, type of slope material, structure and physical properties of materials, water content, amount of vegetation, and proximity to areas undergoing rapid erosion or changes caused by human activities. These activities include mining, construction, and changes to surface drainage areas.

Landslides often accompany other natural hazard events, such as floods, wildfires, or earthquakes. Landslides can occur slowly or very suddenly and can damage and destroy structures, roads, utilities, and forested areas, and can cause injuries and death.

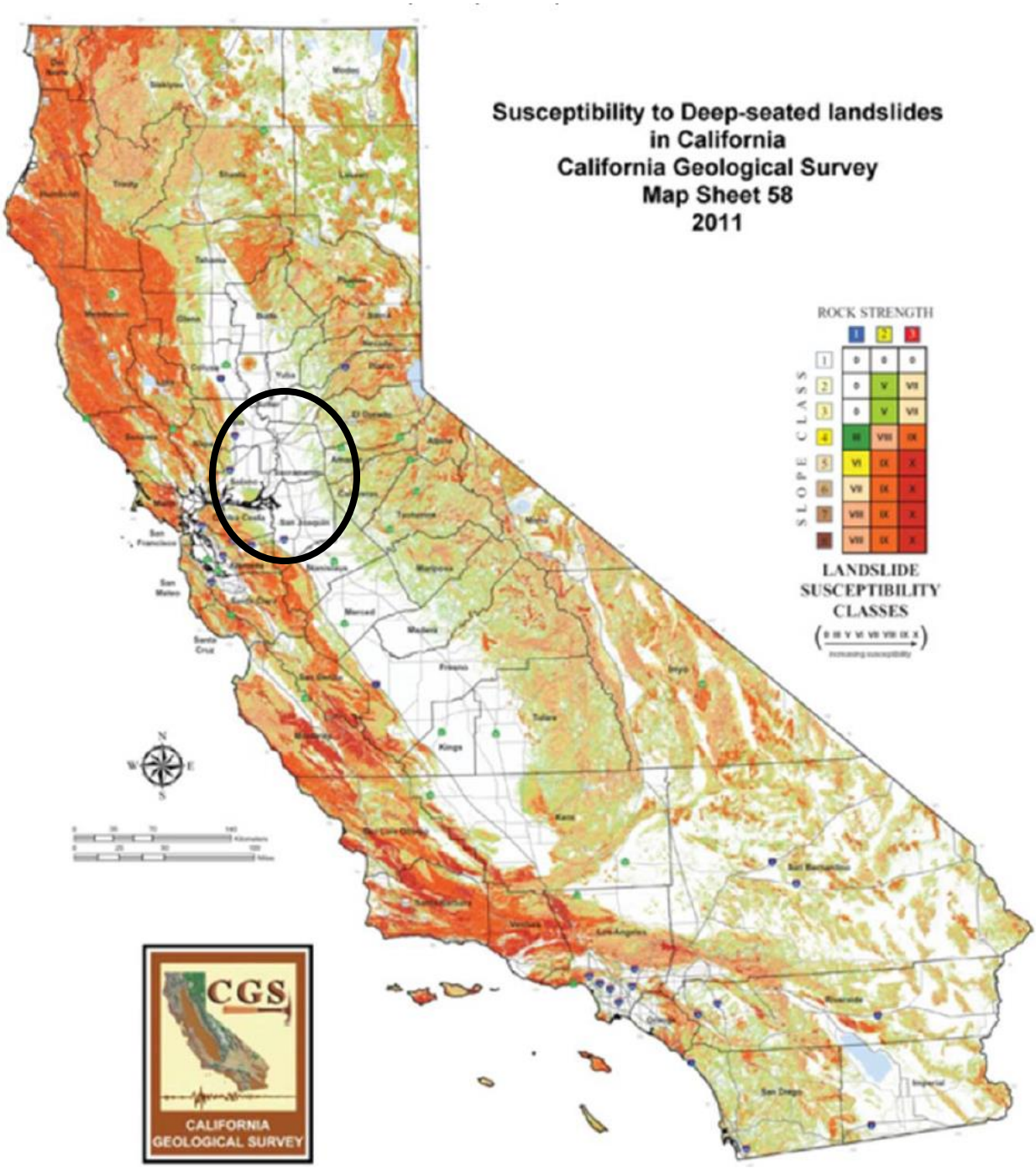
Landslides directly damage buildings in two general ways: 1) disruption of structural foundations caused by differential movement and deformation of the ground upon which the structure sits; and 2) physical impact of debris moving down slope against structures located in the travel path. In addition to buildings, other types of engineered structures are vulnerable to the impact and ground deformation caused by slope failures, particularly utilities and transportation structures. These belong to a category of structures called lifelines. Transmission lines such as telephone lines, electric power, gas, water, sewage, roadways, etc., are necessary for today's functioning society. They present a particular vulnerability because of their

geographic extent and susceptibility to physical distress. Lifelines are generally linear structures that, because of their geographic extent, have a greater opportunity for impact by ground failure.

The Sacramento County General Plan Background Report describes areas in the County that are particularly prone to landslides. In Sacramento County, only a narrow strip along the eastern boundary, from the Placer County line to the Cosumnes River, is considered to have landslide potential. However, future slides on these slopes are expected to be minor in nature and do not pose a large scale threat to life or property. The American River Bluffs downstream from Folsom and in Fair Oaks and Carmichael are considered stable and are generally not subject to fracture or landslides.

Figure 4-43 was developed for the 2013 State of California Multi-Hazard Mitigation Plan. It indicates that most areas throughout Sacramento County are at low risk for landslides, with areas in the eastern portion of the County is at low to medium risk for landslides.

Figure 4-43 Landslide Risk Zones



Source: 2013 State of California Multi-Hazard Mitigation Plan

Past Occurrences

Disaster Declaration History

There have been no disaster declarations associated with landslides in Sacramento County.

NCDC Events

The NCDC contains no records of landslides in the County.

HMPC Events

NO EVENTS WERE NOTED IN THE LAST PLAN, HAS THAT CHANGED?

Likelihood of Future Occurrence

Unlikely – The topography of the majority of Sacramento County is relatively flat and not subject to landslide. In Sacramento County, only a narrow strip along the eastern boundary, from the Placer County line to the Cosumnes River, is considered to have landslide potential. However, future slides on these slopes are expected to be minor in nature and do not pose a large scale threat to life or property. The American River Bluffs downstream from Folsom and in Fair Oaks and Carmichael are considered stable and are generally not subject to fracture or landslides; most land movement in this area is attributed to natural processes. This small portion, coupled with a lack of previous occurrences, equates to a likelihood of future occurrence of unlikely.

Climate Change and Landslide and Debris Flows

According to the CAS, climate change may result in precipitation extremes (i.e., wetter wet periods and drier dry periods). While total average annual rainfall may decrease only slightly, rainfall is predicted to occur in fewer, more intense precipitation events. The combination of a generally drier climate in the future, which will increase the chance of drought and wildfires, and the occasional extreme downpour is likely to cause more mudslides and landslides.

4.2.17. Levee Failure

Hazard/Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made. A natural levee is formed when sediment settles on the stream bank, raising the level of the land around the stream. To construct a man-made levee, workers place dirt or concrete along the stream banks, creating an embankment. This embankment is flat at the top, and slopes at an angle down to the water. For added strength, sandbags are sometimes placed over dirt embankments.

Approximately 150 years ago, the levees of the Sacramento-San Joaquin Delta were raised to prevent flooding on what remains some of the most fertile farmland in the nation. While the peat soils were excellent for agriculture, they were not the best choice to create strong foundations for levee barriers meant to contain a constant flow of river water. Nevertheless, it was these native soils that were primarily used to create the levee system.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. Levees reduce, not eliminate, the risk to individuals and structures located behind them.

The time of year of a failure is an important factor in determining risk. Overtopping is most likely to occur during high water events in the winter. Multiple failures during large floods would generally not pose an immediate threat to water supplies outside the Delta. In contrast, a structural failure during a period of low inflow, such as summer, can draw ocean salinity into the Delta. The saline water could cause a multi-year disruption to statewide water use. Large-scale disruptions could cost hundreds of billions of dollars annually.

A levee system failure or overtopping can create severe flooding and high water velocities. It's important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

There are three primary risks to levee integrity in Sacramento County:

- Earthquake failure
- High water failure
- Dry weather failure

Earthquake Failure

Seismic risk in the Delta Region is characterized as moderate-to-high because of many active faults in the San Francisco Bay Area. Figure 4-30 in Section 4.2.12 Earthquake, illustrates the locations of faults in and near the San Francisco Bay Area and the Delta Region. Area seismic activity during the last 100 years is significantly less than what was experienced during the 1800s and the first part of the 1900s. Seismic experts predict increased seismic activity in the future similar to that which occurred up to the first part of the 1900s. Seismic risk to levees stems from the risk of liquefaction. Liquefaction is discussed as a stand-alone hazard in Section 4.2.13. A more in depth discussion may be found there.

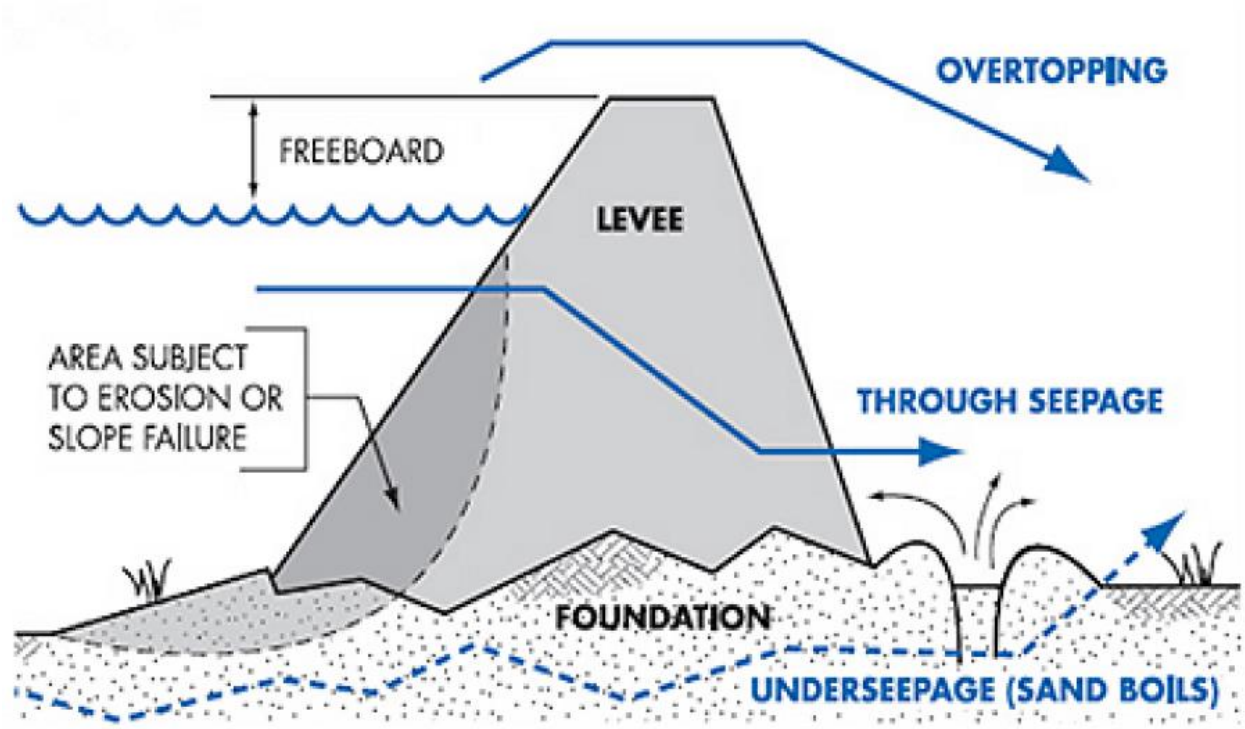
High Water Failure

Although earthquakes pose the greatest single risk to Delta Region levees, winter storms and related high water conditions are also a serious risk to all levees in the Sacramento County Planning Area. High water events can overtop levees. High water also increases the hydrostatic pressure on levees and their foundations, causing instability. The risk of through-levee and under-levee seepage failures increases as well.

Under-seepage refers to water flowing under the levee through the levee foundation materials, often emanating from the bottom of the landside slope and ground surface and extending landward from the landside toe of the levee. Through-seepage refers to water flowing through the levee prism directly, often emanating from the landside slope of the levee. Both conditions can lead to failure by several mechanisms, including excessive water pressures causing foundation heave and slope instabilities, slow progressing internal erosion, and piping leading to levee slumping.

Rodents burrowing into and compromising the levee system is a significant issue in the Planning Area. Erosion can also lead to levee failure. More information on erosion can be found in Section 4.2.18. Figure 4-44 depicts many causes of levee failure.

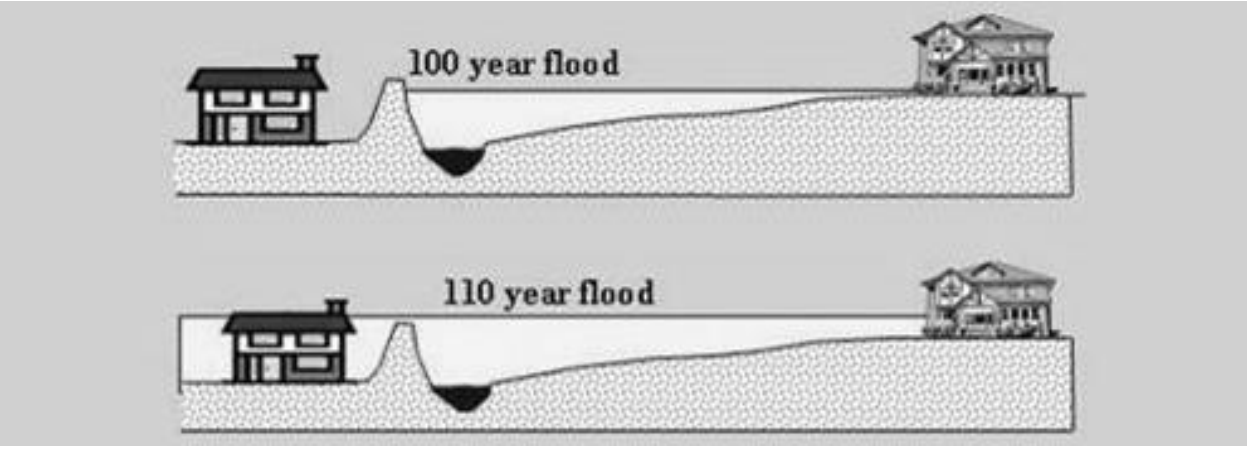
Figure 4-44 Potential Causes of Levee Failure



Source: USACE

Overtopping failure occurs when the flood water level rises above the crest of a levee. As shown in Figure 4-45, overtopping of levees can cause greater damage than a traditional flood due to the often lower topography behind the levee.

Figure 4-45 Flooding from Levee Overtopping



Source: Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.

Most levee failures in the Delta Region have occurred during winter storms and related high water conditions, often in conjunction with high tides and strong winds.

Dry Weather Failures

Dry weather, or sunny-day, failures are levee breaches that are not flood or seismic related. These failures typically occur between the end of the late snowmelt from the Sierras, in late May, and the beginning of the rainy season, in early October. Sunny-day failures are addressed separately from flood-induced failures to differentiate between winter and summer events. Aside from seismic events, factors that can cause levee failures in the Sacramento–San Joaquin River Delta (Delta) in the summer period are different than the factors that can cause winter failures.

Burrowing animal activities and pre-existing weaknesses in the levees and foundation are the key weak links leading to levee failures. This is the case whether or not the failures occur during a high-tide condition. Most practicing engineers, scientists, and maintenance personnel in the Delta and Suisun Marsh believe that rodents are prolific in the Delta and use levees for burrowing. As a result, they cause undue weaknesses by creating a maze of internal and interconnected galleries of tunnels.

Under-seepage and through-levee seepage are slow processes that tend to work through time by removing fines from levee and foundation material during episodes of high river levels. Cumulative deterioration through the years can lead to foundations ultimately failing in dry weather by means of uncontrollable internal erosion that leads to slumping and cracking of levees.

Accredited and Provisionally Accredited Levees (PAL)

It is important that community officials and citizens have the most accurate and up-to-date information to make decisions based on the flood risk that exists in levee-impacted areas. Accredited levees are those levees meeting the criteria set forth in 44 CFR 65.10 Mapping of Areas Protected by Levee Systems and certified as providing a 100-year level of flood protection. The PAL designation is used for a levee system

when FEMA has previously accredited the levee system on an effective FIRM or DFIRM and FEMA is awaiting data and/or documentation that will demonstrate the levee system's compliance with Section 65.10 of the NFIP regulations.

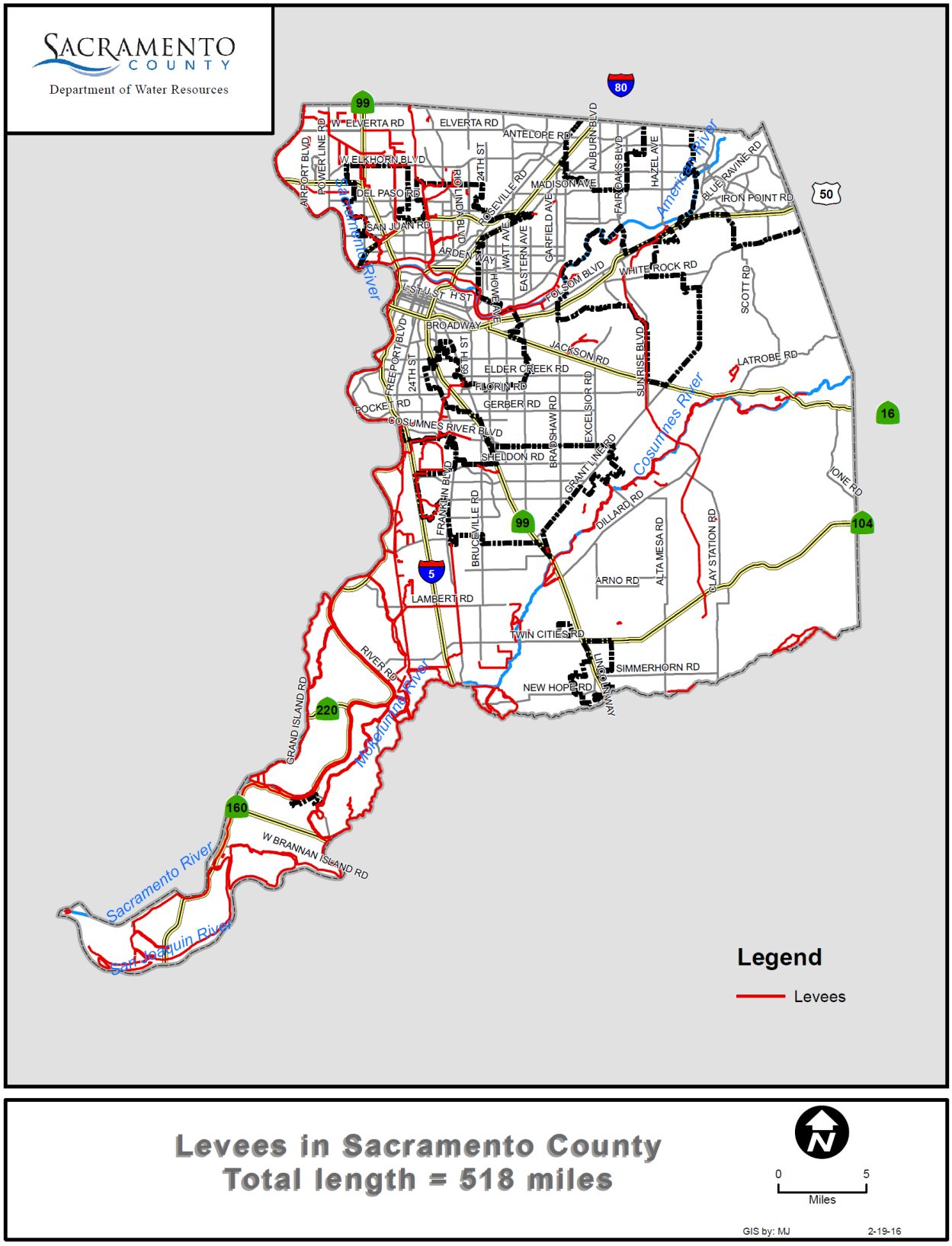
To be eligible for the PAL designation, the levee system must be shown as accredited on the effective Flood Insurance Rate Map (FIRM). For levee systems that meet the PAL requirement, FEMA will place a note on the DFIRM panel landward of the levee system to indicate FEMA has provisionally accredited the levee system and the designation of any existing Zone X (shaded) area is provisional. The area impacted by the PAL system is shown as Zone X (shaded) except for areas of residual flooding, such as ponding areas, which are shown as Special Flood Hazard Areas (SFHAs), areas subject to inundation by the base (1-percent annual chance) flood.

Current Accredited Levee and PAL Status in Sacramento County

There are over 1,100 miles of levees in Sacramento County; including over 500 miles of project levees. Currently, there are no accredited levees or PALs within the Sacramento County Planning Area. Although, the current 2015 DFIRMs still reflect the presence of some levees as providing 100-year level of flood protection. However, as described throughout this LHMP Update, there are numerous planned and ongoing flood control system improvements, including levee improvement projects, that will result in establishing increased flood protection levels. Increased flood protection levels will include a minimum of 100-year level of protection to meet FEMA NFIP accreditation requirements and 200-year level of protection to meet the State of California's legislation resulting from Senate bill 5 and associated Urban Level of Flood Protection (ULOP) requirements and Urban Levee Design Criteria (ULDC).

Sacramento County's levee system can be seen in Figure 4-46.

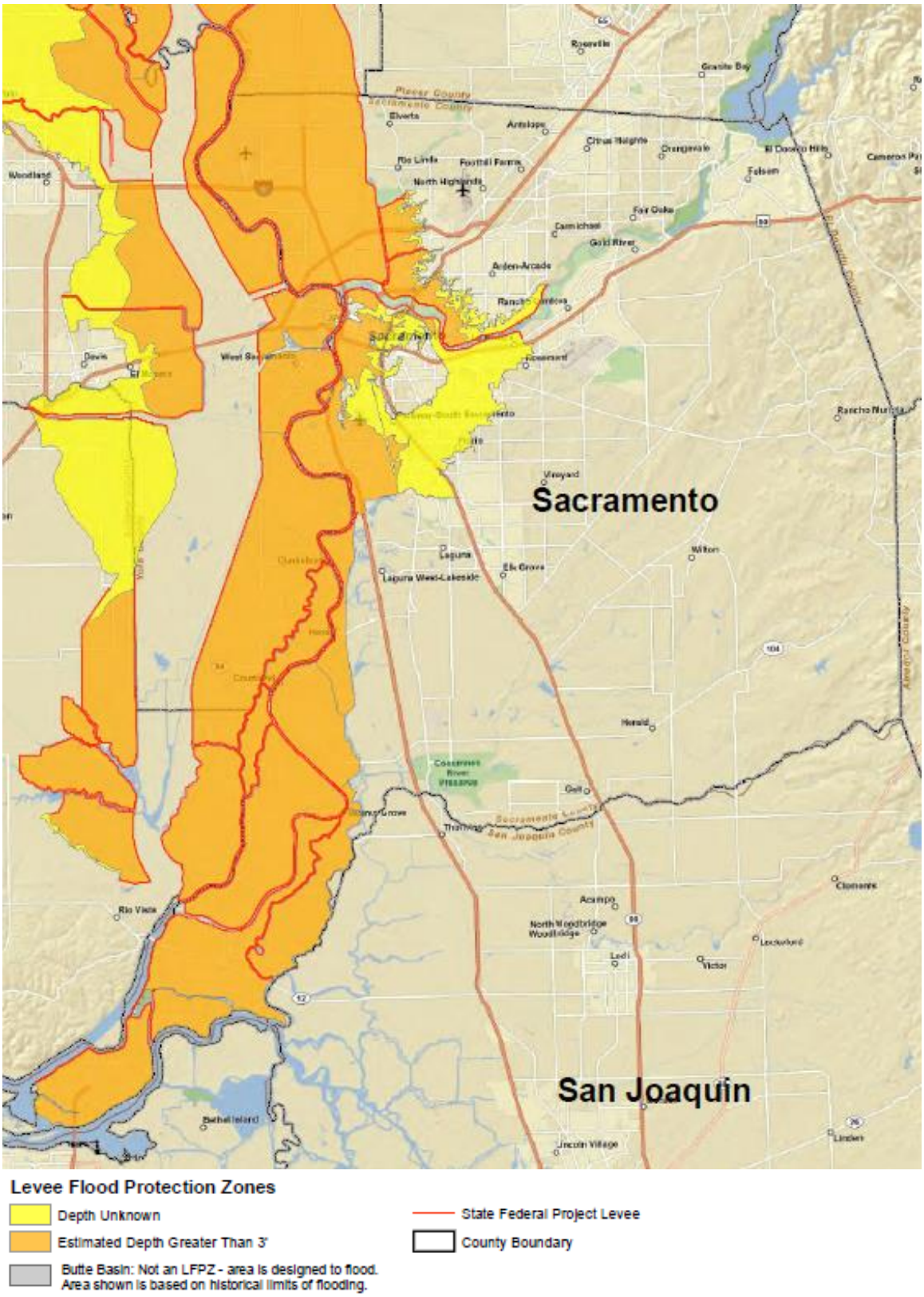
Figure 4-46 Sacramento Planning Area – Levee Map



Levee Flood Protection Zones (LFPZ) Maps

LFPZ maps represent floodplain areas protected by Central Valley State-Federal Project Levees. Under Water Code Section 9110(b), "LFPZ" means the area, as determined by the Central Valley Flood Protection Board or DWR, that is protected by a project levee. These maps were developed based on the best available information as required by Assembly Bill 156. This Bill requires DWR to prepare LFPZ maps to identify the areas where flood levels would be more than three feet deep if a project levee were to fail. DWR delineated the LFPZs by estimating the maximum area that may be flooded if a project levee fails with flows at maximum capacity that may reasonably be conveyed. DWR is using information from several sources, including FEMA floodplain maps, FEMA Q3 data, USACE's 2002 Sacramento and San Joaquin River Basins Comprehensive Study, and local project levee studies. Using this data, DWR is implementing a multi-year program to evaluate and delineate detailed floodplains for areas protected by project levees. This effort includes new topography, hydrology, hydraulic models, and floodplain maps. This information will be used to update the initial LFPZ maps. LPFZ maps can be accessed at: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/levee_protection_zones/LFPZ_maps.cfm. Figure 4-47 is the most recent LFPZ map for the Sacramento County Planning Area.

Figure 4-47 Sacramento County - Levee Flood Protection Zones



Source: California Department of Water

Past Occurrences

Disaster Declaration History

There have been two FEMA disaster declarations in Sacramento County related to levee failure. Both were federal and state declared disasters.

- 1980 Delta Levee Break (Disaster EM-3078 declared on 1/23/1980)
- 1972 Andrus Island Levee Break (Disaster DR-342 declared on 6/21/1972)

NCDC Events

The NCDC does not track levee failure events.

FIS Events

The FIS reported the following regarding levee failure flooding.

Past flooding in the City of Isleton area has been due to levee failures caused by the separate or coincidental occurrence of very high tides and high stream outflow through the delta region, or from unexplained levee failures apparently not related from high tides and/or high stream outflow can reasonably be expected, such failures cannot be reliably predicted. A detailed field inspection of levees protecting Andrus, Brannan and Twitchell Islands, was made to determine levee conditions insofar as it is possible to do so without subsurface exploration. The report on the inspection identifies problem areas susceptible to failure and requires exploratory borings and testing of core materials to definitively determine levee stability (USACE, 1976). Because 2-percent annual chance flooding would overtop levees, stability analysis was deemed unnecessary, and this study is concerned only with levee overtopping and disintegration of levee sections subsequent to overtoppings.

The Delta has a long history of flooding, but little definitive data on specific flood events are available. Andrus, Brannan and Twitchell Islands, have all experienced historical floods. Large areas of the delta were inundated during floods, and it is probable that the City of Isleton was damaged or seriously threatened.

The 1950 and 1955 floods were outstanding in peak outflows through the delta and several islands were flooded. The City of Isleton, however, was not affected. In December 1965 and January 1965, the coincidental occurrence of very high tides and heavy inflow resulted in unusually high stages on all delta waterways. Concurrent strong onshore winds generated high waves that created very perilous conditions for many islands. Levees protecting Twitchell Island were seriously threatened by erosion and overtopping, but a massive flood fighting effort prevented overflow, destruction of levees and inundation of the City of Isleton.

In December 1964 and January 1965, the coincidental occurrence of very high tides and heavy inflow resulted in unusually high stages on all delta waterways. Concurrent strong onshore winds generated high waves that created very perilous conditions for many islands. Several hundred acres were flooded and damages, mainly flood fighting and repair of levees and levee roads, were a little less than $1 million. In January and February 1969, high tides and adverse wave action in the delta, combined with large river

inflow and rain-soaked levees, caused the flooding of several islands and the endangerment of many other islands. Approximately 11,400 acres were inundated and flood damages amounted to about $9.2 million. The levee separating Andrus Island and the San Joaquin River failed from unknown causes in June 1972, resulting in the flooding of Andrus and Brannan Islands (including the City of Isleton). High winds had occurred prior to the break, but there had been no antecedent rainfall and the tidal cycle was not on the higher side. About 15,000 acres were inundated and flood damages for the event approximated $30 million.

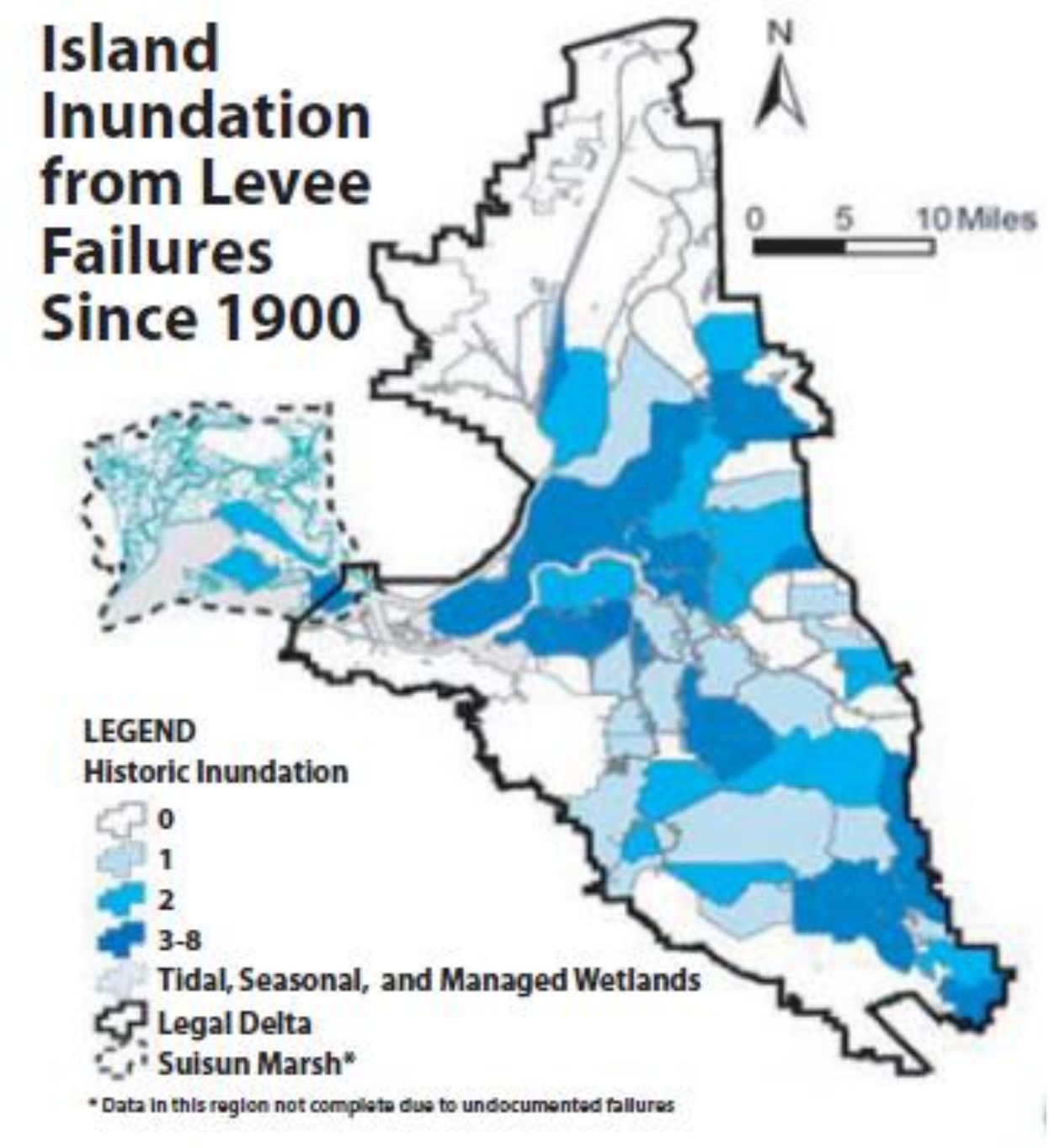
The most devastating and recent flooding of the City of Isleton resulted from failure of a levee at the southern end of Andrus Island. The levee failed from unknown causes during the night of June 21, 1972. There had not been any antecedent rainfall and the tidal cycle was not on the higher side, but high winds had been occurring prior to the break. Approximately 200,000 acre-feet of water from the San Joaquin River inundated Andrus and Brannan Islands. Activities to fight floods to protect the City of Isleton proved to be a losing battle, and almost all of the city was flooded. The entire population was evacuated, with some residents not being able to return to their homes for 4 months. Approximately one-half of the housing units in the city were damaged or destroyed. Damage from the flood event on the islands and in the City of Isleton totaled approximately $30 million.

Due to the size of the delta region, and the complexity of its stream and tidal regimen, flood frequency varies from location to location. In general, the 1950, 1955 and 1964 tidal stages in the central delta, had frequencies of 10, 30 and 5 years, respectively. Stage during the 1955 and 1964 flood periods was strongly influenced by onshore winds. The 1972 flood event cannot be assigned a frequency because the levee failure that caused the flooding cannot be attributed to tidal stage or streamflow conditions.

HMPC Events

There have been about 100 levee failures and 163 levee breaches since the early 1900. However, most of these failures occurred in the Delta area and are not specific to portions of the Delta located inside of Sacramento County. Only 14 failures and 17 breaches occurred after 1990 due to overall improvements in the levee systems throughout the Delta. These historic numbers are not representative of future occurrences within the County. Figure 4-48 shows the levee failures since 1900.

Figure 4-48 Island Inundation from Levee Failures from 1900-Present



Some islands have been flooded and recovered multiple times. A few islands, such as Franks Tract in San Joaquin County, have never been recovered. Some of the more major levee breaks in Sacramento County are detailed below.

June 21, 1972 – A levee in the Brannan-Andrus Levee Maintenance District broke. 35% of the City of Isleton was inundated. A national disaster was declared June 27, and the breach was closed on July 26. Estimated damages in 2011 dollars were $234 million. The USACE repaired the break.

February 19, 1986 – Heavy rains and flooding affected Sacramento County and the surrounding area. 6 months of precipitation fell in 10 days in mid-February. High water content caused multiple levee failures. Two levee breaks in the same general area occurred on the 8,800 acre Tyler Island in Sacramento County. These two levee breaks were approximately 300 feet in length (see Figure 4-49). A FEMA disaster declaration was declared on February 21. The approximate cost to repair the breaks was $6 million in 2011 dollars. Details on damages to structures and crops on the islands was not available.

Figure 4-49 1986 Tyler Island Levee Breach

Source: California Department of Water Resources

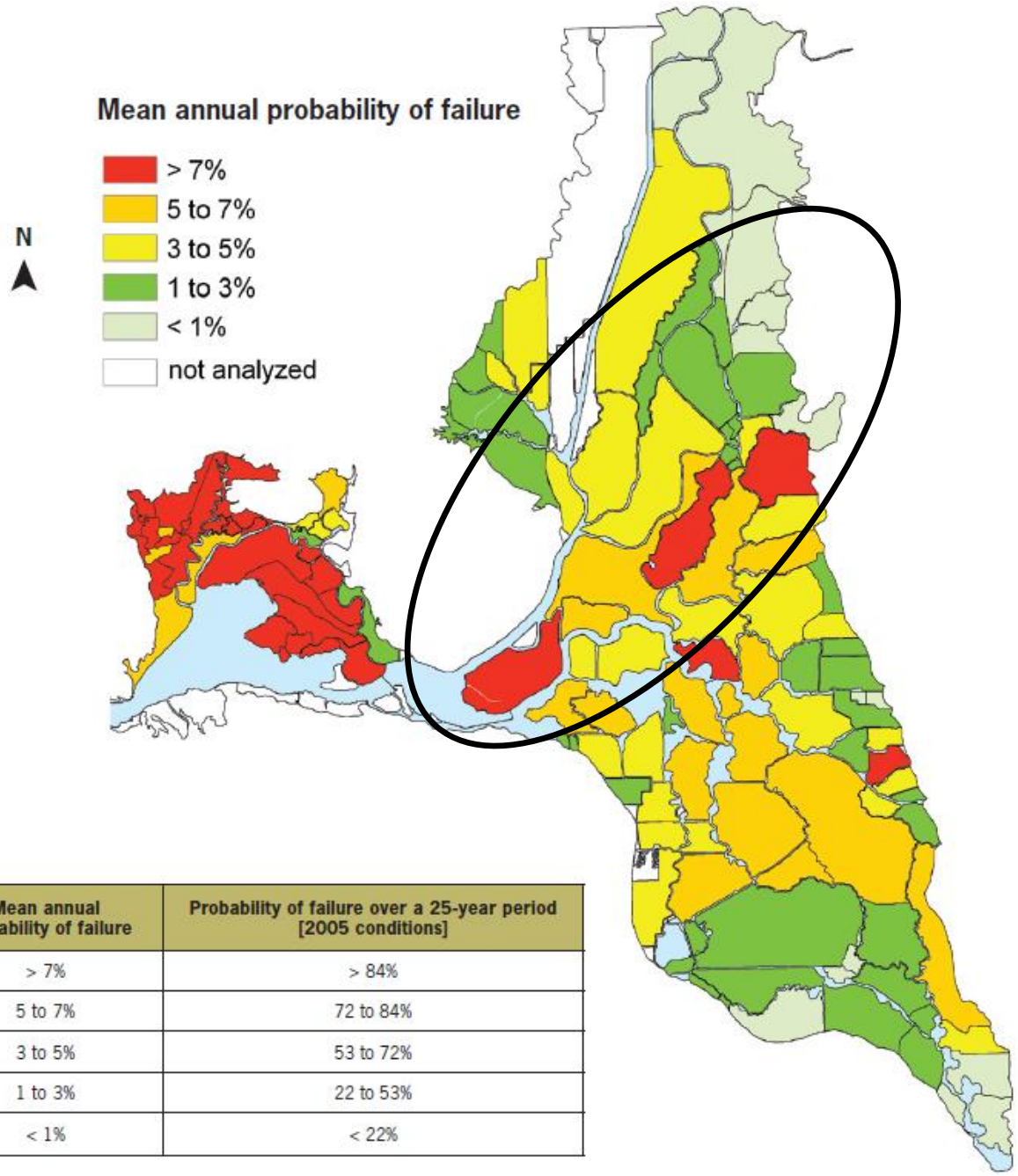
December 1996 was one of the wettest Decembers on record. Watersheds in the Sierra Nevada were already saturated by the time three subtropical storms added more than 30 inches of rain in late December 1996 and Early January 1997. The third and most severe of these storms lasted from December 31, 1996 through January 2, 1997. Rain in the Sierra Nevada caused record flows that stressed the flood management

system to capacity in the Sacramento River Basin and overwhelmed the system in the San Joaquin River Basin. Levee failures due to breaks or overtopping in the Sacramento River Basin resulted in extensive damages. In the San Joaquin River Basin, dozens of levees failed throughout the river system and produced widespread flooding. The Sacramento-San Joaquin River Delta also experienced several levee breaks and levee overtopping. Affected Delta islands within Sacramento County included McCormack-Williamson Tract, Dead Horse Island and Glanville Tract.

Likelihood of Future Occurrence

Occasional – Due to the high number of past events, increasing subsidence, and the deteriorating conditions of the levees in Sacramento, future levee failures will occur occasionally. This can be seen for the Delta area in Figure 4-50.

Figure 4-50 Estimated Frequency of Levee Overtopping Under Current Conditions



Mean annual probability of failure	Probability of failure over a 25-year period [2005 conditions]
> 7%	> 84%
5 to 7%	72 to 84%
3 to 5%	53 to 72%
1 to 3%	22 to 53%
< 1%	< 22%

Source: Delta Risk Management Strategy

Climate Change and Levee Failure

Increased flood frequency in California is a predicted consequence of climate change. Mechanisms whereby climate change leads to an elevated flood risk include more extreme precipitation events and shifts in the seasonal timing of river flows. This threat may be particularly significant because recent estimates indicate the additional force exerted upon the levees is equivalent to the square of the water level rise.

These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods.

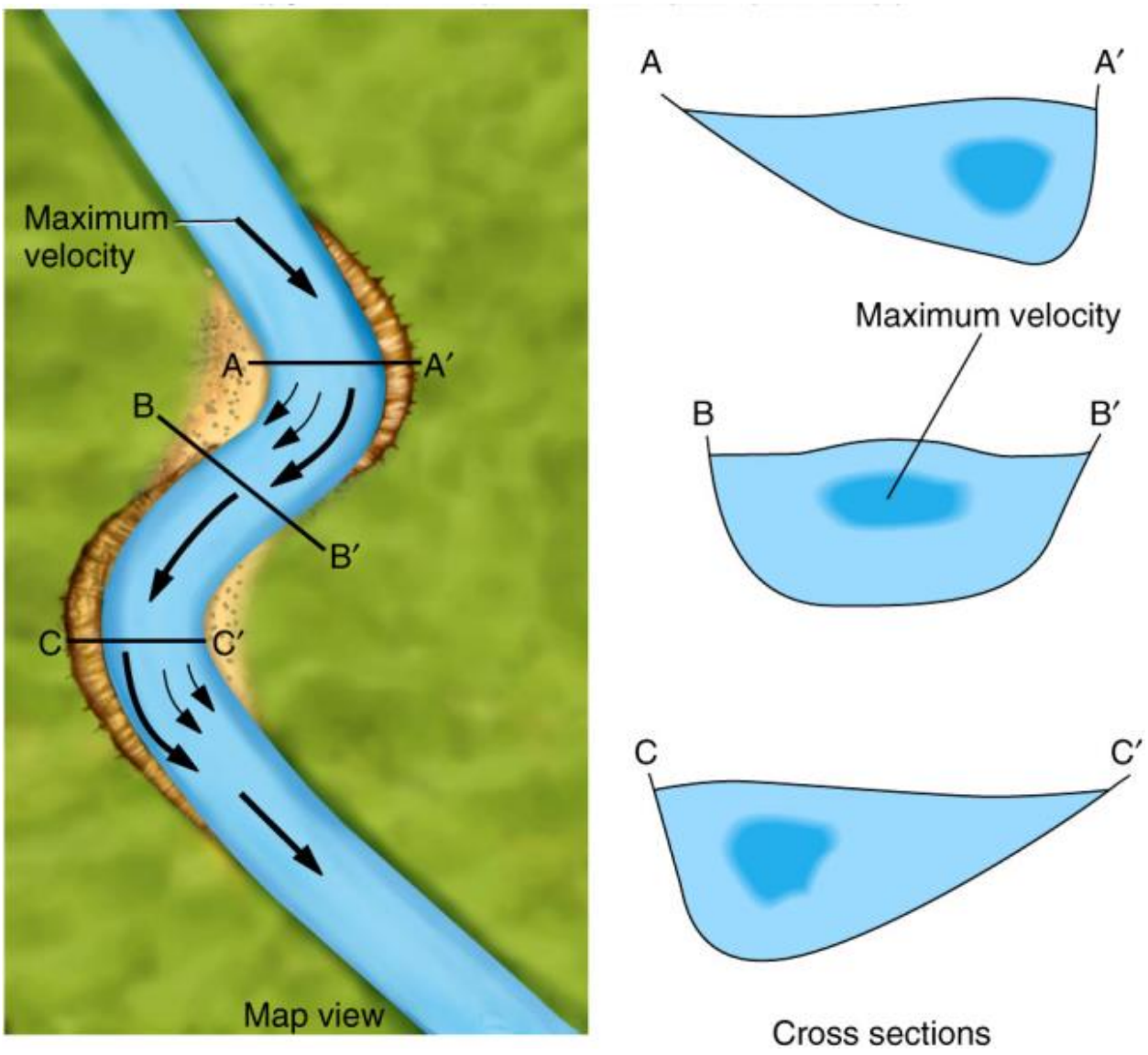
4.2.18. River/Stream/Creek Bank Erosion

Hazard/Problem Description

Any flowing body of water (brook, creek, stream, river) is a stream. Stream flow is expressed as volume per unit time, usually cubic meters per second, cubic feet per second, sometimes cubic kilometers per second, or acre-feet per second or day. Stream flow varies tremendously with time. Short term controls include rainfall, snowmelt, and evaporation conditions. Long term controls include land use, soil, groundwater state, and rock type.

Streams erode by a combination of direct stream processes, like down cutting and lateral erosion, and indirect processes, like mass-wasting accompanied by transportation. Water tends to move downstream in slugs that extend all the way across a channel as shown in Figure 4-51. When the channel bends, water on the outside of the bend (the cut-bank) flows faster and water on the inside of the bend (the point) flows slower. This distribution of velocity results in erosion occurring on the outside of the bend (cut) and deposition occurring on the inside of the bend.

Figure 4-51 Meanders and Streamflows



Stream bank erosion is a natural process, but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Stream bank erosion processes, although complex, are driven by two major components: stream bank characteristics (erodibility) and hydraulic/gravitational forces. Many land use activities can affect both of these components and lead to accelerated bank erosion. The vegetation rooting characteristics can protect banks from fluvial entrainment and collapse, and also provide internal bank strength. When riparian vegetation is changed from woody species to annual grasses and/or forbs, the internal strength is weakened, causing acceleration of mass wasting processes. Stream bank aggradation or degradation is often a response to stream channel instability. Since bank erosion is often a symptom of a larger, more complex problem, the long-term solutions often involve much more than just bank stabilization. Numerous studies have demonstrated that stream bank erosion contributes a large portion of the annual sediment yield.

Determining the cause of accelerated streambank erosion is the first step in solving the problem. When a stream is straightened or widened, streambank erosion increases. Accelerated streambank erosion is part of the process as the stream seeks to re-establish a stable size and pattern. Damaging or removing streamside vegetation to the point where it no longer provides for bank stability can cause a dramatic increase in bank erosion. A degrading streambed results in higher and often unstable, eroding banks. When land use changes occur in a watershed, such as clearing land for agriculture or development, runoff increases. With this increase in runoff the stream channel will adjust to accommodate the additional flow, increasing streambank erosion. Addressing the problem of streambank erosion requires an understanding of both stream dynamics and the management of streamside vegetation.

Approximately 150 years ago, the levees of the Sacramento-San Joaquin Delta were raised to prevent flooding on what remains some of the most fertile farmland in the nation. While the peat soils were excellent for agriculture, they were not the best choice to create strong foundations for levee barriers meant to contain a constant flow of river water. Nevertheless, it was these native soils that were primarily used to create the levee system.

As farmers settled the valleys, the Gold Rush drew prospectors to the hills. As mining in the Sierra Nevada turned to the more "efficient" methods of hydraulic mining, the use of environmentally destructive high-pressure water jets washed entire mountainsides into local streams and rivers. Hydraulic gold mining in the northern Sierra Nevada foothills produced 1.1 billion cubic meters of sediment. As a result, the enormous amounts of silt deposited in the riverbeds of the Central Valley increased flood risk. As a remedy to these rising riverbeds, levees were built very close to the river channels to keep water velocity high and thereby scour away the sediment.

However, the design of these narrow channels has been too successful. While the Gold Rush silt is long gone, the erosive force of the constrained river continues to eat away at the levee system. In addition, the peat soils of the Delta have subsided, gradually lowering the elevations of Delta islands. As a result, some of these parcels are now more than 20 feet below sea level.

Erosion and deposition are occurring continually at varying rates over the planning area. Swiftly moving floodwaters cause rapid local erosion as the water carries away earth materials. Severe erosion removes the earth from beneath bridges, roads and foundations of structures adjacent to streams. By undercutting it can lead to increased rockfall and landslide hazard. The deposition of material can block culverts, aggravate flooding, destroy crops and lawns by burying them, and reduce the capacity of water reservoirs as the deposited materials displace water.

Streambank erosion increases the sediment that a stream must carry, results in the loss of fertile bottomland and causes a decline in the quality of habitat on land and in the stream. High velocity flows can erode material from the streambank. Erosion may also occur on the outboard or waterside of the levee (see Section 4.2.17), which may lead to instability and failure. Erosion can occur at once or over time as a function of the storm cycle and the scale of the peak storms.

Past Occurrences

Disaster Declaration History

There have been no disasters declarations in Sacramento County for erosion activity.

NCDC Events

The NCDC does not track erosion events.

USACE Events

The USACE began an annual erosion inventory of the Sacramento River in 1997, following the large flood event in the winter of 1996 and 1997. This flood event caused a levee failure and required numerous flood fighting efforts throughout the Sacramento River System. The original goal of the inventory was to identify the weak spots in the levee system caused by streambank erosion and repair them. However, concerns for the environment and endangered species limited the repair work to mainly emergency work (PL84-99) and local maintenance efforts. Under the SRBPP project, one site on the Sacramento River and a few sites on the American River were repaired prior to 2006.

In 2006, after the City of New Orleans was flooded, concern was raised for the threat of flooding to the Sacramento Valley. The Sacramento River Levee System has a lower level of flood protection than that of New Orleans. In February 2006, the governor of California declared a state of emergency for the Central Valley levees. Soon after, all the sites that were defined as "critical" in the 2005 inventory were repaired. Repairs have continued every year since and over 100 sites have been repaired since the declaration through the combined efforts of the US Army Corps of Engineers and the California Department of Water Resources.

While sites are currently being repaired, more sites enter the erosion inventory every year. The number of erosion sites within the system is large and even with repairs being completed every year, the number of stream bank erosion sites shows little decline year over year. With the large number of sites, a ranking system was developed to help determine which sites should be considered the highest priority for repair. Based on a 2010 field investigation, the total number of erosion sites within the Sacramento River Flood Control System is 185 sites, of which 3 are critical, 13 are new, 7 are minor, 11 were repaired, and 1 was removed. In 2010, none of these critical sites were located in Sacramento County.

In 2009, there were 221,582 linear feet of erosion within the system. In 2010, there is a total of 233,697 linear feet of erosion in the system. The total linear feet added in 2010 was 14,311 ft, of which 9,220 came from adding Wadsworth Canal into the inventory. The total linear feet repaired in 2009 was 5,497 ft. Data for specific linear feet in Sacramento County was unavailable for this plan.

During the 2011 annual erosion inventory, the following was added:

- There are currently 205 erosion sites in the inventory, or approximately 261,192 linear feet of eroding sites within the system.
- There are 48 new erosion sites and 47,113 linear feet of eroding bank were added this year.

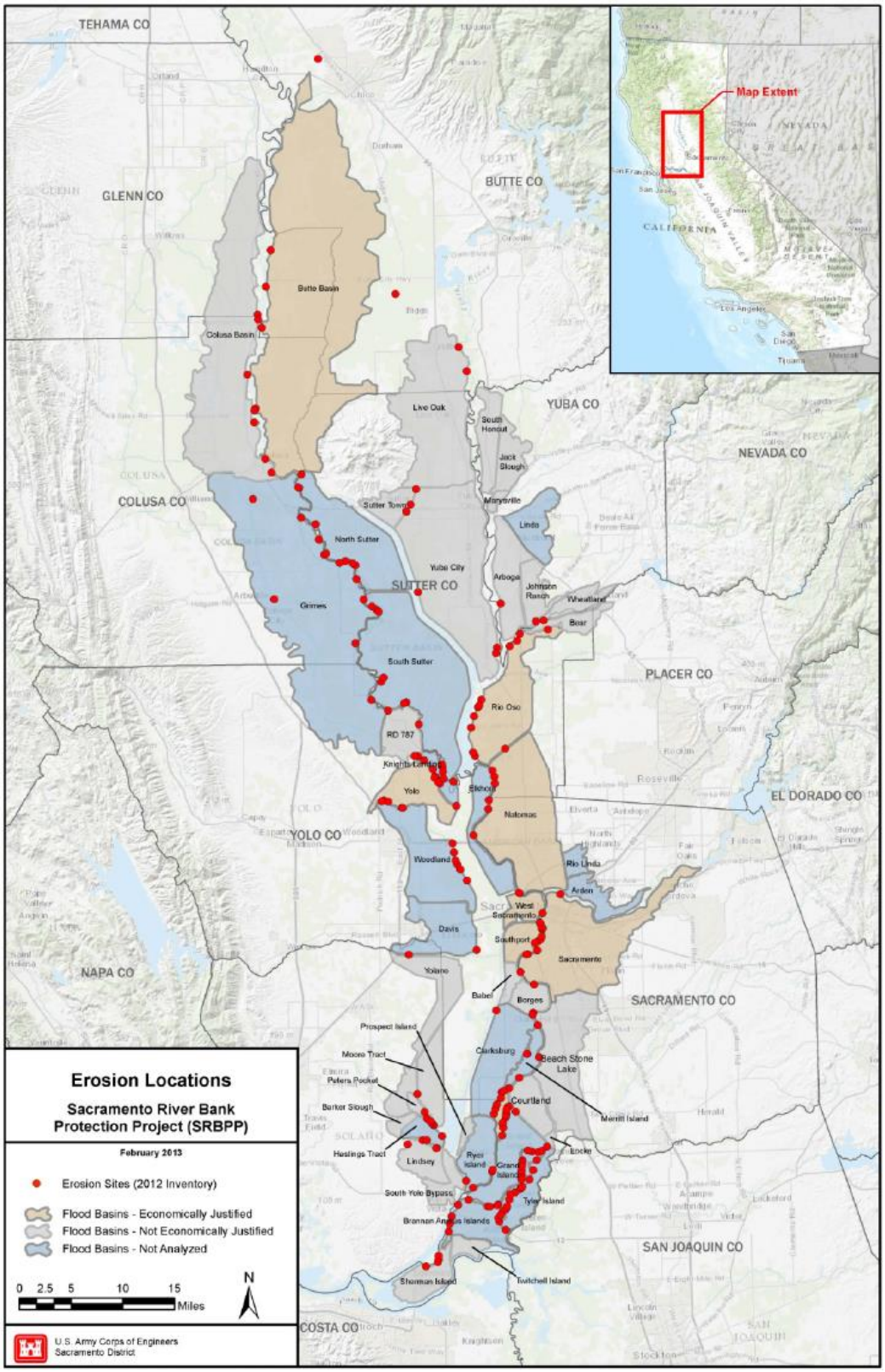
- There are 13 critical erosion sites: three on Cache Creek, five on Georgiana Slough, three on the Sacramento River, and two on Steamboat Slough. Ten of these critical erosion sites were upgraded to critical this year.

Following the 2012 annual erosion inventory the following was added:

- There are currently 201 erosion sites in the inventory, or approximately 265,625 linear feet of eroding sites within the system.
- There are 4 new erosion sites and 7,654 linear feet of eroding bank which were added this year.
- There are 14 critical erosion sites: three on Cache Creek, four on Georgiana Slough, six on the Sacramento River, and one on Steamboat Slough. Three of these erosion sites were upgraded to critical this year.

The 2012 Sacramento River Protection Project report (the most recent report available), done by the US Army Corps of Engineers, identified erosion spots of concern on the Sacramento River. These sites are shown on Figure 4-52.

Figure 4-52 2012 Identified Erosion Sites within the Sacramento River Flood Control Project



Source: Post Authorization Change Report for the Sacramento River Bank Protection Project Draft EIS

HMPC Events

ANY EVENTS NOT CAPTURED ABOVE?

Likelihood of Future Occurrence

Highly Likely – Due to the high number of linear feet in need of repair and the continuing number of linear feet that enter the USACE inventory, the likelihood of future occurrences of streambank erosion in Sacramento County is highly likely.

Climate Change and Soil Bank Erosion

Climate change may affect flooding in Sacramento County, which in turn may affect erosion rates. While average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. High water associated with these heavy rains and flooding can contribute to increased erosion to stream and creek banks. It is possible that average soil moisture and runoff could decline, however, due to increasing temperature, evapotranspiration rates, and spacing between rainfall events.

4.2.19. Subsidence

Hazard/Problem Description

Subsidence is the gradual settling or sinking of the earth's surface over manmade or natural underground voids with little or no horizontal motion. Subsidence occurs naturally and also through man-driven or technologically exacerbated circumstances. In Sacramento County, the Delta in the southeast portion of the County is highly at risk to subsidence. In the Delta, subsidence affects the islands as well as the levees.

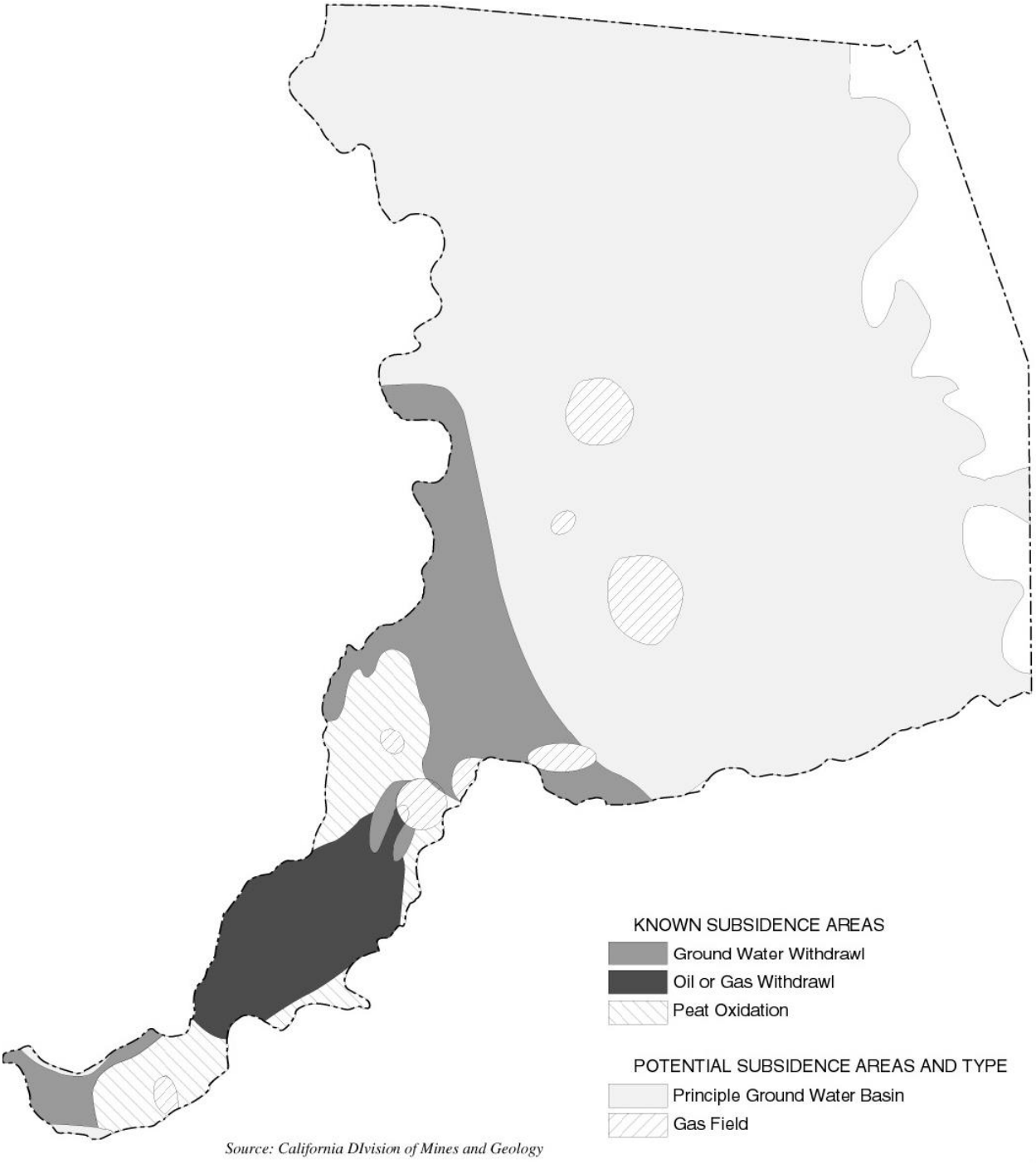
The Delta, located at the confluence of the Sacramento and San Joaquin Rivers, is blanketed by peat and peaty alluvium deposited where streams, originating in the Sierra Nevada, Coast Ranges, and southern Cascade Range, enter the San Francisco Bay system. In the late-1800s, large-scale agricultural development in the Delta required levee-building to prevent frequent flooding. The leveed marshland tracts then had to be drained, cleared of wetland vegetation, and tilled. Levees and drainage systems were largely complete by 1930 and the Delta had taken on its current appearance, with most of its 1,150-squaremile area reclaimed for agricultural use. Today the Delta includes about 57 islands or tracts that are imperfectly protected from flooding by more than 1,100 miles of levees.

Sacramento County is affected by five types of subsidence. They are:

- compaction of unconsolidated soils by earthquake shaking (liquefaction)
- compaction by heavy structures
- the erosion of peat soils
- peat oxidation
- fluid withdrawal

These areas are shown in Figure 4-53.

Figure 4-53 Known and Potential Subsidence Areas in Sacramento County



Source: Sacramento County General Plan Background Report, 2011

Compaction of Unconsolidated Soils by Earthquake Shaking (Liquefaction)

Compaction of unconsolidated soils by earthquake shaking is also known as liquefaction. Liquefaction is profiled as a separate hazard in Section 4.2.13. Refer to that section for more detail.

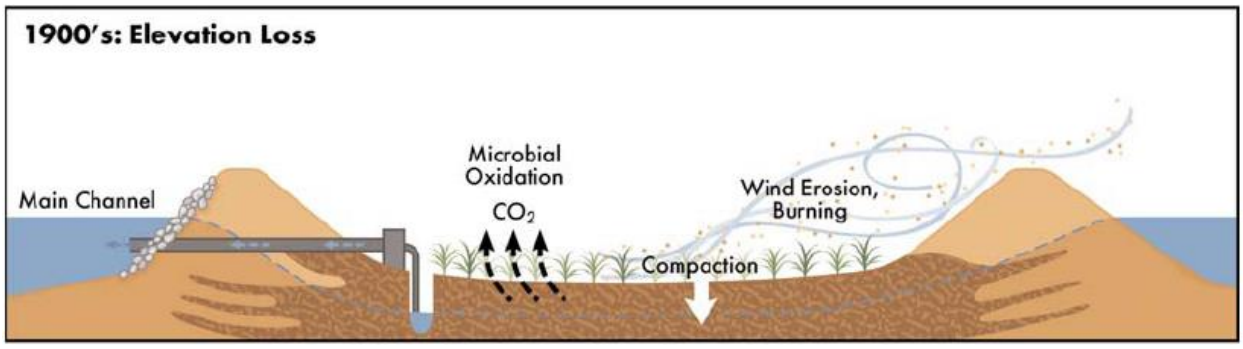
Compaction by Heavy Structures

Land development pressures are forcing the building of structures on top of fine grained water saturated sediments. Unfortunately, the weight of the structures presses the water out of the soils. To mitigate the problem, piles are installed from the footings of the heavy structures to a subsurface zone that will support the structural footing loads. The utilities, travel ways, and smaller building will be constructed to rest on the soil surface. As surface loading causes subsidence, the footings and pile support systems of the heavy structures will be exposed. In extreme situations, it may be necessary to build up the area to gain access into the pile supported structure as the area subsides. Structures that are not supported on piles will have a high probability of damage as the area subsides.

The Erosion of Peat Soils

Prior to 1950, poor land use practices, including burning of peat soils and wind erosion, exacerbated soil losses due to microbial oxidation (discussed in the next section and shown in Figure 4-54). Peat soils, being much less dense than mineral soils, are more easily eroded by wind. Peat soils are frequently wet either at, or close to, the surface thus limiting the amount of material which can be lost. Nevertheless, peat soils do blow causing spectacular dust clouds and degradation of this valuable resource.

Figure 4-54 Causes of Subsidence in the Delta during the 20th Century

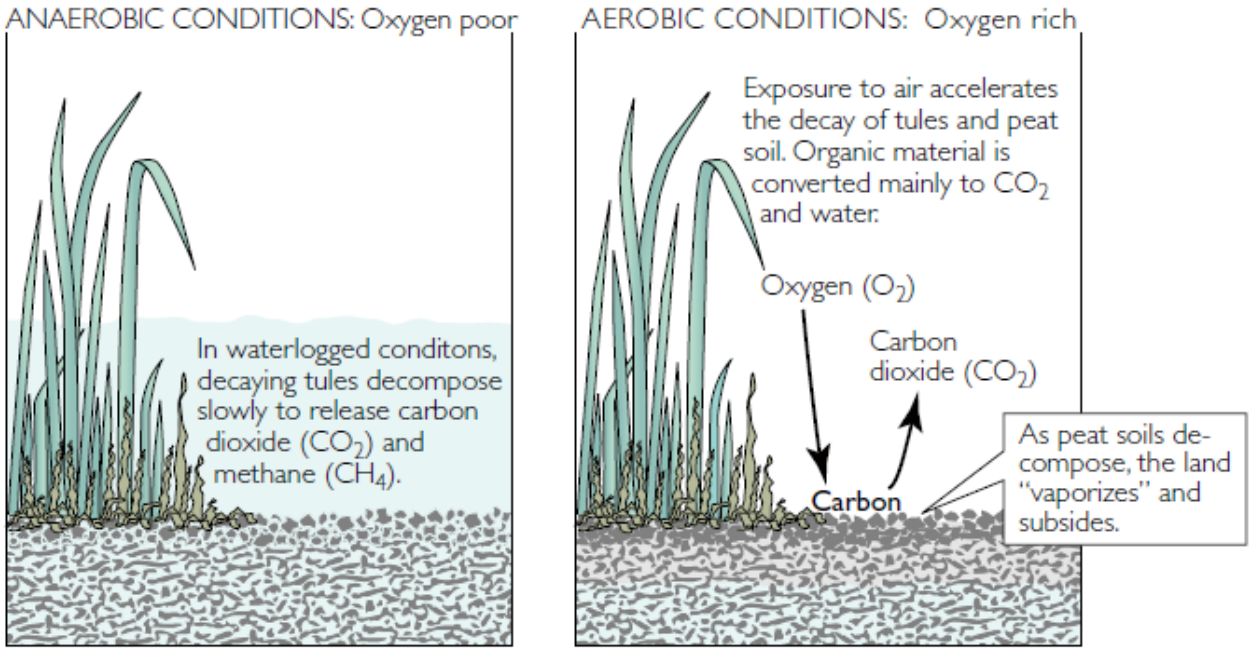


Source: Mount J, Twiss R. 2005. Subsidence, sea level rise, seismicity in the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science. Vol. 3, Issue 1 (March 2005), Article 5.

Peat Oxidation

The dominant cause of land subsidence in the Delta is decomposition of organic carbon in the peat soils. As shown in Figure 4-55, prior to agricultural development, the soil was waterlogged and anaerobic (oxygen-poor). Organic carbon accumulated faster than it could decompose. Drainage for agriculture led to aerobic (oxygen-rich) conditions that favor rapid microbial oxidation of the carbon in the peat soil. Most of the carbon loss is emitted as carbon dioxide gas to the atmosphere.

Figure 4-55 Peat Oxidation in Anaerobic and Aerobic Conditions



Source: USGS Publication "Sacramento-San Joaquin Delta: The Sinking Heart of the State." Report FS-005-00

Fluid Withdrawal

In the late-1800s, large-scale agricultural development in the Delta required levee-building to prevent frequent flooding. The leveed marshland tracts then had to be drained, cleared of wetland vegetation, and tilled. Levees and drainage systems were largely complete by 1930 and the Delta had taken on its current appearance, with most of its 1,150-square mile area reclaimed for agricultural use. As oxidation, erosion, and burning continued to cause subsidence of the land, more water needed to be withdrawn to maintain a constant water table to ensure agricultural plant growth. Water levels in the depressed islands are maintained 3 to 6 feet below the land surface by an extensive network of drainage ditches, and the accumulated agricultural drainage is pumped through or over the levees into stream channels. Without this drainage the islands would become waterlogged.

Groundwater Pumping

Central Sacramento County Groundwater Management Plan discussed groundwater pumping in the County.

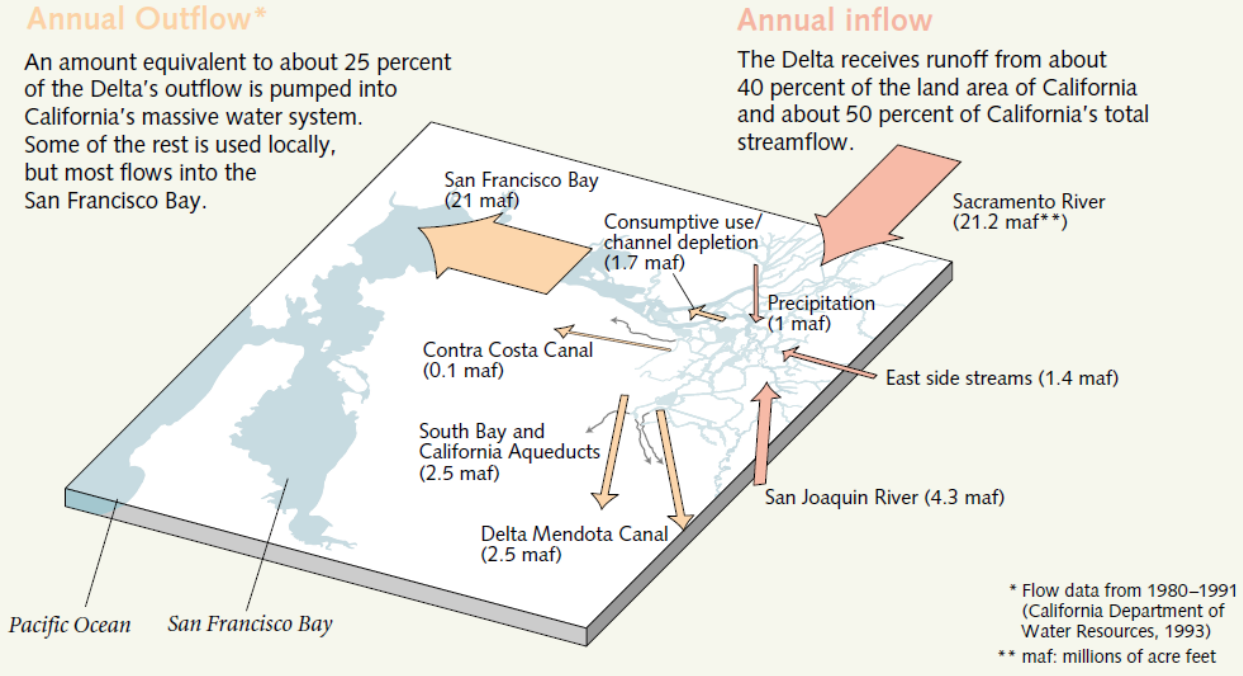
> *Historical benchmark elevation data for the period from 1912 through the late 1960s obtained from the National Geodetic Survey (NGS) were used to evaluate land subsidence in north Sacramento County. From 1947 to 1969, the magnitude of land subsidence measured at benchmarks north of the American River ranged from 0.13 feet to 0.32 feet, with a general decrease in subsidence in a northeastward direction. This decrease is consistent with the geology of the area: formations along the eastern side of the Sacramento Valley are older than those on the western side and are subject to a greater degree of pre-consolidation, making them less susceptible to subsidence. The maximum documented land subsidence of 0.32 feet was measured at both benchmark L846, located approximately two miles northeast of the former McClellan AFB, and benchmark*

G846, located approximately one mile northeast of the intersection of Greenback Lane and Elkhorn Boulevard. Another land subsidence evaluation was performed in the Arden-Arcade area of Sacramento County from 1981 to 1991. Elevations of nine wells in the Arden-Arcade area were surveyed in 1981, 1986, and 1991. The 1986 results were consistently higher than the 1981 results; this was attributed to extremely high rainfall totals in early 1986 that recharged the aquifer and caused a rise in actual land surface elevations. The 1991 results were consistently lower than the 1986 results; this was attributed to five years of drought immediately preceding the 1991 measurements which caused depletion of the aquifer and resulting land surface subsidence. Comparison of eight of the locations indicates that seven benchmarks had lower elevations in 1991 than in 1981 and one benchmark had a higher elevation in 1991. Of the seven benchmarks with lower elevations in 1991, the maximum difference is 0.073 feet (less than one inch). Whether this is inelastic subsidence is indeterminate from the data, but it is clear that the magnitude of the potential subsidence in the benchmarks between 1981 and 1991 was negligible.

Subsidence and Delta Water Supply

The Delta receives runoff from about 40 percent of the land area of California and about 50 percent of California's total streamflow, as shown in Figure 4-56. It is the heart of a massive north-to-south water-delivery system whose giant engineered arterials transport water southward. State and Federal contracts provide for export of up to 7.5 million acre-feet per year from two huge pumping stations in the southern Delta near the Clifton Court Forebay. About 83 percent of this water is used for agriculture and the remainder for various urban uses in central and southern California. Two-thirds of California's population (more than 20 million people) gets at least part of its drinking water from the Delta.

Figure 4-56 The Delta and California's Water System



Source: USGS Publication "Sacramento-San Joaquin Delta: The Sinking Heart of the State." Report FS-005-00

Land subsidence of Delta islands indirectly affects the north-to-south water transfer system, which is predicated on the available water supply (annual inflows to the Delta), the viability of aquatic species populations, and acceptable water quality in the southern Delta. The statewide water-transfer system in California is so interdependent that decreased water quality in the Delta, whether due to droughts or levee failures, might lead to accelerated subsidence in areas dependent on imported water from the Delta.

The waterways of the Delta are subject to tidal action. Ocean tides propagating into San Francisco Bay are observed 5–6 hours later along the Cosumnes River in the eastern Delta. The position of the interface between the saline waters of the Bay and the freshwaters of the Delta depends upon the tidal cycle and the flow of freshwater through the Delta. Before major dams were built on rivers in the Delta watershed, the salinity interface migrated as far upstream as Courtland along the Sacramento River. Today, releases of freshwater from dams far upstream help reduce the maximum landward migration of the salinity interface during the late summer. In the spring, however, reservoirs and Delta exports consistently act in concert to increase the landward migration of the salinity interface over that expected under conditions of unimpaired flows.

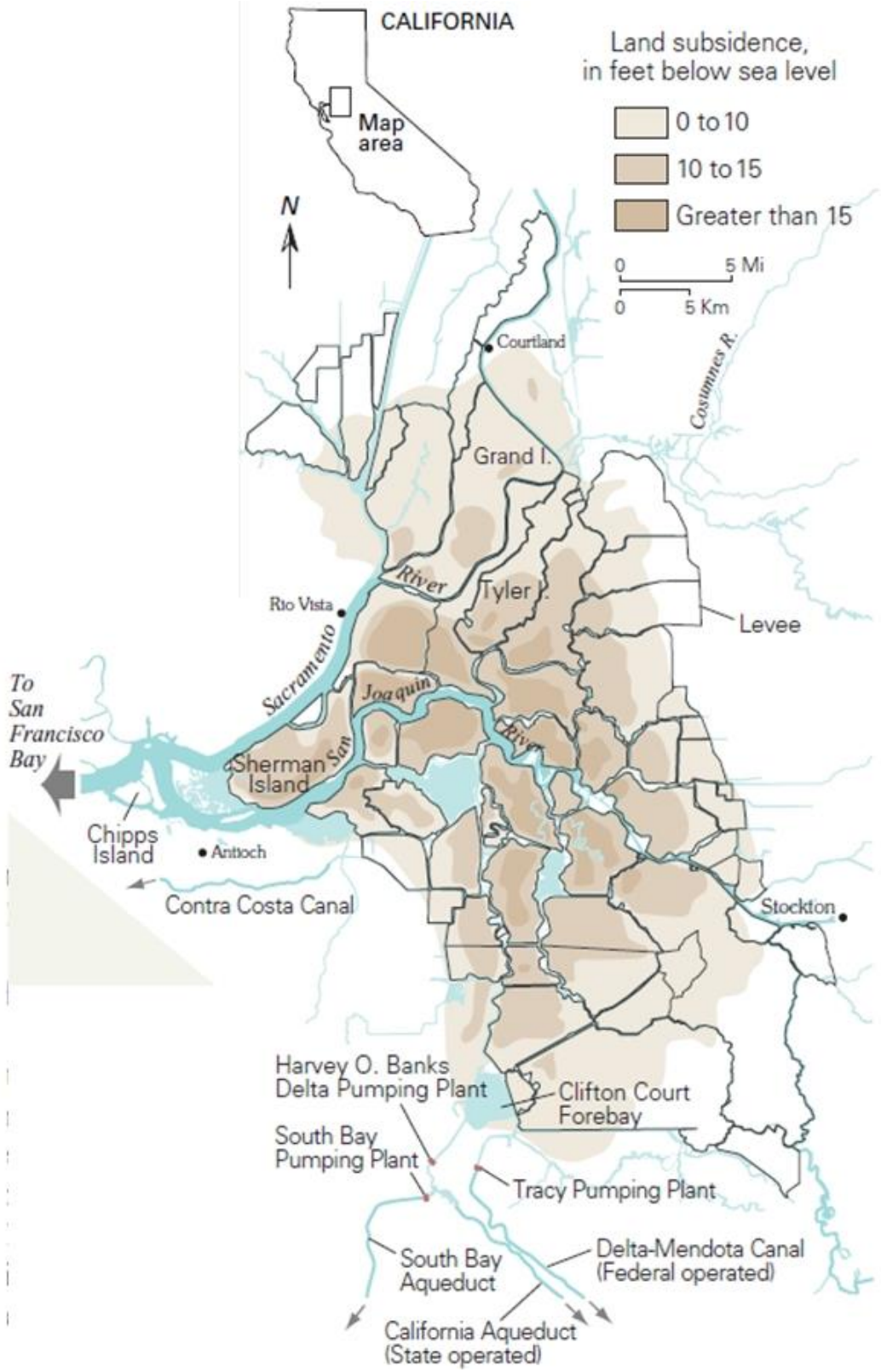
A less significant, terms of acreage effected, but no less severe problem arising from subsidence of bayward Delta islands is salt water intrusion of subsurface fresh water. River water runoff during years of comparatively normal precipitation has been sufficient to retard salt water from intruding into the fresh water table. However, the rate of salt water intrusion of west Delta islands increases during years of below normal precipitation, causing damage to crops irrigated with subsurface water contaminated with salt water. Efforts to develop salt tolerant crops and a reduction in the subsidence rate might enable farming to continue on west Delta islands for a limited time. However, continuing crop production accelerates peat oxidation and potentially lessens irrigation water quality from salt water intrusion of subsurface fresh water sources.

Subsidence and Levee Failure

Island subsidence has reduced the stability of Delta levees, increasing the risk of failure (see the discussion of Levee Failure in Section 4.2.17). Embankment and foundation materials for most Delta levees are substandard, adding the risk of failure during seismic events. Subsidence of levees and crop covered islands is occurring, though levees lower at a slower rate due primarily to a slow oxidation process from reduced tillage and irrigation.

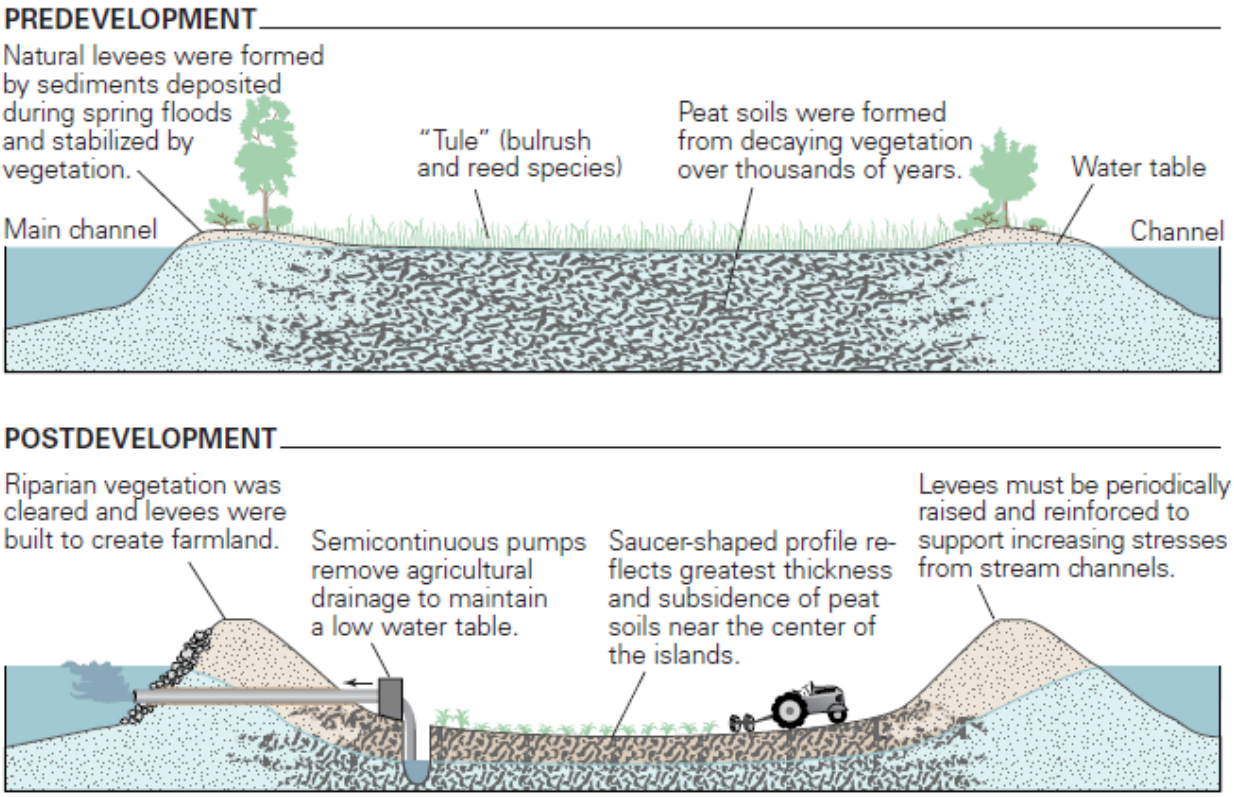
As shown in Figure 4-57, many of the islands in the central Delta are presently 10 to nearly 25 feet below sea level. The land surface profile of many islands is somewhat saucer-shaped, because subsidence is greater in the thick peat soils near their interior than in the more mineral-rich soils near their perimeter. As subsidence progresses, the levees themselves must be regularly maintained and periodically raised and strengthened to support the increasing stresses on their banks.

Figure 4-57 Land Subsidence in the Sacramento-San Joaquin Delta



Source: USGS Publication "Sacramento-San Joaquin Delta: The Sinking Heart of the State." Report FS-005-00

Figure 4-58 Subsidence in Peat Soils on the Delta Islands



Source: USGS Publication "Sacramento-San Joaquin Delta: The Sinking Heart of the State." Report FS-005-00

When levee breaches occur on deeply-subsided islands, rapid filling draws brackish water into the Delta, temporarily degrading water quality over a large region. Known colloquially as the "Big Gulp," the water quality impact of island filling is principally a function of the magnitude and location of anthropogenic accommodation space (vertical space once filled by peat but that has now subsided). Island flooding directly affects tidal prism dynamics within the Delta, with the potential for long-term degradation of water quality. The magnitude of the impact depends upon the location of flooded islands, the volume of water within the island, and the geometry of breach openings.

The costs of levee construction and maintenance are borne by the State of California and the Federal government, as well as by local reclamation districts. These costs increase as subsidence progresses, forcing levees to be built higher and stronger. Between 1981 and 1986, the total amount spent on emergency levee repairs related to flooding was about $97 million, and in 1981 to 1991 the amount spent on routine levee maintenance was about $63 million. Annual cost of repair and maintenance of Delta levees in the 1980s averaged about $20 million per year.

Subsidence and Natural Resources Protection

The Delta provides at least a portion of the water supply for about two-thirds of California's population, and provides a migratory pathway for four fish that are listed as endangered or threatened pursuant to the federal Endangered Species Act.

Past Occurrences

Disaster Declaration History

There have been no disaster declarations related to subsidence in Sacramento County.

NCDC Events

The NCDC database shows no past occurrences of subsidence.

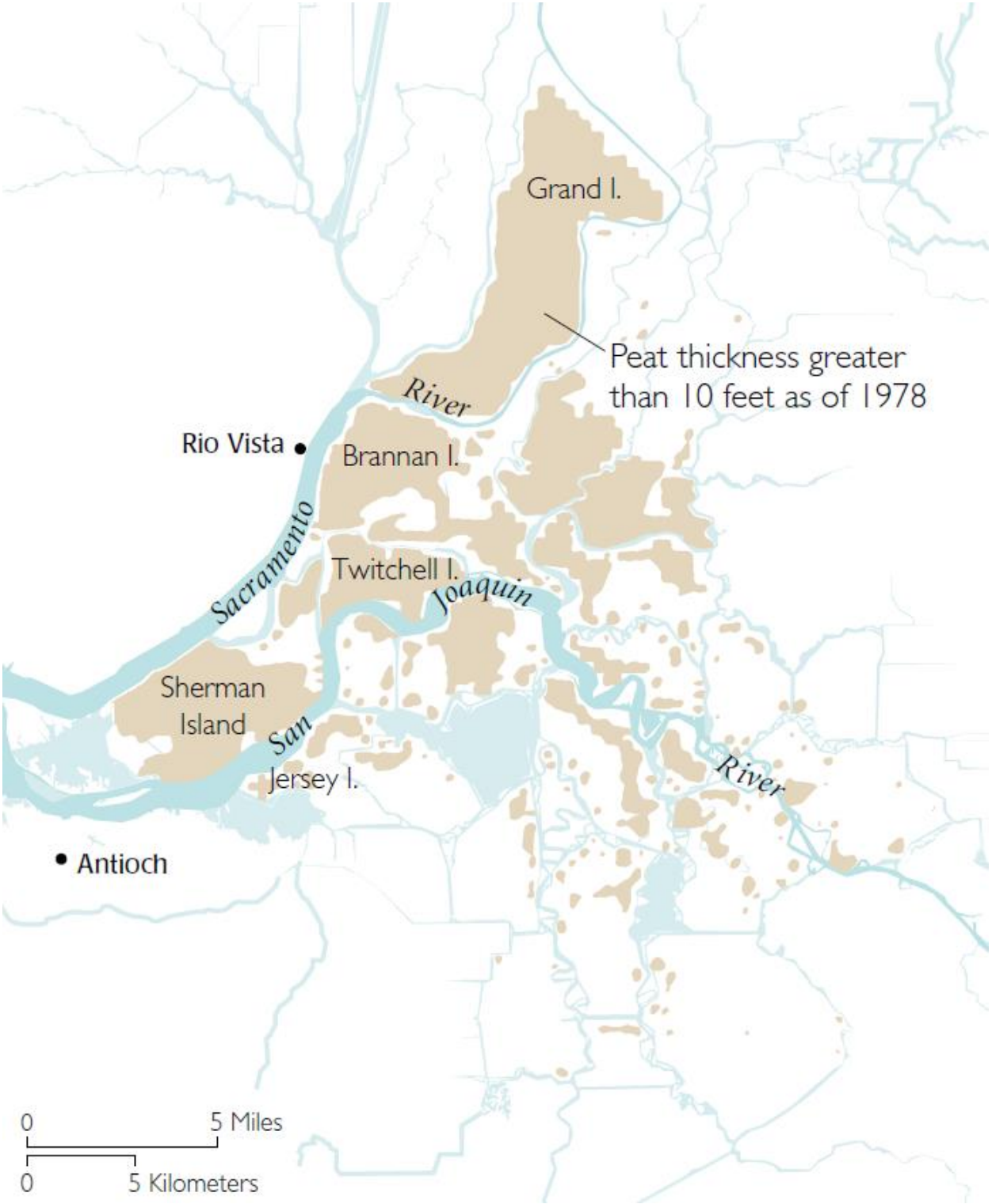
HMPC Events

Subsidence has been occurring since the late 1800s, when the land in the Delta region first was converted to farmland. Reclamation projects continued, and by the 1930s the levee system was complete. The best evidence for long-term rates of subsidence comes from two sources—measurements of the exposure of transmission-line foundations on Sherman and Jersey Islands in the western Delta and repeated leveling surveys on Mildred and Bacon Islands and Lower Jones Tract in the southern Delta. The transmission lines in the western Delta were installed in 1910 and 1952. They are founded on pylons driven down to a solid substrate, so that comparison of the original foundation exposure with the current exposure allows estimates of soil loss. The southern Delta transect was surveyed 21 times between 1922 and 1981; in 1983 further surveys were precluded when Mildred Island flooded. Both data sets indicate long-term average subsidence rates of 1 to 3 inches per year, but also suggest a decline in the rate of subsidence over time, probably due to a decreased proportion of readily oxidizable peat in the near surface. In fact, rates of elevation loss measured at three selected sites in 1990 to 1992 were less than 0.4 inches per year, consistent with the inferred slowing of subsidence. However, all of these sites were near island edges, and likely underestimate the average island-wide elevation loss.

Likelihood of Future Occurrences

Highly Likely—Subsidence in the Delta has been a historical problem, occurring on an annual basis. Although changes in farming techniques and improved land use practices have slowed levels of subsidence, subsidence continues to occur. This is unlikely to change in the near future. Areas with peat thickness over 10 feet have a great potential for continued subsidence. These areas are shown in Figure 4-59.

Figure 4-59 Peat Thickness Estimates



Source: California Department of Water Resources, 1998

Climate Change and Subsidence

Climate change may further contribute to subsidence in the County, by increasing evapotranspiration rates for agriculture and other vegetation and by increasing periods of drought, both of which can increase demand for water, accelerate groundwater pumping and the drilling of new groundwater wells and lead to further lowering of the groundwater table.

4.2.20. Volcano

Hazard/Problem Description

The California State Hazard Mitigation Plan identifies volcanoes as one of the hazards that can adversely impact the State. However, there have been few losses in California from volcanic eruptions. Of the approximately 20 volcanoes in the State, only a few are active and pose a threat. Of these, Long Valley Caldera and Lassen Peak are the closest to Sacramento County. The Long Valley area is considered to be an active volcanic region of California and includes features such as the Mono-Inyo Craters, Long Valley Caldera, and numerous active and potential faults. Figure 4-60 shows volcanoes in or near California and the location of the Lassen Peak and the Long Valley area relative to the Sacramento County Planning Area.

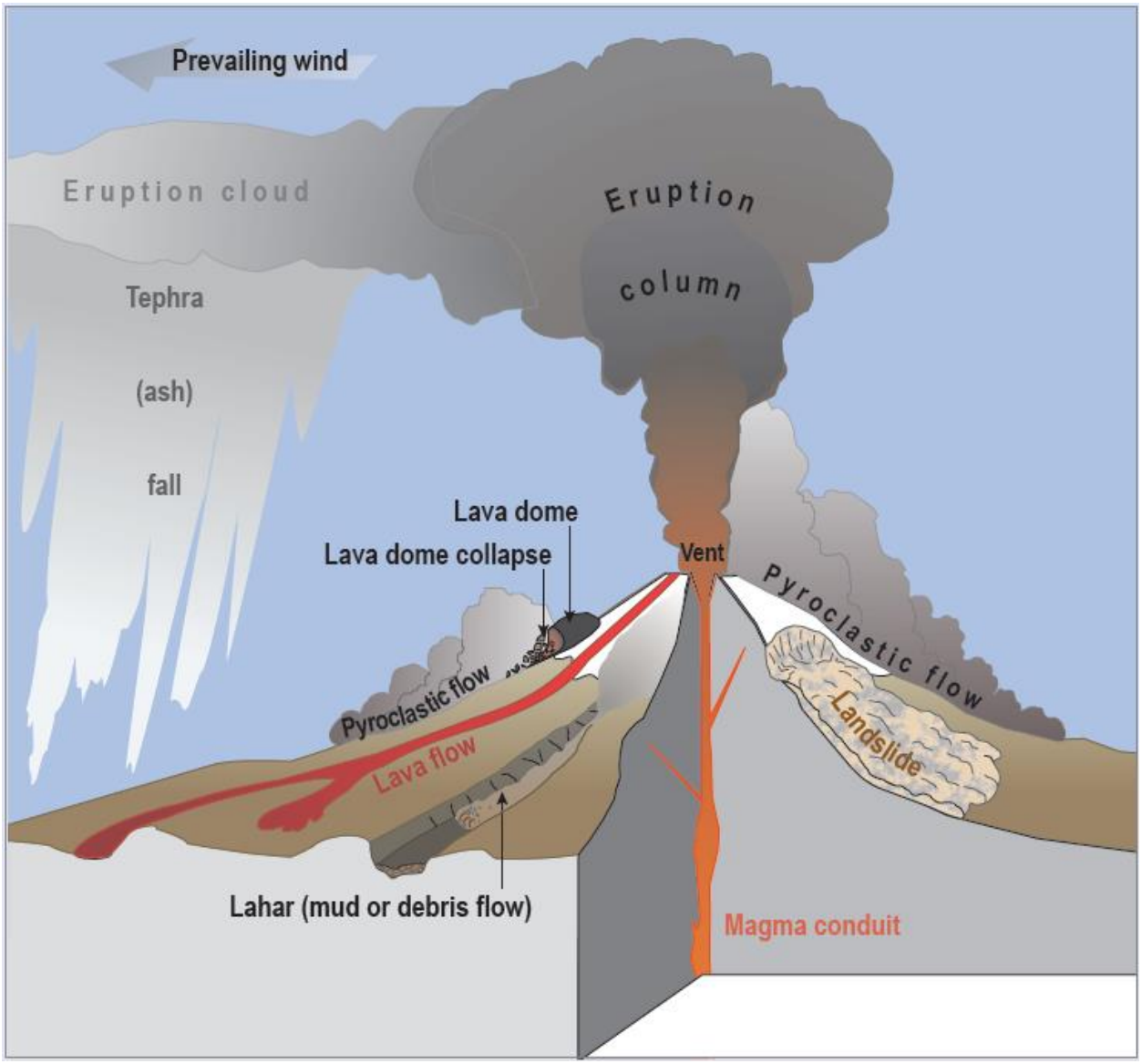
Figure 4-60 Active Volcanoes in California and in the Sacramento County Area

Source: 2013 State of California Hazard Mitigation Plan

As shown in Figure 4-61, active volcanoes pose a variety of natural hazards. Explosive eruptions blast lava fragments and gas into the air with tremendous force. The finest particles (ash) billow upward, forming an eruption column that can attain stratospheric heights in minutes. Simultaneously, searing volcanic gas laden with ash and coarse chunks of lava may sweep down the flanks of the volcano as a pyroclastic flow. Ash in the eruption cloud, carried by the prevailing winds, is an aviation hazard and may remain suspended for

hundreds of miles before settling to the ground as ash fall. During less energetic effusive eruptions, hot, fluid lava may issue from the volcano as lava flows that can cover many miles in a single day. Alternatively, a sluggish plug of cooler, partially solidified lava may push up at the vent during an effusive eruption, creating a lava dome. A growing lava dome may become so steep that it collapses, violently releasing pyroclastic flows potentially as hazardous as those produced during explosive eruptions.

Figure 4-61 Volcanoes and Associated Hazards

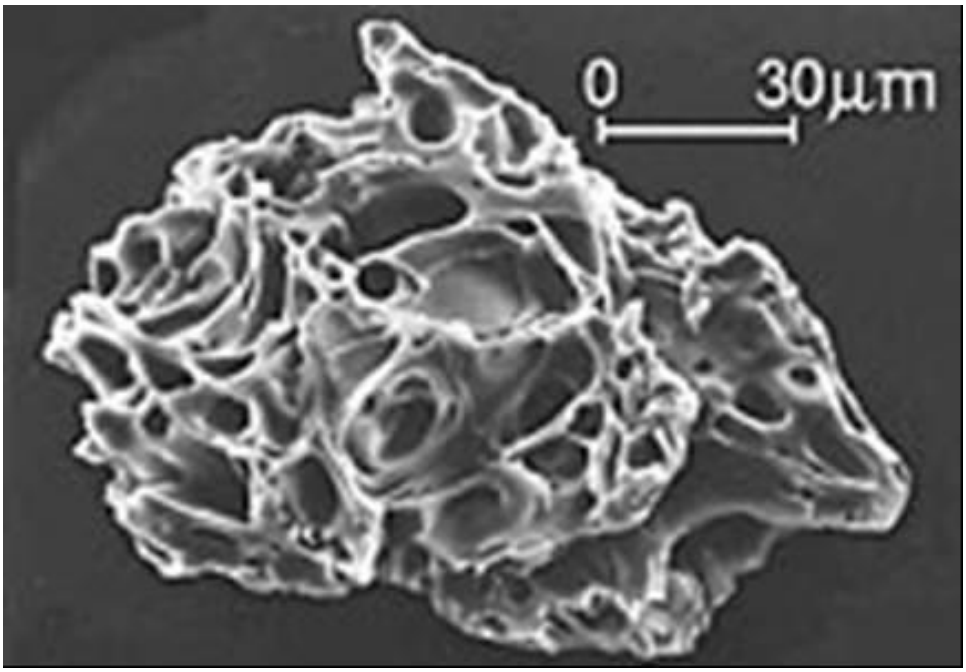


Source: USGS Publication 2014-3120

During and after an explosive or effusive eruption, loose volcanic debris on the flanks of the volcano can be mobilized by heavy rainfall or melting snow and ice, forming powerful floods of mud and rock (lahars) resembling rivers of wet concrete. These can rush down valleys and stream channels as one of the most destructive types of volcano hazards.

Populations living near volcanoes are most vulnerable to volcanic eruptions and lava flows, although volcanic ash can travel and affect populations many miles away and cause problems for aviation. The USGS notes specific characteristics of volcanic ash. Volcanic ash is composed of small jagged pieces of rocks, minerals, and volcanic glass the size of sand and silt, as shown in Figure 4-62. Very small ash particles can be less than 0.001 millimeters across. Volcanic ash is not the product of combustion, like the soft fluffy material created by burning wood, leaves, or paper. Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive, and conducts electricity when wet.

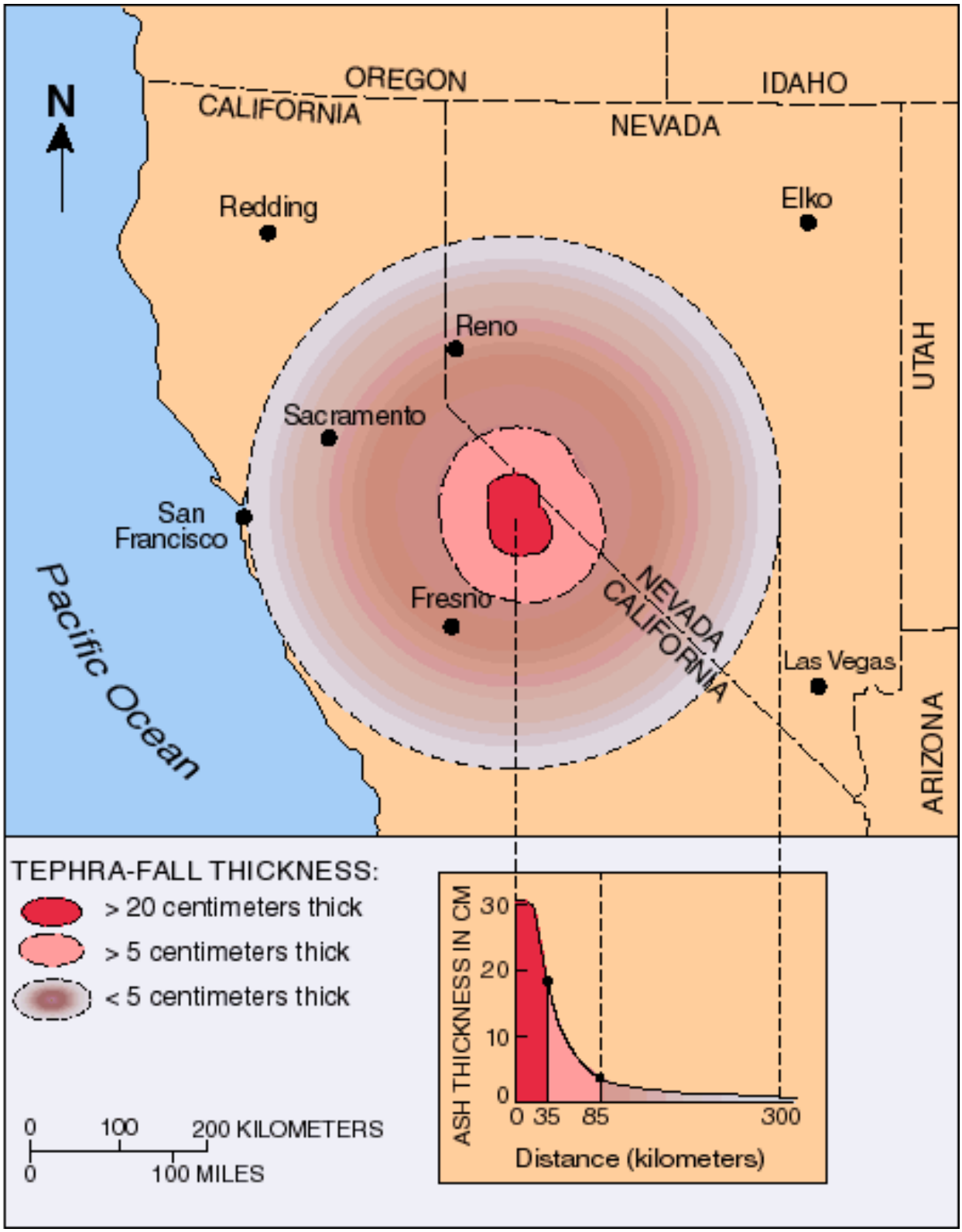
Figure 4-62 Ash Particle from 1980 Mt. St Helens Eruption Magnified 200 Times



Source: US Geological Survey: Volcanic Ash: Effect & Mitigation Strategies. http://volcanoes.usgs.gov/ash/properties.html.

Volcanic ash is formed during explosive volcanic eruptions. Explosive eruptions occur when gases dissolved in molten rock (magma) expand and escape violently into the air, and also when water is heated by magma and abruptly flashes into steam. The force of the escaping gas violently shatters solid rocks. Expanding gas also shreds magma and blasts it into the air, where it solidifies into fragments of volcanic rock and glass. Once in the air, wind can blow the tiny ash particles tens to thousands of miles away from the volcano. Figure 4-63 is a volcanic hazard's ash dispersion map for the Long Valley Caldera, which could possible affect Sacramento County.

Figure 4-63 Volcanic Hazards Ash Dispersion Map for the Long Valley Caldera



Source: US Geological Survey

The average grain-size of rock fragments and volcanic ash erupted from an exploding volcanic vent varies greatly among different eruptions and during a single explosive eruption that lasts hours to days. Heavier, large-sized rock fragments typically fall back to the ground on or close to the volcano and progressively smaller and lighter fragments are blown farther from the volcano by wind. Volcanic ash, the smallest particles (2 mm in diameter or smaller), can travel hundreds to thousands of kilometers downwind from a volcano depending on wind speed, volume of ash erupted, and height of the eruption column.

The size of ash particles that fall to the ground generally decreases exponentially with increasing distance from a volcano. Also, the range in grain size of volcanic ash typically diminishes downwind from a volcano (becoming progressively smaller). At specific locations, however, the distribution of ash particle sizes can vary widely. Based on Figure 4-63, the US Geological Survey estimated that ash of up to 2" could fall in areas of Sacramento County.

Past Occurrences

Disaster Declarations

There have been no disaster declarations related to volcano.

NCDC Events

The NCDC does not track volcanic activity.

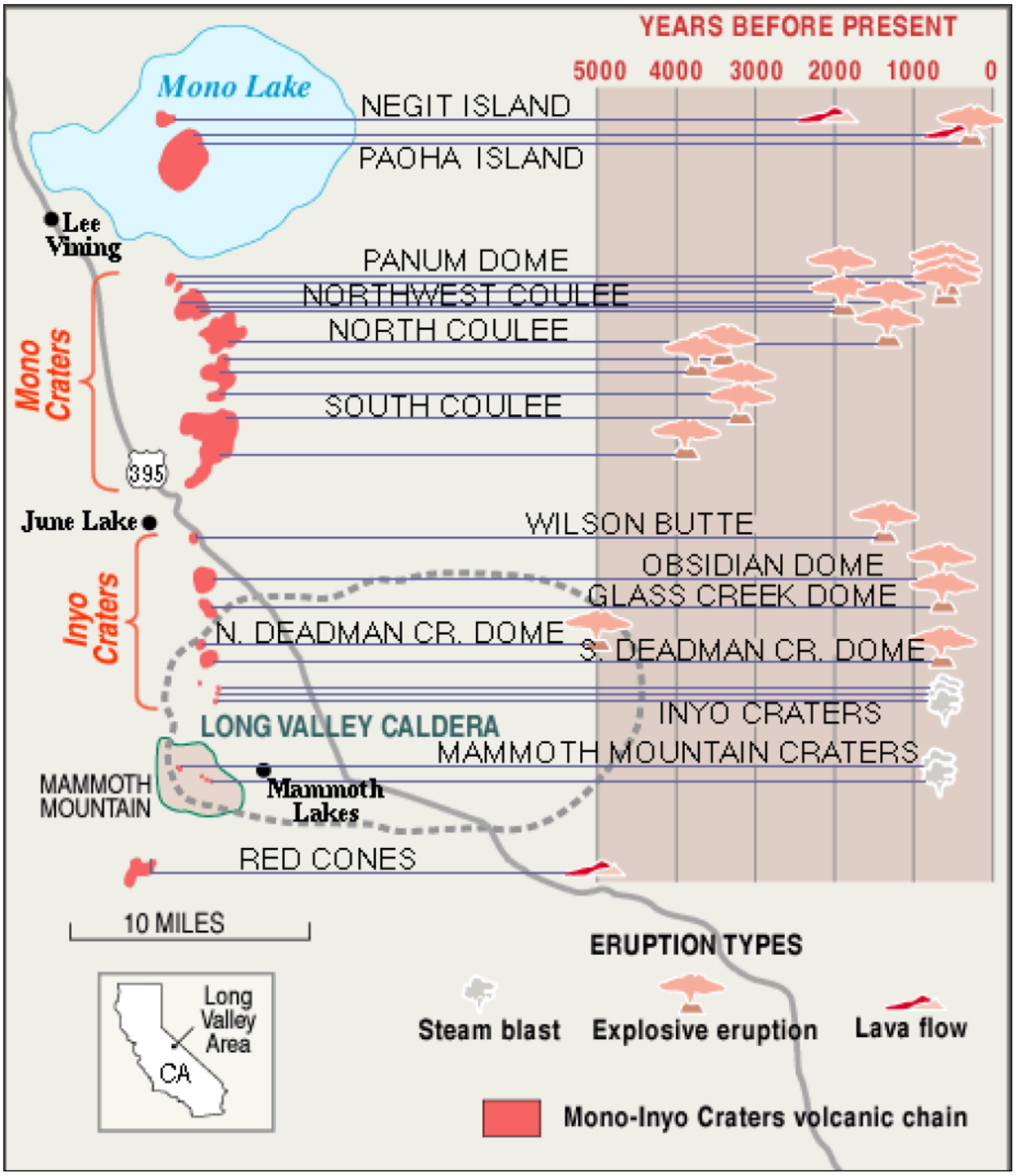
HMPC Events

The HMPC noted no volcanic events.

USGS Events

During the past 1,000 years there have been at least 12 volcanic eruptions in the Long Valley area. This activity is likely to continue long into the future. The Long Valley Caldera and Mono-Inyo Craters volcanic chain has a long history of geologic activity that includes both earthquakes and volcanic eruptions. Volcanoes in the Mono-Inyo Craters volcanic chain have erupted often over the past 40,000 years. As shown in Figure 4-64. over the past 5,000 years, small to moderate eruptions have occurred at various sites along the Mono-Inyo Craters volcanic chain at intervals ranging from 250 to 700 years.

Figure 4-64 Volcanic Activity in the Mono-Inyo Craters Volcano Chain in the Past 5,000 Years



Source: U.S. Geological Survey

As recently as 1980 four large earthquakes (greater than magnitude 6 on the Richter Scale) and numerous relatively shallow earthquakes occurred in the area. Since then, earthquakes and associated uplift and deformation in the Mammoth Lakes Caldera have continued. Because such activities are common

precursors of volcanic eruptions, the U.S. Geological Survey closely monitors the unrest in the region. There are no records of past impacts from volcanic eruptions to the Sacramento County Planning Area.

Likelihood of Future Occurrences

Unlikely—According to the U.S. Geological Survey, the pattern of volcanic activity over the past 5,000 years suggests that the next eruption in the Long Valley area will most likely happen somewhere along the Mono-Inyo volcanic chain. However, the probability of such an eruption occurring in any given year is less than 1 percent. The next eruption will most likely be small and similar to previous eruptions along the Mono-Inyo volcanic chain during the past 5,000 years (see Figure 4-64 above). According to the State Multi-Hazard Mitigation Plan, only Medicine Lake, Mount Shasta, Lassen Peak, and the Long Valley Caldera are considered active and pose a threat of future activity. However, due to the location of the planning area relative to the active volcanoes, the State Plan does not consider Sacramento County to be vulnerable to eruption and/or ash from these volcanoes.

4.2.21. Wildfire

Hazard/Problem Description

Wildland fire is an ongoing concern for the Sacramento County Planning Area. Generally, the fire season extends from early spring through late fall of each year during the hotter, dryer months. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, accumulation of vegetation, and high winds.

Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire suppression practices have affected the natural cycle of the ecosystem. While wildfire risk is predominantly associated with wildland urban interface (WUI) areas, significant wildfires can also occur in heavily populated areas. The wildland urban interface is a general term that applies to development adjacent to landscapes that support wildland fire. Wildland fires affect grass, forest, and brushlands, as well as any structures located within them.

WUI fires are the most damaging. WUI fires occur where the natural and urban development intersect. Even relatively small acreage fires may result in disastrous damages. WUI fires occur where the natural forested landscape and urban-built environment meet or intermix. The damages are primarily reported as damage to infrastructure, built environment, loss of socio-economic values and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern now burns developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Wildfire and urban wildfire are an ongoing concern for Sacramento County. Generally, the fire season extends from early spring to late fall. Fire conditions arise from a combination of hot weather, an accumulation of vegetation, and low moisture content in the air. These conditions when combined with high winds and years of drought increase the potential for a wildfire to occur. Urban wildfires often occur in those areas where development has expanded into the rural areas. A fire along this urban/rural interface can result in major losses of property and structures. Generally, there are three major factors that sustain wildfires and allow for predictions of a given area's potential to burn. These factors include fuel, topography, weather, and human actions.

- **Fuel**. Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles and leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also to be considered as a fuel source, are man-made structures and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread. The volume of available fuel is described in terms of Fuel Loading. Certain areas in and surrounding Sacramento County are extremely vulnerable to fires as a result of dense grassy vegetation combined with a growing number of structures being built near and within rural lands. In the northern portion of the County, such as Folsom, an increase in forested areas increase the risk and vulnerability of wildfire.
- **Topography**. An area's terrain and land slopes affect its susceptibility to wildfire spread. Fire intensities and rates of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes. Most of the Sacramento area is relatively flat, thus limiting the influence of this factor on wildfire behavior.
- **Weather**. Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread, and the more intense it will be. Winds can be significant at times in Sacramento County. However, it should be noted that the winds generally occur during the winter storm season, not during the summer, fire season. In addition to high winds, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. Related to weather is the issue of recent drought conditions contributing to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases.
- **Human Actions** – Most wildfires are ignited by human action, the result of direct acts of arson, carelessness, or accidents. Many fires originate in populated areas along roads and around homes, and are often the result of arson or careless acts such as the disposal of cigarettes, use of equipment or debris burning. Recreation areas that are located in high fire hazard areas also result in increased human activity that can increase the potential for wildfires to occur.

Potential losses from wildfire include human life, structures and other improvements, natural and cultural resources, quality and quantity of water supplies, cropland, timber, and recreational opportunities. Economic losses could also result. Smoke and air pollution from wildfires can be a severe health hazard. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Past Occurrences

Disaster Declaration History

There were no FEMA or Cal OES disaster declarations associated with wildfire in the Sacramento County Planning Area. There was one USDA Secretarial Disaster Declaration (S3626) for wildfire in 2014.

NCDC Events

The NCDC has tracked wildfire events in the County dating back to 1993. Events in Sacramento County are shown in Table 4-36.

Table 4-36 NCDC Wildfire Events in Sacramento County 1993 to 12/31/2015

Date	Event	Injuries (direct)	Deaths (direct)	Property Damage	Crop Damage	Injuries (direct)	Deaths (direct)
7/4/2014	Wildfire	0	0	$2,500,000	$0	0	0
7/22/2015	Wildfire	0	0	$0	$0	0	0
7/27/2015	Wildfire	0	0	$500,000	$0	0	0
Totals		**0**	**0**	**$3,000,000**	**$0**	**0**	**0**

Source: NCDC

*Deaths, injuries, and damages are for the entire event, and may not be exclusive to the County.

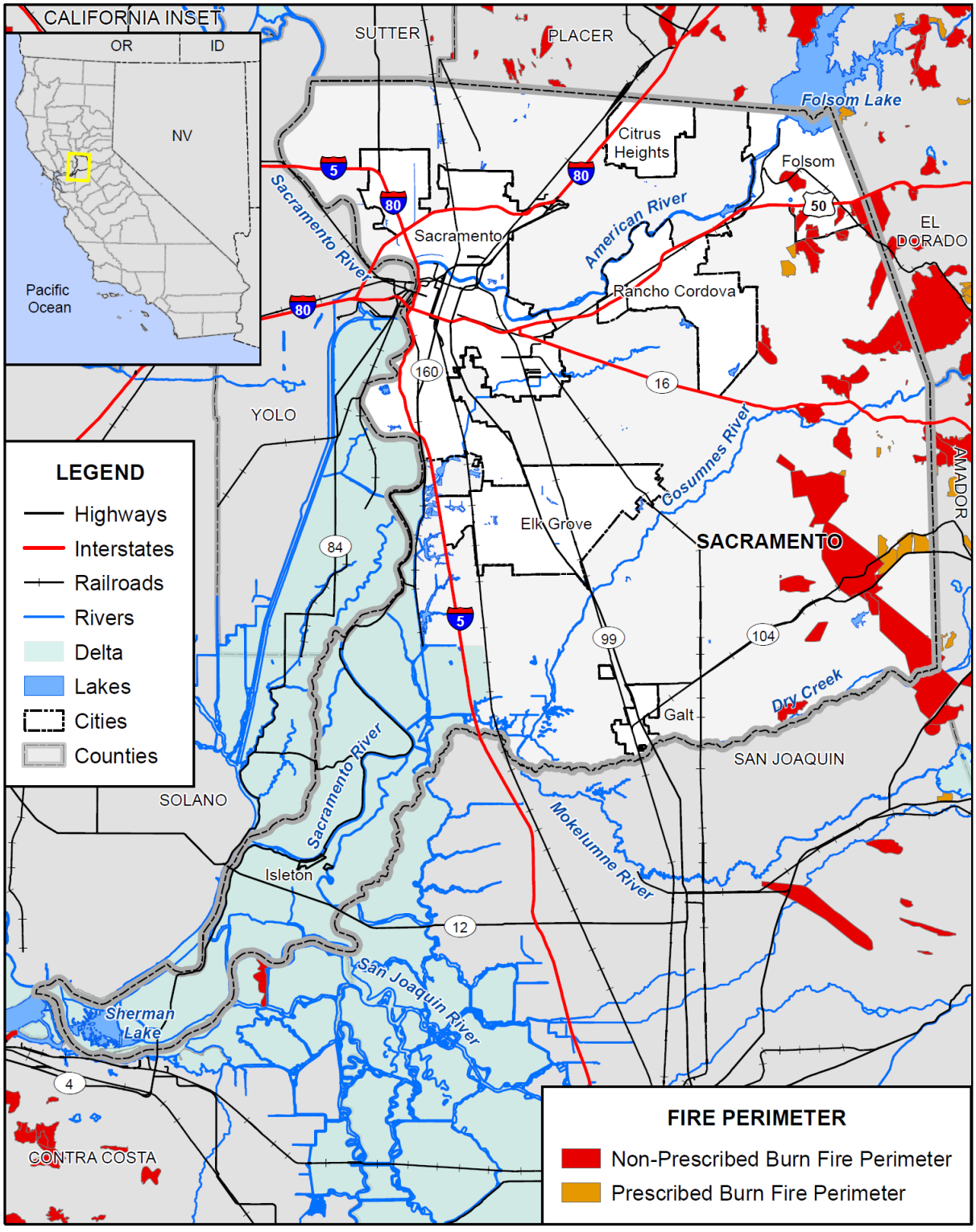
CAL FIRE Events

CAL FIRE, USDA Forest Service Region 5, Bureau of Land Management (BLM), the National Park Service (NPS), Contract Counties and other agencies jointly maintain a comprehensive fire perimeter GIS layer for public and private lands throughout the state. The data covers fires back to 1878 (though the first recorded incident for the County was in 1950). For the National Park Service, Bureau of Land Management, and US Forest Service, fires of 10 acres and greater are reported. For CAL FIRE, timber fires greater than 10 acres, brush fires greater than 50 acres, grass fires greater than 300 acres, and fires that destroy three or more residential dwellings or commercial structures are reported. CAL FIRE recognizes the various federal, state, and local agencies that have contributed to this dataset, including USDA Forest Service Region 5, BLM, National Park Service, and numerous local agencies.

Fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should not be used for statistical or analytical purposes.

The data provides a reasonable view of the spatial distribution of past large fires in California. Using GIS, fire perimeters that intersect Sacramento County were extracted and are listed in Table 4-37. There are 50 fires recorded in this database for Sacramento County. 44 of these burned areas greater than 50 acres. Each of them was tracked by Cal Fire; Cal Fire last updated this database in June 2014. Table 4-37 lists each fire's date, cause, name, and acreage burned in Sacramento County. Figure 4-65 shows fire history for the County, colored by burn type. This map contains fires from 1950 to 2014.

Figure 4-65 Sacramento County Wildfire History



Data Source: Sacramento County GIS, Cal-Atlas, Cal-Fire 05/2015 Fire History Data; Map Date: 05/2016.

Table 4-37 Sacramento County Wildfire History 1950 to 2014

Alarm Date	Fire Name	Cause	Prescribed / Non-prescribed Burn	Acres
6/6/1950	Russi	Unknown / Unidentified	Non-prescribed Burn	534
6/19/1950	Questo Ranch	Unknown / Unidentified	Non-prescribed Burn	878
9/13/1950	Cavitt	Unknown / Unidentified	Non-prescribed Burn	339
10/4/1962	Roadside #31 Series	Unknown / Unidentified	Non-prescribed Burn	352
7/10/1964	Joerger	Unknown / Unidentified	Non-prescribed Burn	1514
6/22/1968	Van Vleck	Unknown / Unidentified	Non-prescribed Burn	2665
6/18/1973	Russell	Unknown / Unidentified	Non-prescribed Burn	408
6/7/1974	Cosumnes School	Unknown / Unidentified	Non-prescribed Burn	582
6/7/1974	Grantline	Unknown / Unidentified	Non-prescribed Burn	311
6/20/1976	Gill	Unknown / Unidentified	Non-prescribed Burn	715
7/29/1980	Michigan Bar	Unknown / Unidentified	Non-prescribed Burn	848
6/14/1981	Meiss	Miscellaneous	Non-prescribed Burn	14126
6/18/1981	Joerger Series	Equipment Use	Non-prescribed Burn	1676
6/20/1981	Silva	Arson	Non-prescribed Burn	248
9/21/1981	Prairie City	Arson	Non-prescribed Burn	593
7/6/1983	Clay	Equipment Use	Non-prescribed Burn	405
7/14/1983	White Rock	Miscellaneous	Non-prescribed Burn	169
8/28/1983	Meiss	Equipment Use	Non-prescribed Burn	603
3/1/1985	Arroyo Seco #3		Prescribed Burn	406
7/20/1986	White Rock Series	Arson	Non-prescribed Burn	7
7/20/1986	White Rock Series	Arson	Non-prescribed Burn	82
7/20/1986	White Rock Series	Arson	Non-prescribed Burn	162
7/20/1986	White Rock Series	Arson	Non-prescribed Burn	282
7/20/1986	White Rock Series	Arson	Non-prescribed Burn	33
6/17/1989	Trunk Handle (Unit1)		Prescribed Burn	56
6/17/1989	Trunk Handle (Unit2)		Prescribed Burn	178
6/21/1992	Smud #1	Powerline	Non-prescribed Burn	1179
6/26/1996	Prairie City		Prescribed Burn	316
8/2/1996	Scott	Arson	Non-prescribed Burn	8828
6/16/2001	Vanvleck		Prescribed Burn	23
6/23/2001	Bevan	Equipment Use	Non-prescribed Burn	687
7/4/2001	Dillard Wf2	Playing with Fire	Non-prescribed Burn	11
7/5/2001	Payen	Miscellaneous	Non-prescribed Burn	302
7/31/2001	Clay	Arson	Non-prescribed Burn	526
7/31/2001	Michigan #4	Arson	Non-prescribed Burn	55

Alarm Date	Fire Name	Cause	Prescribed / Non-prescribed Burn	Acres
6/8/2002	Twin	Arson	Non-prescribed Burn	322
6/12/2002	Pony	Powerline	Non-prescribed Burn	702
7/1/2002	White	Vehicle	Non-prescribed Burn	81
9/16/2002	Puerto	Arson	Non-prescribed Burn	17
10/10/2002	White #2	Unknown / Unidentified	Non-prescribed Burn	170
6/12/2003	Cosumnes River Preserve #2		Prescribed Burn	70
7/15/2003	Cosumnes River Preserve #1		Prescribed Burn	433
4/4/2004	Scott	Unknown / Unidentified	Non-prescribed Burn	609
9/26/2005	Twin	Vehicle	Non-prescribed Burn	104
6/9/2006	CHANCE Ranch VMP		Prescribed Burn	560
6/14/2006	Van Vleck Ranch VMP		Prescribed Burn	57
6/12/2007	Chance Ranch VMP		Prescribed Burn	479
7/7/2011	Chance Ranch		Prescribed Burn	263
3/25/2012	Van Vleck		Prescribed Burn	3
5/28/2013	Prairie City OHV - Prairie City		Prescribed Burn	176

Source: CAL FIRE

HMPC Events

The HMPC also provided the following information on historical fires in the County.

- **Late 1850**s: The worst fire in Sacramento history leveled nine-tenths of the City.
- **September/October 2014 – King Fire**. While the King Fire did not burn ground in Sacramento County, it did affect the County. Production from the Upper American River Hydroelectric Power Plant was disrupted for 2 weeks, requiring an additional unbudgeted $37 million for replacement power, by far the largest cost compared to the approximately $4M in immediate physical damage.
- **7/2015 NOAA** (fires regional to Sacramento County) – Rocky Fire burned 69,000 acres in Lake, Yolo & Colusa Counties. 43 homes and 53 outbuildings were destroyed.
- A 25-acre fire in Elk Grove occurred on **June 9, 2015**. A grass fire that started about 1:30 p.m. at Bond and Waterman roads was driven by high, shifting winds. It quickly spread toward homes that border the field to the east and south. The fire damaged one Elk Grove home and prompted evacuation of several other residences before it was contained.

Likelihood of Future Occurrence

Highly Likely — From May to October of each year, Sacramento County faces a wildfire threat. Fires will continue to occur on an annual basis in the Sacramento County Planning Area. The threat of wildfire and potential losses constantly increase as human development and population increase in the wildland urban interface area in the County. This results in a likely rating of future occurrence.

Climate Change and Wildfire

Preliminary Draft - Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP), Ascent Environmental 2016 Analysis

According to the Sacramento County Phase 1 Vulnerability Assessment, contained within the 2016 Preliminary Draft CAP, which utilized Cal Adapt to model potential climate change impacts to Sacramento County, changes in precipitation patterns and increased temperatures associated with climate change will alter the distribution and character of natural vegetation and associated moisture content of plants and soils. Increased temperatures will increase the rate of evapotranspiration in plants, resulting in a greater presence of dry fuels in forests and grasslands and creating a higher potential for wildfire risks. Warmer temperatures will also create a more favorable habitat for bark beetles and other pests that will deteriorate tree health, increasing their vulnerability to wildfires. Thus, increasing heat coupled with declining precipitation can lead to a secondary impact of climate change – an increase in the frequency and intensity of wildfires. The Sacramento Metropolitan Fire District's CWPP also predicts an overall increase in the frequency and intensity of wildfires as a result of the changes associated with climate change.

Cal-Adapt's wildfire tool predicts the potential increase in the amount of burned areas for the year 2085, as compared to current (2010) conditions. Based on this model, Cal-Adapt predicts that wildfire risk in Sacramento County will increase slightly in the near term, and subside during mid-to late-century. However, wildfire models can vary depending on the parameters used. Cal-Adapt does not take landscape and fuel sources into account in their model. In all likelihood, in Sacramento County, precipitation patterns, high levels of heat, topography, and fuel load will determine the frequency and intensity of future wildfire.

Wildfires and Air Quality. In addition to a probable increase in wildfire risk, wildfires within the Sierra Nevada and areas outside the County affect air quality in Sacramento County and across the Sacramento Valley. Particulate matter from wildfire dissipates throughout the Central Valley degrading air quality conditions for short or extended periods of time. An increase in air pollutants can cause or exacerbate health conditions. The duration of wildfire-related particulate matter in the County's air is further linked to wind patterns (i.e., the Delta Breeze) originating from the Sacramento-San Joaquin Delta that disperse air pollutants north of the Sacramento Valley. However, during about half of the days from July to September (high fire season), a phenomenon called the "Schultz Eddy" prevents this from occurring. All of these factors will affect the severity of wildfire-related air pollution in Sacramento County. Climate change has already significantly lengthened California's fire season, as well as the intensity, frequency and size of individual wildfires around the state, and this trend is likely to continue without further mitigation. It is likely that Sacramento County will experience worsened air quality from increased wildfires throughout Northern California and even Oregon.

4.2.22. Natural Hazards Summary

Table 4-38 summarizes the results of the hazard identification and hazard profile for the Sacramento County Planning Area based on the hazard identification data and input from the HMPC. For each hazard profiled in Section 4.2, this table includes the likelihood of future occurrence and whether the hazard is considered a priority hazard for the Sacramento County Planning Area.

Table 4-38 Hazard Identification/Profile Summary and Determination of Priority Hazard: Sacramento County Planning Area

Hazard	Likelihood of Future Occurrence	Priority Hazard
Agricultural Hazards	Highly Likely	Y
Bird Strike	Highly Likely	Y
Climate Change	Highly Likely	Y
Dam Failure	Unlikely	Y
Drought and Water Shortage	Likely	Y
Earthquake	Occasional	Y
Earthquake: Liquefaction	Occasional	Y
Flood: 100/200/500-year	Occasional/Unlikely	Y
Flood: Localized Stormwater Flooding	Highly Likely	Y
Landslides	Unlikely	N
Levee Failure	Occasional	Y
River/Stream/Creek Bank Erosion	Highly Likely	Y
Severe Weather: Extreme Temperatures – Cold/Freeze	Highly Likely	N
Severe Weather: Extreme Temperatures – Heat	Highly Likely	Y
Severe Weather: Fog	Highly Likely	N
Severe Weather: Heavy Rains and Storms (Thunderstorms/Hail, Lightning)	Highly Likely	Y
Severe Weather: Wind and Tornadoes	Likely	N
Subsidence	Highly Likely	N
Volcano	Unlikely	N
Wildfire	Highly Likely	Y

4.3 Vulnerability Assessment

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

With Sacramento County's hazards identified and profiled, the HMPC conducted a vulnerability assessment to describe the impact that each hazard would have on the County. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to natural hazards and estimates potential losses. This section focuses on the risks to the County as a whole. Data from the individual participating jurisdictions was also evaluated and is integrated here and in the jurisdictional annexes, and noted where the risk differs for a particular jurisdiction within the Planning Area.

This vulnerability assessment followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses. The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

Data Sources

Data used to support this assessment included the following:

- ArkStorm at Tahoe - Stakeholder Perspectives on Vulnerabilities and Preparedness for an Extreme Storm Event in the Greater Lake Tahoe, Reno and Carson City Region. 2014.
- birdnature.com Pacific Flyway
- California Adaptation Planning Guide
- Cal-Adapt
- CAL FIRE GIS datasets
- California Department of Finance, E-1 Report
- California Department of Finance, E-4 Report
- California Department of Finance, P-1 Report
- California Department of Fish and Game's Natural Diversity Database
- California Department of Food and Agriculture
- California Native Plant Society

- California Office of Historic Preservation
- County GIS data (hazards, base layers, and assessor's data)
- Delta Risk Management Strategy. June 2011.
- Existing plans and studies
- Federal Aviation Administration National Wildlife Database
- FEMA's HAZUS-MH 2.2 GIS-based inventory data
- FEMA Digital Flood Insurance Rate Map. June 16, 2015.
- FEMA Sacramento County Flood Insurance Study. June 16, 2015.
- Liu, J.C., Mickley, L.J., Sulprizio, M.P. et al. Climatic Change. 138: 655. doi:10.1007/s10584-016-1762-6. 2016.
- Kenward, Alyson PhD, Adams-Smith, Dennis, and Raja, Urooj. Wildfires and Air Pollution – The Hidden Health Hazards of Climate Change. Climate Central. 2013.
- National Drought Mitigation Center – Drought Impact Reporter
- National Park Service – Historic American Buildings Survey and Historic American Engineering Record
- Personal interviews with planning team members and staff from the County and participating jurisdictions
- Preliminary Draft – Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan
- Sacramento County 2035 General Plan
- Sacramento County Department of Water Resources
- Sacramento County General Plan Environmental Impact Report
- Sacramento County General Plan Open Space Element Background
- Sacramento County of Governments Population Projections for 2008, 2020, and 2035
- Sacramento General Plan Background Report
- Sacramento Municipal Utility District Dam inundation maps
- South Sacramento Habitat Conservation Plan
- State Department of Water Resource's Delta Atlas
- Statewide GIS datasets compiled by the California Office of Emergency Services to support mitigation planning
- University of California – Integrated Pest Management Program
- US Census Bureau 2010 Household Population Estimates
- US Department of Agriculture Farm Service Agency
- US Fish and Wildlife Service
- US Fish and Wildlife Service's National Wetlands Inventory maps
- Written descriptions of inventory and risks provided by participating jurisdictions

4.3.1. Sacramento County Vulnerability and Assets at Risk

As a starting point for analyzing the Planning Area's vulnerability to identified hazards, the HMPC used a variety of data to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur in the Planning Area, this section describes significant assets at risk in the Planning Area. Data used in this baseline assessment included:

- Total assets at risk;
- Critical facility inventory;

- Cultural, historical, and natural resources; and
- Growth and development trends.

Total Assets at Risk

The total assets at risk for Sacramento County is intended to capture the values associated with assessed assets located within the Sacramento County Planning Area. The 2016 GIS parcel layer, obtained from Sacramento County GIS and the 2015 Sacramento County Assessor's Data – Certified Roll obtained from the County Assessor was used for this analysis. This data provided by Sacramento County represents best available data.

Understanding the total assessed value of Sacramento County is a starting point to understanding the overall value of the Planning Area. When the total assessed values are combined with potential values associated with other community assets such as natural resources, cultural and historic resources, and public and private critical infrastructure, the big picture emerges as to what is potentially at risk and vulnerable to the damaging effects of natural hazards within the County Planning Area.

Data Limitations & Notations

Although based on best available data, the resulting information should only be used as an initial guide to overall values in the County.

The County GIS parcel data contained 445,518 records and the County Assessor data contained 474,727 records. Both tables were joined together within the GIS environment, and a total of 444,089 records were linked. In some cases, it is possible that the Assessor data may contain duplicate records under one parcel identification number (APN). For the purpose of this study, 1 Assessor record corresponds to 1 GIS parcel. In total, there were 2,429 Assessor records that are not included in the Total Assets at Risk Tables detailed below and are also excluded from further hazard analyses as these records were not matched to the GIS records.

In the event of a disaster, infrastructure and improvements are at the greatest risk of damage. Depending on the type of hazard and resulting damages, the land itself may not suffer a significant loss. For that reason, the values of infrastructure and improvements are of greatest concern. As such, it is critical to note a specific limitation to the assessed values data within the County, due to Proposition 13. Instead of adjusting property values annually, no adjustments are made until a property transfer occurs. As a result, overall property value information is most likely low and may not reflect current market or true potential loss values for properties within the County.

Methodology

Sacramento County's 2015 Assessor Data provided by the County Assessor's office, were used as the basis for the inventory of assessed values for both improved and unimproved parcels within the Planning Area. The source GIS parcel data used for this analysis provides the land and improved values assessed for each parcel, along with information about property use and ownership. The jurisdiction in which the parcel resides is also indicated in the source parcel data.

Sacramento County Use Codes provide detailed descriptive information about how each property is generally used, such as irrigated farm, apartment, restaurant, or industrial warehouse. The many use codes were logically grouped into the following simplified categories for the hazards analysis: Agricultural, Care/Health, Church/Welfare, Industrial, Miscellaneous, Office, Public/Utilities, Recreational, Residential, Retail/Commercial, Vacant, and No Data. Once Use Codes were grouped into categories, the number of total and improved parcels were inventoried by jurisdiction.

Values associated with land, and improved structure values were identified and summed in order to determine total values at risk in the Sacramento County Planning Area, and specific to each jurisdiction. Together, the Land Value and Improved Structure Value make up the total value associated with each identified parcel or asset. Improved parcel counts were based on the assumption that a parcel was improved if a structure value was present.

The Sacramento County Planning has a total land value of $38.87 billion, improved structure value of $90.9 billion, and a total value of $ $129.7 billion. Unincorporated Sacramento County has 157,818 improved parcels with a total value (both land and improvements) of close to $47.1 billion. Table 4-39 shows the total assets or exposure for the entire Sacramento County Planning Area, by jurisdiction. The values for the Sacramento County Planning Area are broken out by property use type and are provided in Table 4-40. The values for unincorporated Sacramento County are broken out by property use type and are provided in Table 4-41. More information on assets at risk for each jurisdiction can be found in their respective annexes.

Table 4-39 Sacramento County Planning Area – Total Assets at Risk by Jurisdiction

Jurisdiction	Parcels	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Citrus Heights	24,479	23,505	$1,821,701,542	$4,048,528,628	$5,870,230,170
Elk Grove	51,367	47,402	$4,715,438,843	$12,083,762,602	$16,799,201,445
Folsom	23,072	20,597	$3,174,056,439	$7,683,643,073	$10,857,699,512
Galt	7,407	6,775	$458,313,638	$1,207,447,807	$1,665,761,445
Isleton	525	334	$16,873,341	$28,552,704	$45,426,045
Rancho Cordova	20,487	18,092	$1,920,584,312	$4,678,740,531	$6,599,324,843
City of Sacramento	145,102	131,085	$11,595,915,150	$29,128,632,405	$40,724,547,555
Unincorporated County	171,650	157,818	$15,118,073,272	$32,019,808,313	$47,137,881,585
Total	**444,089**	**405,608**	**$38,820,956,537**	**$90,879,116,063**	**$129,700,072,600**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data

Table 4-40 Sacramento County Planning Area – Total Assets at Risk by Property Use

Property Use	Parcels	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	2,611	1,373	$767,692,839	$482,974,390	$1,250,667,229
Care/Health	657	578	$285,193,234	$1,868,570,719	$2,153,763,953
Church/Welfare	1,152	1,000	$278,262,900	$1,288,936,722	$1,567,199,622
Industrial	4,323	3,737	$1,453,868,813	$3,697,428,752	$5,151,297,565

Property Use	Parcels	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Miscellaneous	5,066	23	$10,160,514	$441,341	$10,601,855
Office	3,297	2,982	$1,812,286,238	$6,904,196,029	$8,716,482,267
Public/Utilities	8,148	27	$18,100,245	$17,165,874	$35,266,119
Recreational	339	247	$141,449,975	$302,617,324	$444,067,299
Residential	395,142	389,263	$28,744,320,158	$70,213,156,500	$98,957,476,658
Retail/Commercial	6,360	5,731	$3,189,209,185	$6,041,970,640	$9,231,179,825
Vacant	16,969	637	$2,118,289,106	$59,314,963	$2,177,604,069
No Data	25	10	$2,123,330	$2,342,809	$4,466,139
Total	**444,089**	**405,608**	**$38,820,956,537**	**$90,879,116,063**	**$129,700,072,600**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data

Table 4-41 Unincorporated Sacramento County – Total Assets at Risk by Property Use

Property Use	Parcels	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	2,530	1,353	$679,920,436	$480,921,531	$1,160,841,967
Care/Health	320	297	$123,738,793	$560,655,489	$684,394,282
Church/Welfare	454	396	$127,584,797	$572,325,056	$699,909,853
Industrial	1,431	1,158	$537,734,087	$1,300,231,985	$1,837,966,072
Miscellaneous	1,648	13	$4,015,960	$110,909	$4,126,869
Office	1,114	1,019	$412,752,708	$1,204,253,632	$1,617,006,340
Public/Utilities	3,120	19	$10,432,623	$14,668,775	$25,101,398
Recreational	170	129	$63,680,892	$104,357,747	$168,038,639
Residential	153,070	151,060	$11,348,721,940	$25,812,071,443	$37,160,793,383
Retail/Commercial	2,189	2,031	$1,074,762,890	$1,942,470,967	$3,017,233,857
Vacant	5,592	339	$733,182,032	$26,933,649	$760,115,681
No Data	12	4	$1,546,114	$807,130	$2,353,244
Total	**171,650**	**157,818**	**$15,118,073,272**	**$32,019,808,313**	**$47,137,881,585**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data

Critical Facility Inventory

For purposes of this plan, a critical facility is defined as:

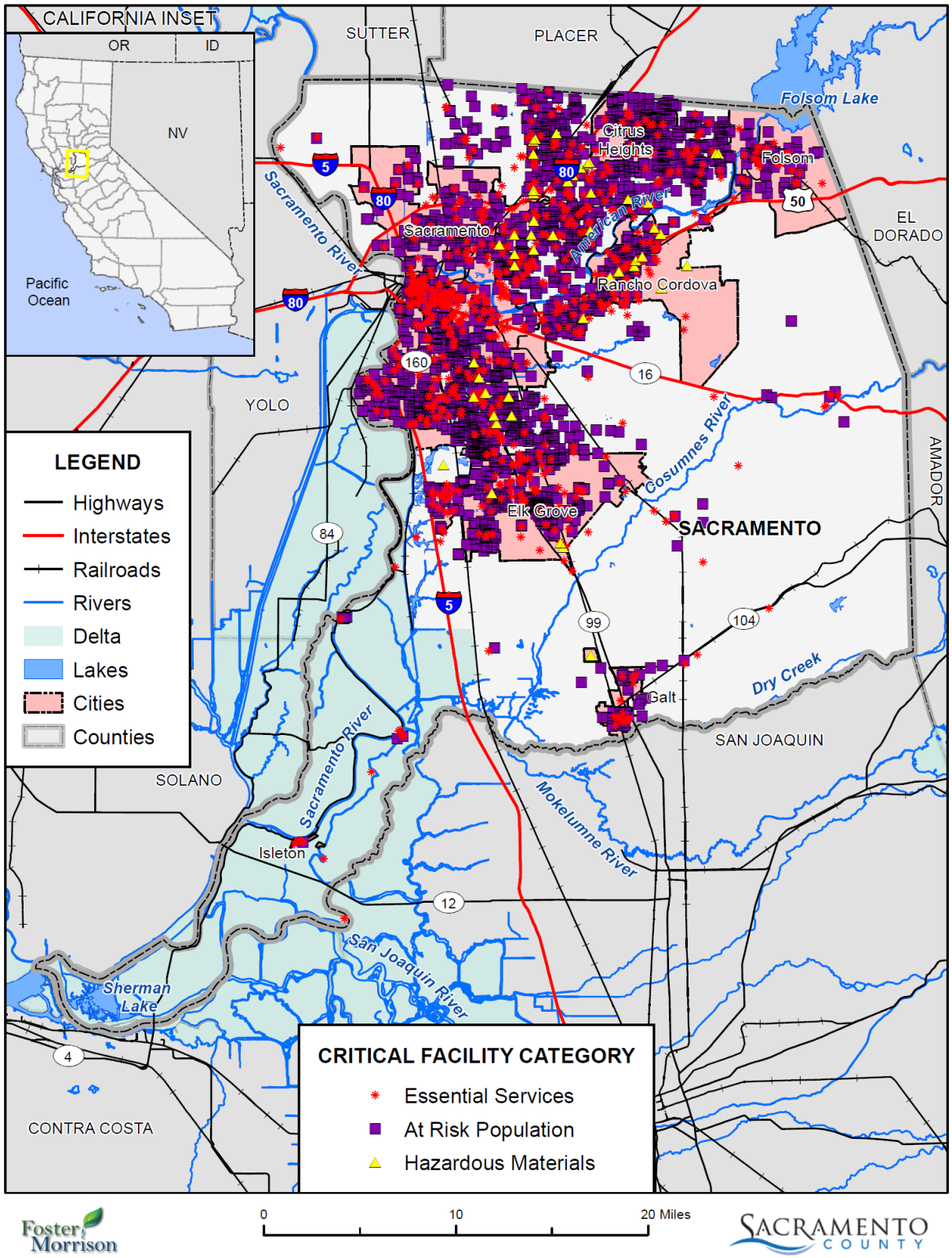
Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.

A critical facility is classified by the following categories: (1) Essential Services Facilities, (2) Hazardous Materials Facilities, (3) At-risk Populations Facilities.

- Essential Services Facilities include, without limitation, public safety, emergency response, emergency medical, designated emergency shelters, communications, public utility plant facilities and equipment, and government operations. Sub-Categories:
  - ✓ Public Safety - Police stations, fire and rescue stations, emergency operations centers
  - ✓ Emergency Response - Emergency vehicle and equipment storage and essential governmental work centers for continuity of government operations.
  - ✓ Emergency Medical - Hospitals, emergency care, urgent care, ambulance services - EXCLUDING clinics, doctors offices, and non-urgent care medical facilities.
  - ✓ Designated Emergency Shelters
  - ✓ Communications - Main hubs for telephone, main broadcasting equipment for television systems, radio and other emergency warning systems - EXCLUDING towers, poles, lines, cables and conduits.
  - ✓ Public Utility Plant Facilities - including equipment for treatment, generation, storage, pumping and distribution (hubs for water, wastewater, power (EXCLUDING hydroelectric facilities) and gas - EXCLUDING towers, poles, power lines, buried pipelines, transmission lines, distribution lines and service lines.
  - ✓ Essential Government Operations - Public records, courts, jails, building permitting and inspection services, government administration and management, maintenance and equipment centers.
- At Risk Population Facilities include, without limitation, pre-schools, public and private primary and secondary schools, before and after school care centers with 12 or more students, daycare centers with 12 or more children, group homes, and assisted living residential or congregate care facilities with 12 or more residents.
- Hazardous Materials Facilities include, without limitation, any facility that could, if adversely impacted, release of hazardous material(s) in sufficient amounts during a hazard event that would create harm to people, the environment and property.

A fully detailed list of all critical facilities in the planning are can be found in Appendix E. A summary of critical facilities in the County can be found in Figure 4-66 and Table 4-42.

Figure 4-66 Sacramento County Planning Area –Critical Facilities Inventory



Data Source: Sacramento County GIS, Cal-Atlas; Map Date: 05/2016.

Table 4-42 Sacramento County Planning Area –Critical Facilities Inventory

Critical Facility Category	Facility Type	Facility Count
Essential Services Facilities	Airport	10
	Arena	1
	Bus Terminal	8
	Convention Center	1
	Corporation Yard	1
	Detention Basin	45
	Dispatch Center	2
	Drainage	6
	Emergency Evacuation Shelter	233
	Emergency Rooms	1
	EOC	2
	Fire Station	94
	Gas Storage	1
	General Acute Care Hospital	9
	Government Facilities	68
	Hospitals	1
	Light Rail Stop	52
	Medical Health Facility	200
	Police	22
	Sand Bag	5
	Stadium	3
	State and Fed Facilities	1
	State Facility	1
	Traffic Operations Center	1
	Train Station	1
	Urgent Care Facilities	2
	Vehicle and Equipment Storage	2
	Water Treatment Plant	3
	Essential Services Facilities Total	**776**
At Risk Population Facilities	Adult Day Care	26
	Adult Education School	12
	Adult Residential	308
	Alternative Education School	7
	Assisted Living Centers	58
	Charter School	25
	Children's Home	2

Critical Facility Category	Facility Type	Facility Count
	College/University	7
	Community Day School	9
	Day Care Center	416
	Detention Center	3
	Group Home	96
	Hotel	50
	Independent Study School	2
	Infant Center	33
	JAIL	1
	Prison	1
	Private Elementary School	65
	Private High School	30
	Private K-12 School	37
	Public Continuation High School	22
	Public Elementary School	230
	Public High School	35
	Public Middle School	43
	Residential Care/Elderly	414
	Residential Facility Chronically	1
	School	38
	School-Age Day Care Center	97
	Senior Center	1
	Social Rehabilitation Facility	4
	Special Education School	10
	Total	2,083
Hazardous Materials Facilities	Oil Collection Center	45
	OTHER	1
	Propane Storage	1
	Sewer Treatment Plant	2
	Total	**49**
Grand Total		**2,908**

Source: Sacramento County GIS

Cultural, Historical, and Natural Resources

Assessing Sacramento County's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the several reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian and sensitive habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Cultural and Historical Resources

Sacramento County has a large stock of historically significant homes, public buildings, and landmarks. To inventory these resources, the HMPC collected information from a number of sources. The California Department of Parks and Recreation Office of Historic Preservation (OHP) was the primary source of information. The OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs. Each program has different eligibility criteria and procedural requirements.

- The **National Register of Historic Places** is the nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.
- The **California Register of Historical Resources** program encourages public recognition and protection of resources of architectural, historical, archeological, and cultural significance and identifies historical resources for state and local planning purposes; determines eligibility for state historic preservation grant funding; and affords certain protections under the California Environmental Quality Act. The Register is the authoritative guide to the state's significant historical and archeological resources.
- **California Historical Landmarks** are sites, buildings, features, or events that are of statewide significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Landmarks #770 and above are automatically listed in the California Register of Historical Resources.
- **California Points of Historical Interest** are sites, buildings, features, or events that are of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Points designated after December 1997 and recommended by the State Historical Resources Commission are also listed in the California Register.

Historical resources included in the programs above are identified in Table 4-43.

Table 4-43 Sacramento County Planning Area Historical Resources

Name (Landmark Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/Area
A. W. Clifton House, Compton Mansion (C17)			X		2/1/2002	Sacramento
Adams And Company Building (607)		X			5/22/1957	Sacramento
Alkali Flat Central Historic District (N1294)	X				7/26/1984	Sacramento
Alkali Flat North Historic District (N1279)	X				4/19/1984	Sacramento
Alkali Flat West Historic District (N1295)	X				7/26/1984	Sacramento
Alta Mesa Farm Bureau Hall (N1476)	X				1/7/1987	Wilton
American River Grange Hall #172 (P823)	X			X	5/15/1996	Rancho Cordova
Archway, The (P614)				X	5/18/1983	Rio Linda
B. F. Hastings Building (606)		X			5/22/1957	Sacramento
Blue Anchor Building (N1171)	X				2/3/1983	Sacramento
Brewster Building (N2099)	X				8/16/2000	Galt
Brewster House (N638)	X				6/23/1978	Galt
Brighton School (N952)	X				4/3/1981	Sacramento
Brown, John Stanford, House (N2252)	X				7/28/2004	Walnut Grove
Business & Professional Building, Consumer Affairs Building (C8)			X		2/10/2000	Sacramento
California Almond Growers Exchange Processing Facility (967)		X			10/1/1985	Sacramento
California Governor's Mansion (N60)	X				11/10/1970	Sacramento
California State Capitol (N222)	X				4/3/1973	Sacramento
California's Capitol Complex (872)	X	X			5/6/1974	Sacramento
California's First Passenger Railroad (526)		X			3/7/1955	Sacramento
Calpak Plant No. 11 (N1285)	X				5/17/1984	Sacramento
Camp Union, Sutterville (666)		X			11/5/1958	Sacramento
Capitol Extension District (N1288)	X				5/24/1984	Sacramento
Chevra Kaddisha (Home Of Peace Cemetery) (654)		X			7/28/1958	Sacramento
Chinese Diggings, Natoma Station Ground Sluice (P712)				X	11/22/1988	Folsom
Chung Wah Cemetery (N1918)	X				8/21/1995	Folsom

Name (Landmark Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/Area
Cohn House (N1001)	X				1/21/1982	Folsom
Coloma Road At Nimbus Dam (746)		X			7/5/1960	Folsom
Coloma Road At Sutter's Fort (745)		X			7/5/1960	Sacramento
Coolot Company Building (N671)	X				9/20/1978	Sacramento
Cranston--Geary House (N2010)	X				1/23/1998	Sacramento
Crocker, E. B., Art Gallery (N86)	X	X			5/6/1971	Sacramento
Curran Farmhouse (P666)				X	12/17/1985	Sacramento
D. O. Mills Bank Building (609)		X			5/22/1957	Sacramento
Delta Meadows Site (N130)	X				11/5/1971	Locke
Dunlap's Dining Room (N1764)	X				4/2/1992	Sacramento
Eagle Theater (595)		X			5/22/1957	Sacramento
Eastern Star Hall (P754)	X			X	8/8/1991	Sacramento
Ebner's Hotel (602)		X			5/22/1957	Sacramento
Ehrhardt, William, House (N2209)	X				7/10/2003	Elk Grove
Elk Grove Grammar School / Elk Grove Unified School Distr (P717)				X	6/12/1989	Elk Grove
Elk Grove Historic District (N1553)	X				3/1/1988	Elk Grove
Fifteen Mile House-Overland Pony Express Route In California (698)		X			9/11/1959	Rancho Cordova
Fire Station No. 6 (N1686)	X				4/25/1991	Sacramento
Firehouse No. 3 (N1743)	X				10/29/1991	Sacramento
First Transcontinental Railroad (780)		X			11/20/1962	Sacramento
First Transcontinental Railroad-Western Base Of The Sierra Nevada (780)		X			11/20/1962	Sacramento
Five Mile House-Overland Pony Express Route In California (697)		X			9/11/1959	Sacramento
Folsom Depot (N1035)	X				2/19/1982	Folsom
Folsom Powerhouse (N258)	X				10/2/1973	Folsom
Folsom-Overland Pony Express Route In California (702)		X			9/11/1959	Folsom
Galarneaux, Mary Haley, House (N2121)	X				2/12/2001	Sacramento
George Hack House (P800)				X	8/5/1994	Sacramento
Goethe House (N1036)	X				2/19/1982	Sacramento
Governor's Mansion (823)		X			6/7/1968	Sacramento
Grave Of Alexander Hamilton Willard (657)		X			9/26/1958	Franklin

Name (Landmark Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/Area
Grave Of Elitha Cumi Donner Wilder (719)		X			12/2/1959	Elk Grove
Greene, John T., House (N1092)	X				4/15/1982	Sacramento
Headquarters Of The Big Four (600)		X			5/22/1957	Sacramento
Heilbron House (N462)	X				12/12/1976	Sacramento
Hotel Regis (N1147)	X				10/29/1982	Sacramento
Hotel Senator (N782)	X				5/30/1979	Sacramento
Howe, Edward P., Jr., House (N1037)	X				2/19/1982	Sacramento
Hubbard-Upson House (N543)	X				12/2/1977	Sacramento
I Street Bridge (N1094)	X				4/22/1982	Sacramento
Imperial Theatre (N1148)	X				10/29/1982	Walnut Grove
Indian Stone Corral (N349)	X				4/16/1975	Orangevale
Isleton Chinese And Japanese Commercial Districts (N1674)	X				3/14/1991	Isleton
J Street Wreck (N1692)	X				5/16/1991	Sacramento
Jean Harvie School, Walnut Grove Community Center (P665)				X	8/20/1985	Walnut Grove
Joe Mound (N121)	X				10/14/1971	Sacramento
Johnson, J. Neely, House (N438)	X				9/13/1976	Sacramento
Joseph Hampton Kerr Homesite (P126)				X	6/6/1969	Sacramento
Judah, Theodore, School (N1985)	X				7/25/1997	Sacramento
Kuchler Row (N1121)	X				6/25/1982	Sacramento
Lady Adams Building (603)		X			5/22/1957	Sacramento
Lais, Charles, House (N1350)	X				2/28/1985	Sacramento
Libby Mcneil And Libby Fruit And Vegetable Cannery (N1050)	X				3/2/1982	Sacramento
Liberty Schoolhouse (P579)				X	12/21/1981	Galt
Locke Historic District (N87)	X				5/6/1971	Locke
McClatchy, C.K., Senior High School (N2148)	X				11/2/2001	Sacramento
Merchants National Bank Of Sacramento (N1936)	X				2/16/1996	Sacramento
Merrium Apartments (N1654)	X				9/13/1990	Sacramento
Mesick House (N1002)	X				1/21/1982	Sacramento
Michigan (468)		X			8/30/1950	Sacramento

Name (Landmark Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/Area
Motor Vehicle Building, Department Of Food & Agriculture (C4)			X		11/5/1999	Sacramento
Murphy's Ranch (680)		X			5/11/1959	Elk Grove
Negro Bar (P798)				X	5/31/1994	Folsom
New Helvetia Cemetery (592)		X			5/22/1957	Sacramento
Nisenan Village Site (N562)	X				3/21/1978	Carmichael
Nisipowinan Village Site (900)	X	X			6/16/1976	Sacramento
Old Elk Grove Hotel Site (P532)				X	6/29/1979	Sacramento
Old Fair Oaks Bridge (N2342)	X				9/25/2006	Fair Oaks
Old Folsom Powerhouse (633)		X			3/3/1958	Folsom
Old Folsom Powerhouse-Sacramento Station A (633)		X			3/3/1958	Sacramento
Old Sacramento (812)	X	X			12/30/1965	Sacramento
Old Tavern (N1242)	X				9/15/1983	Sacramento
Original Sacramento Bee Building (611)		X			5/22/1957	Sacramento
Overton Building (610)		X			5/22/1957	Sacramento
Pioneer Telegraph Station (366)		X			10/9/1939	Sacramento
Pony Express Terminal (N66000220)	X				10/15/1966	Sacramento
Prairie City (464)		X			8/30/1950	Prairie City
Public Works Office Building, Caltrans Building (C5)			X		11/5/1999	Sacramento
Rae House (P743)				X	5/8/1991	Galt
River Mansion (P149)				X	11/3/1969	Sacramento
Rosebud Ranch (N846)	X				12/31/1979	Hood
Ruhstaller Building (N1003)	X				1/21/1982	Sacramento
Runyon House (N2109)	X				10/27/2000	Courtland
Rusch Home (P737)				X	2/11/1991	Citrus Heights
Sacramento Air Depot Historic District (N1747)	X				1/21/1992	North Highlands
Sacramento Bank Building (N1004)	X				1/21/1982	Sacramento
Sacramento City Cemetery (566)		X			2/25/1957	Sacramento
Sacramento City Library (N1784)	X				7/30/1992	Sacramento
Sacramento Hall Of Justice (N2067)	X				9/24/1999	Sacramento
Sacramento Junior College Annex And Extensions (N1874)	X				8/22/1994	Sacramento

Name (Landmark Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/Area
Sacramento Masonic Temple (N2131)	X				5/17/2001	Sacramento
Sacramento Memorial Auditorium (N566)	X				3/29/1978	Sacramento
Site Of China Slough (594)		X			5/22/1957	Sacramento
Site Of Congregational Church (613)		X			5/22/1957	Sacramento
Site Of First And Second State Capitols At Sacramento (869)		X			1/11/1974	Sacramento
Site Of First County Free Library Branch In California (817)		X			6/1/1967	Elk Grove
Site Of Grist Mill Built By Jared Dixon Sheldon (439)		X			6/2/1949	Sloughhouse
Site Of Home Of Newton Booth (596)		X			5/22/1957	Sacramento
Site Of Orleans Hotel (608)		X			5/22/1957	Sacramento
Site Of Sacramento Union (605)		X			5/22/1957	Sacramento
Site Of Sam Brannan House (604)		X			5/22/1957	Sacramento
Site Of Stage And Railroad (First) (598)		X			5/22/1957	Sacramento
Site Of The First African American Episcopal Church Established On The Pacific Coast (1013)		X			5/5/1994	Sacramento
Site Of The First Jewish Synagogue Owned By A Congregation On The Pacific Coast (654)		X			7/28/1958	Sacramento
Site Of Pioneer Mutual Volunteer Firehouse (612)		X			5/22/1957	Sacramento
Slocum House (N744)	X				1/31/1979	Fair Oaks
Sloughhouse (575)		X			5/17/1957	Sloughhouse
Southern Pacific Railroad Company's Sacramento Depot (N353)	X				4/21/1975	Sacramento
Southern Pacific Railroad Superintendent House (N2411)	X				6/13/2008	Folsom
St. Elizabeth's Church (P611)				X	3/2/1983	Sacramento
Stanford-Lathrop House (614)		X			5/22/1957	Sacramento
Sutter's Fort (525)		X			11/1/1954	Sacramento
Sutter's Landing (591)		X			5/22/1957	Sacramento
Sutterville (593)		X			5/22/1957	Sacramento

Name (Landmark Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/Area
Temporary Detention Camps For Japanese Americans-Sacramento Assembly Center (934)		X			5/13/1980	Sacramento
Terminal Of California's First Passenger Railroad (558)		X			12/31/1956	Folsom
The Villa (Serve Our Seniors, Incorporated) (P764)				X	2/14/1992	Orangevale
Tower Bridge (N1116)	X				6/24/1982	Sacramento
Travelers' Hotel (N680)	X				10/19/1978	Sacramento
U.S. Post Office, Courthouse And Federal Building (N855)	X				1/25/1980	Sacramento
Utah Condensed Milk Company Plant (N650)	X				8/3/1978	Galt
Van Voorhies House (N535)	X				11/17/1977	Sacramento
Wagner, Anton, Duplex (N923)	X				11/10/1980	Sacramento
Walnut Grove Chinese-American Historic District (N1630)	X				3/22/1990	Walnut Grove
Walnut Grove Commercial/Residential Historic District (N1634)	X				4/12/1990	Walnut Grove
Walnut Grove Gakuen Hall (N882)	X				6/17/1980	Walnut Grove
Walnut Grove Japanese-American Historic District (N1631)	X				3/22/1990	Walnut Grove
Western Hotel (601)		X			5/22/1957	Sacramento
Westminster Presbyterian Church (N2203)	X				5/22/2003	Sacramento
Wetzlar, Julius, House (N1183)	X				3/31/1983	Sacramento
What Cheer House (597)		X			5/22/1957	Sacramento
Whitter Ranch (Originally Saylor Ranch), Witter Ranch (P744)				X	5/8/1991	Sacramento
Winters House (N2046)	X				1/25/1999	Sacramento
Witter, Edwin, Ranch (N1675)	X				3/14/1991	Sacramento
Woodlake Site (N88)	X				5/6/1971	Sacramento
Yeong Wo Cemetery (P810)				X	5/30/1995	Folsom

Source: California Department of Parks and Recreation Office of Historic Preservation, http://ohp.parks.ca.gov/

The National Park Service administers two programs that recognize the importance of historic resources, specifically those pertaining to architecture and engineering. While inclusion in these programs does not give these structures any sort of protection, they are valuable historic assets.

The Historic American Buildings Survey (HABS) and Historic American Engineering Record (HAER) document America's architectural and engineering heritage. Table 4-44 lists the HABS and HAER structures in Sacramento County:

Table 4-44 Sacramento County Planning Area HABS and HAER Structures

Area	Historic Building/Structure
Elk Grove Vicinity	Drew-Sherwood Farm, 7927 Elk Grove Boulevard, Elk Grove vicinity, Sacramento, CA
	Drew-Sherwood Farm, Barn, 7927 Elk Grove Boulevard, Elk Grove vicinity, Sacramento, CA
	Drew-Sherwood Farm, House, 7927 Elk Grove Boulevard, Elk Grove vicinity, Sacramento, CA
	Drew-Sherwood Farm, Shed, 7927 Elk Grove Boulevard, Elk Grove vicinity, Sacramento, CA
	Drew-Sherwood Farm, Tank House, 7927 Elk Grove Boulevard, Elk Grove vicinity, Sacramento, CA
	Nunes Dairy, 9854 Bruceville Road, Elk Grove, Sacramento, CA
	Nunes Dairy, Clay Tile Silo, 9854 Bruceville Road, Elk Grove, Sacramento, CA
	Nunes Dairy, Worker's Residence No. 2, 9854 Bruceville Road, Elk Grove, Sacramento, CA
Folsom Vicinity	Folsom Powerhouse, Adjacent to American River, Folsom vicinity, Sacramento, CA
	Keefe-McDerby Mine Ditch, East of East Bidwell Street between Clarksville Road & Highway 50, Folsom vicinity, Sacramento, CA
	Natomas Ditch System, Blue Ravine Segment, Juncture of Blue Ravine & Green Valley Roads, Folsom vicinity, Sacramento, CA
Folsom	Folsom Powerhouse, Adjacent to American River, Folsom vicinity, Sacramento, CA.
	Guiseppe Murer House, 1121 Folsom Boulevard, Folsom, Sacramento, CA
	House, Folsom, Sacramento, CA
	Keefe-McDerby Mine Ditch, East of East Bidwell Street between Clarksville Road & Highway 50, Folsom vicinity, Sacramento, CA
	Methodist Episcopal Church, Folsom, Sacramento, CA
	Natomas Ditch System, Blue Ravine Segment, Juncture of Blue Ravine & Green Valley Roads, Folsom vicinity, Sacramento, CA
	Natomas Ditch System, Rhodes Ditch, West of Bidwell Street, north of U.S. Highway 50, Folsom, Sacramento, CA
	Trinity Episcopal Church, Folsom, Sacramento, CA
	Wells Fargo & Company Building, Folsom, Sacramento, CA
Isleton	Sacramento River Bridge, Spanning Sacramento River South of Locke, Isleton, Sacramento, CA
Locke	Town of Locke, Boat House, River Road, Locke, Sacramento, CA
	Town of Locke, Christian Center, 13937 Key Street, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13927 River Road, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13931 River Road, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13943 River Road, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13947 River Road, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13952 Main Street, Locke, Sacramento, CA

Area	Historic Building/Structure
	Town of Locke, Commercial Building, 13955 River Road, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13959 Main Street, Locke, Sacramento, CA
	Town of Locke, Commercial Building, 13963 River Road, Locke, Sacramento, CA
	Town of Locke, Commercial-Residential Structure, 13935 Main Street, Locke, Sacramento, CA
	Town of Locke, Dai Loy Gambling Museum, 13951 Main Street, Locke, Sacramento, CA
	Town of Locke, House, 13915 Main Street, Locke, Sacramento, CA
	Town of Locke, House, 13919 Main Street, Locke, Sacramento, CA
	Town of Locke, House, 13927 Main Street, Locke, Sacramento, CA
	Town of Locke, House, 13936 Main Street, Locke, Sacramento, CA
	Town of Locke, House, Key Street, Locke, Sacramento, CA
	Town of Locke, House, Main & Levee Roads, Locke, Sacramento, CA
	Town of Locke, Jan Ying Association, 13947 Main Street, Locke, Sacramento, CA
	Town of Locke, Joe Shoong Chinese School, 13920 Main Street, Locke, Sacramento, CA
	Town of Locke, Locke, Sacramento, CA
	Town of Locke, Residential Building, 13931 Main Street, Locke, Sacramento, CA
	Town of Locke, Residential Building, 13939 Main Street, Locke, Sacramento, CA
	Town of Locke, Residential Building, River & Levee Roads, Locke, Sacramento, CA
	Town of Locke, Residential Structure, 13955 Main Street, Locke, Sacramento, CA
	Town of Locke, Restaurant, 13943 Main Street, Locke, Sacramento, CA
	Town of Locke, Star Theatre, 13939 River Road, Locke, Sacramento, CA
	Town of Locke, The Tules, River Road, Locke, Sacramento, CA
	Town of Locke, Warehouse, 13923 Main Street, Locke, Sacramento, CA
	Town of Locke, Yuen Chong Market, 13923 River Road, Locke, Sacramento, CA
Michigan Bar	Heath's Store, Michigan Bar (historical), Sacramento, CA
Sacramento Vicinity	Reclamation District 1000, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Reclamation District 1000, Pump Plant No. 1, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Reclamation District 1000, Pump Plant No. 2, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Reclamation District 1000, Pump Plant No. 3, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
Sacramento	Adams & Company Building, 1014 Second Street, Sacramento, Sacramento, CA
	Albert Gallatin House, 1527 H Street, Sacramento, Sacramento, CA
	Apollo Building, 228-230 K Street, Sacramento, Sacramento, CA
	Aschenauer Building, 1022 Third Street, Sacramento, Sacramento, CA
	B. F. Hastings Bank Building, 128-132 J Street, Sacramento, Sacramento, CA
	Bank Exchange Building, 1030 Second Street, Sacramento, Sacramento, CA

Area	Historic Building/Structure
	Bee Building, 1016-1020 Third Street, Sacramento, Sacramento, CA
	Big Four Building, 220-226 K Street, Sacramento, Sacramento, CA
	Blake-Waters Assay Office, 222 J Street, Sacramento, Sacramento, CA
	Booth Building, 1019-1021 Front Street, Sacramento, Sacramento, CA
	Brannon Building, 106-110 J & Front Streets, Sacramento, Sacramento, CA
	California State Library & Courts Building, 914 Capitol Mall, Sacramento, Sacramento, CA
	California State Office Building No. 1, 915 Capitol Mall, Sacramento, Sacramento, CA
	California State Printing Office, 1020 O Street, Sacramento, Sacramento, CA
	Cavert Building, 1207 Front Street, Sacramento, Sacramento, CA
	Central Pacific Transcontinental Railroad, Sacramento to Nevada state line, Sacramento, Sacramento, CA
	Cienfugo Building, 1119 Second Street, Sacramento, Sacramento, CA
	City Market, 118 J Street, Sacramento, Sacramento, CA
	Collicott Drug Store, 129 J Street, Sacramento, Sacramento, CA
	Coolot Building, 812 J Street, Sacramento, Sacramento, CA
	Crocker Art Gallery, 216 O Street, Sacramento, Sacramento, CA
	Democratic State Journal Building, Second & K Streets, Sacramento, Sacramento, CA
	Diana Saloon, 205 J Street, Sacramento, Sacramento, CA
	Dingley Spice Mill, 115 I Street, Sacramento, Sacramento, CA
	E. P. Figg Building, 224 J Street, Sacramento, Sacramento, CA
	Ebner's Hotel, 116 K Street, Sacramento, Sacramento, CA
	Esquire Theater, 1217 K Street, Sacramento, Sacramento, CA
	Eureka Swimming Baths, 908-910 Second Street, Sacramento, Sacramento, CA
	Fashion Saloon, 209 J Street, Sacramento, Sacramento, CA
	Francis William Fratt Building, 1103-1109 Second Street, Sacramento, Sacramento, CA
	Gregory-Barnes Store, 126 J Street, Sacramento, Sacramento, CA
	Heywood Building, 1001-1009 Second Street, Sacramento, Sacramento, CA
	Howard House, 109-111 K Street, Sacramento, Sacramento, CA
	Hudson-Cippa-Wolf Ranch, Bunkhouse, Sorento Road, Sacramento, Sacramento, CA
	Hudson-Cippa-Wolf Ranch, Granary, Sorento Road, Sacramento, Sacramento, CA
	Hudson-Cippa-Wolf Ranch, Hay Barn, Sorento Road, Sacramento, Sacramento, CA
	Hudson-Cippa-Wolf Ranch, Main House, Sorento Road, Sacramento, Sacramento, CA
	Hudson-Cippa-Wolf Ranch, Milk Barn, Sorento Road, Sacramento, Sacramento, CA
	Hudson-Cippa-Wolf Ranch, Sorento Road, Sacramento, Sacramento, CA
	I. & S. Wormser Building, 128 J Street, Sacramento, Sacramento, CA
	J Street (Commercial Buildings), Sacramento, Sacramento, CA
	Lady Adams Building, 113-115 K Street, Sacramento, Sacramento, CA

Area	Historic Building/Structure
	Latham Building, 221-225 J Street, Sacramento, Sacramento, CA
	Leggett Ale House, 1023 Front Street, Sacramento, Sacramento, CA
	Leland Stanford House, 800 N Street, Sacramento, Sacramento, CA
	Lincoln School, 418 P Street, Sacramento, Sacramento, CA
	Luhrs Hall & Company Building, 912-916 Second Street, Sacramento, Sacramento, CA
	Mechanics Exchange Hotel, 116-122 I Street, Sacramento, Sacramento, CA
	Morse Building, 1025-1031 Second Street, Sacramento, Sacramento, CA
	Old U. S. Post Office, K & Seventh Streets, Sacramento, Sacramento, CA
	Our House Saloon, 926 Second Street, Sacramento, Sacramento, CA
	P. B. Cornwall Building, 1011-1013 Second Street, Sacramento, Sacramento, CA
	Pioneer Hall & Bakery, 120-124 J Street, Sacramento, Sacramento, CA
	Pioneer Telegraph Building, 1015 Second Street, Sacramento, Sacramento, CA
	Reclamation District 1000, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Reclamation District 1000, Pump Plant No. 1, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Reclamation District 1000, Pump Plant No. 2, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Reclamation District 1000, Pump Plant No. 3, Northwest Sacramento County & southwest Sutter County, bisected by State Highway No. 99, Sacramento vicinity, Sacramento, CA
	Rialto Building, 225-230 J Street, Sacramento, Sacramento, CA
	Rivett-Fuller Building, 128 K Street, Sacramento, Sacramento, CA
	Sacramento Army Depot, Fruitridge Road, Sacramento, Sacramento, CA
	Sacramento City Hall, 915 I Street, Sacramento, Sacramento, CA
	Sacramento Engine Company No. 3, 1112 Second Street, Sacramento, Sacramento, CA
	Sacramento Junior College, Library, 3835 Freeport Boulevard, Sacramento, Sacramento, CA
	Sacramento River Bridge, Spanning Sacramento River at CA State Highway 275, Sacramento, Sacramento, CA
	Sacramento River Water Treatment Plant Intake Pier & Access Bridge, Spanning Sacramento River approximately 175 feet west of eastern levee on river; roughly .5 mile downstream from confluence of Sacramento & American Rivers, Sacramento, Sacramento, CA
	Sacramento, General View, Sacramento, Sacramento, CA
	Sacramento, General View,1865, Sacramento, Sacramento, CA
	Sacramento, Historic View, Sacramento, Sacramento, CA
	Sacramento, Historic View, Sacramento, Sacramento, CA
	Sazerac Building, 131 J Street, Sacramento, Sacramento, CA
	Southern Pacific Railroad Depot, Railroad Terminal Post Office & Express Building, Fifth & I Streets, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Blacksmith Shop, 111 I Street, Sacramento, Sacramento, CA

Area	Historic Building/Structure
	Southern Pacific, Sacramento Shops, Boiler Shop, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Car Machine Shop, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Car Shop No. 3, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Erecting Shop, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Paint Shop, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Pitless Transfer Table, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Planing Mill, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Privy, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Turntable, 111 I Street, Sacramento, Sacramento, CA
	Southern Pacific, Sacramento Shops, Water Tower, 111 I Street, Sacramento, Sacramento, CA
	Stanford Brothers Store, 1203 Front Street, Sacramento, Sacramento, CA
	Stein Building, 218 J Street, Sacramento, Sacramento, CA
	Strub Building, Sacramento, Sacramento, CA
	Studio Theater, 1227 K Street, Sacramento, Sacramento, CA
	Sutter's Fort, L & Twenty-Seventh Streets, Sacramento, Sacramento, CA
	Union Hotel (Annex), 125 K Street, Sacramento, Sacramento, CA
	Union Hotel, 1024-1028 Second Street, Sacramento, Sacramento, CA
	Vernon-Brannan House, 112-114 J Street, Sacramento, Sacramento, CA
	W.I. Elliott Building, 1530 J Street, Sacramento, Sacramento, CA

Source: The Library of Congress, American Memory, http://memory.loc.gov/ammem/collections/habs_haer/

It should be noted that these lists may not be complete, as they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by CEQA and NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Natural Resources

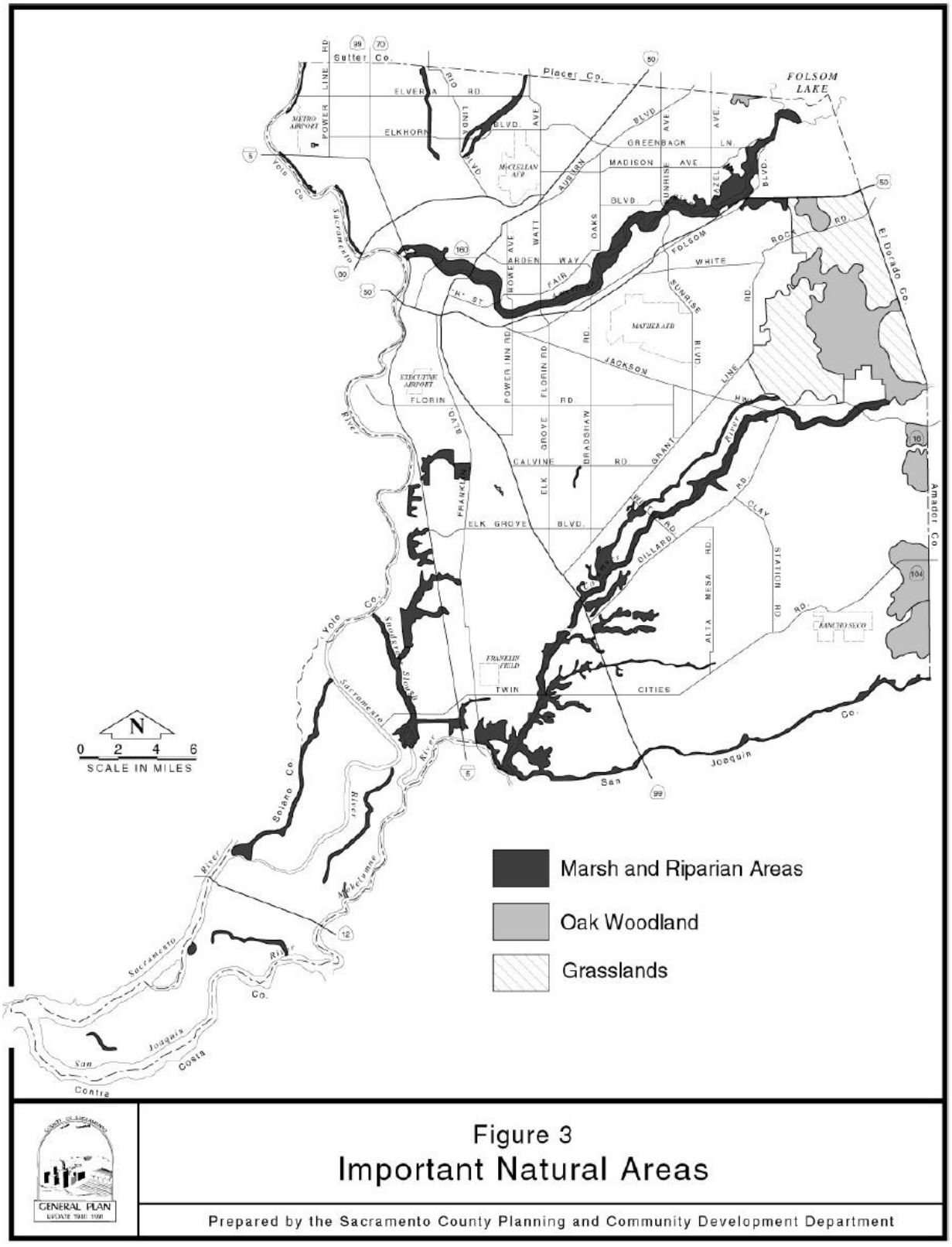
Natural resources are important to include in cost/benefit analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

Sacramento County once supported limited oak savannah and riparian woodland, with an herbaceous layer of perennial grasses and both annual and perennial wildflowers. These woodland areas were centered on the County's three main rivers: Sacramento, American and Cosumnes. Expansive native valley grassland,

also referred to as California prairie, stretched out from the edge of these woodlands and blanketed the bulk of the County's landscape. Vernal pools were scattered in both low and high density clusters throughout the valley grassland habitat. After European settlement of the County, many of the native perennial grasses were replaced by Mediterranean annual grasses. However, within the vernal pools native vegetation uniquely suited to spring time inundation survived. Today these vernal pools harbor a number of listed plant and animal species. In addition to vernal pools, other seasonal and emergent wetlands occurred, mostly in association with the many natural drainage systems that previously flowed through the County, but which are now either channelized or confined within a system of artificial levees.

The County of Sacramento is fortunate to have several locations where vestiges of the once vast and diverse Central Valley natural habitat areas still exist. Habitat areas include riparian zones, riverine habitats, wetlands, woodlands, and grasslands. These are shown in Figure 4-67. This map delineates areas considered primarily natural such as riparian zones, marshlands, and oak woodlands. The boundaries are drawn based on review of reports and maps of public and private agencies including the U.S. Fish and Wildlife Service's National Wetlands Inventory maps, the State Department of Water Resource's Delta Atlas, the California Department of Fish and Game's Natural Diversity Database, and aerial photography.

Figure 4-67 Important Natural Areas in Sacramento County



Source: Sacramento County General Plan Open Space Element Background

Remaining marsh and riparian areas in the County include backwater basins and riparian woodlands along the Sacramento, American, and Cosumnes Rivers and other smaller waterways, and in the Delta. These biologically dynamic areas host thousands of waterfowl migrating along the Central Valley leg of the Pacific Flyway. In addition, numerous other migratory and resident species, some of which are listed as threatened or endangered, inhabit the County's natural areas. Species include majestic colony birds such as the American egret and great blue heron, the opportunistic coyote, the industrious beaver, deer, and elusive grey fox and bobcat.

The wetland and riparian areas are regarded as the County's most important resource. Such habitat becomes all the more significant when viewed against the acreage lost since the time of European settlement. Approximately 95 percent of the Central Valley's wetlands have disappeared in the last 100 years, reducing habitat for millions of migratory waterfowl. Riparian habitat has suffered a similar fate. In the Sacramento River Valley only 25,000 of the estimated 500,000 acres of the riparian habitat existing in 1850 exists today.

The aquatic environment of the County supports tens of thousands of anadromous fish and rears a comparable amount of resident species. Anadromous fish include salmon, bass, shad, and sturgeon. Resident fish include trout, catfish, sunfish, and bullhead. With the development of urban areas and water projects, fisheries have declined. This loss has been generated by habitat destruction, water diversion, and temperature increases.

Extending out from the riparian zone are the distinctive upland habitats of the Central Valley, scattered with oak, blanketed with grazing lands, and dotted with vernal pools. Native oaks, signature trees of the Central Valley have declined in population over the years to accommodate agriculture and development. Concentrated efforts will need to be undertaken if the County is to preserve the isolated groves and diminishing woodlands. Native grasslands have virtually disappeared due to grazing and development. The once prolific and well adapted bunchgrass has been displaced by invasive weeds from the Mediterranean region. The vernal pools which once dotted vast areas of the Central Valley landscape, are found only in concentrations in the southern section of the County (see the discussion in the next section of the South Sacramento Habitat Conservation Plan). The pools sustain flora and fauna adapted to the ephemeral nature of these small yet vibrant habitats.

Wetlands: Natural and Beneficial Functions

Wetlands are habitats in which soils are intermittently or permanently saturated or inundated. Wetland habitats vary from rivers to seasonal ponding of alkaline flats and include swamps, bogs, marshes, vernal pools, and riparian woodlands. Wetlands are considered to be waters of the United States and are subject to the jurisdiction of the U.S. Army Corps of Engineers as well as the California Department of Fish and Wildlife (CDFW). Where the waters provide habitat for federally endangered species, the U.S. Fish and Wildlife Service may also have authority.

Wetlands are a valuable natural resource for communities providing beneficial impact to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation is vital, and reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the

reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water.

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flow. Wetlands perform a variety of ecosystem functions including food web support, habitat for insects and other invertebrates, fish and wildlife habitat, filtering of waterborne and dry-deposited anthropogenic pollutants, carbon storage, water flow regulation (e.g., flood abatement), groundwater recharge, and other human and economic benefits.

Wetlands, and other riparian and sensitive areas, provide habitat for insects and other invertebrates that are critical food sources to a variety of wildlife species, particularly birds. There are species that depend on these areas during all parts of their lifecycle for food, overwintering, and reproductive habitat. Other species use wetlands and riparian areas for one or two specific functions or parts of the lifecycle, most commonly for food resources. In addition, these areas produce substantial plant growth that serves as a food source to herbivores (wild and domesticated) and a secondary food source to carnivores.

Wetlands slow the flow of water through the vegetation and soil, and pollutants are often held in the soil. In addition, because the water is slowed, sediments tend to fall out, thus improving water quality and reducing turbidity downstream.

These natural floodplain functions associated with the natural or relatively undisturbed floodplain that moderates flooding, such as wetland areas, are critical for maintaining water quality, recharging groundwater, reducing erosion, redistributing sand and sediment, and providing fish and wildlife habitat. Preserving and protecting these areas and associated functions are a vital component of sound floodplain management practices for the Sacramento County planning area.

Natural site features such as wetlands with native plants and hydric soils have long disappeared and they no longer can function as they should. Landowners are encouraged to plant native plants on their property. These plants will assist with absorption and filtration of water. They will help to hold soils to keep erosion and siltation from occurring in the waterway. Landowners are also encouraged to remove any obstructions which might restrict water conveyance during high water events.

The South Sacramento Habitat Conservation Plan (SSHCP) was created to identify and protect natural habitats in the southern portion of Sacramento County. In this plan, floodplains and wetlands were identified, and the inter-relationship between the two is explained in greater detail. Floodplains can have natural and beneficial functions. Two types are described in the SSHCP and summarized in the sections that follow.

Preservation of Wetlands

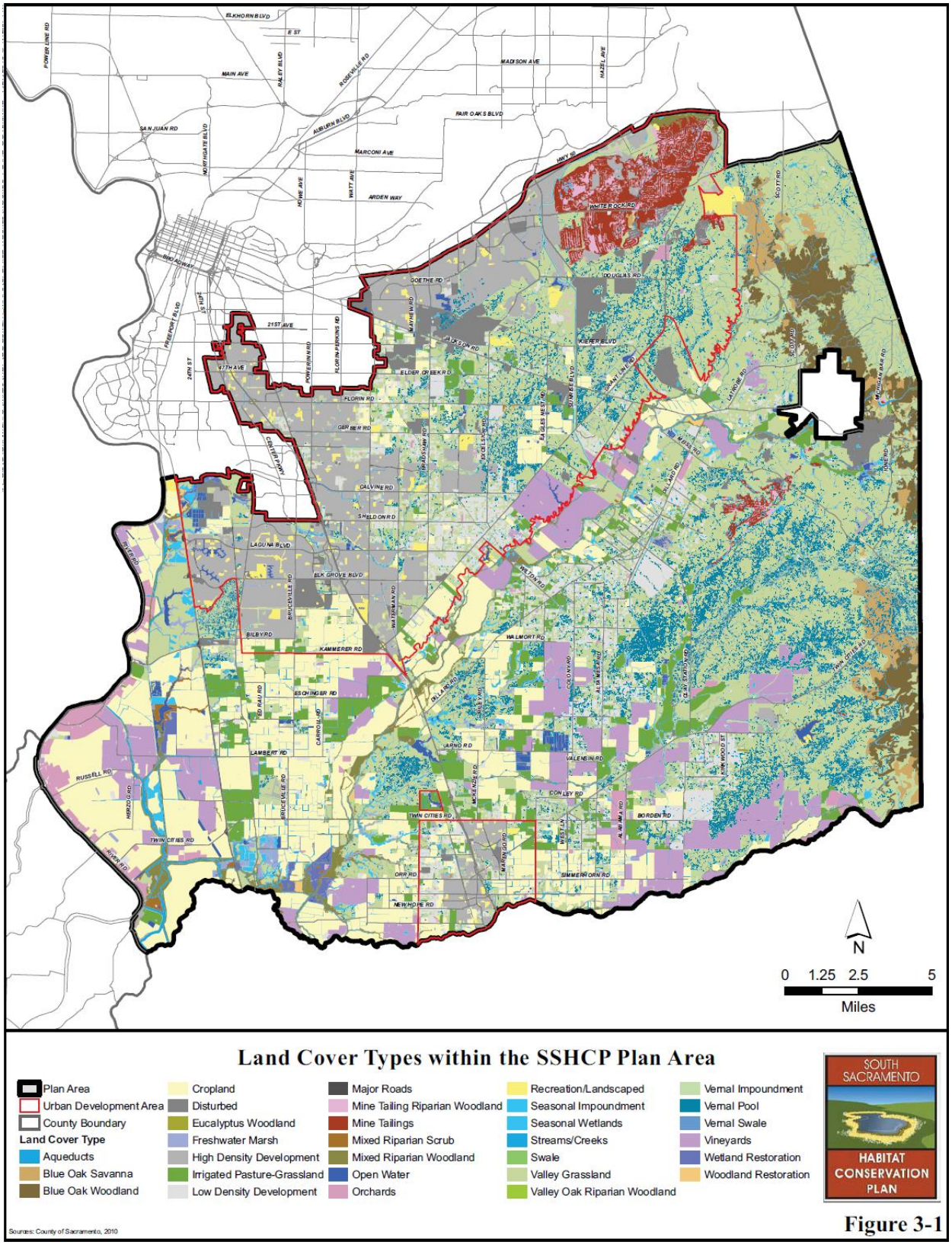
Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow the speed of floodwaters and distribute them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface- water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging

of crops. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees. In the SSHCP, the following types of wetlands were identified and defined:

- Freshwater Marsh
- Open Water
- Seasonal Impoundment
- Seasonal Swale
- Seasonal Wetlands
- Vernal Pools
- Vernal Swales
- Vernal Impoundments
- Streams and Creeks
- Wetland Restoration

Figure 4-68 shows the wetlands and other land cover types in the SSHCP plan area.

Figure 4-68 Land Cover in the SSHCP



Source: South Sacramento Habitat Conservation Plan

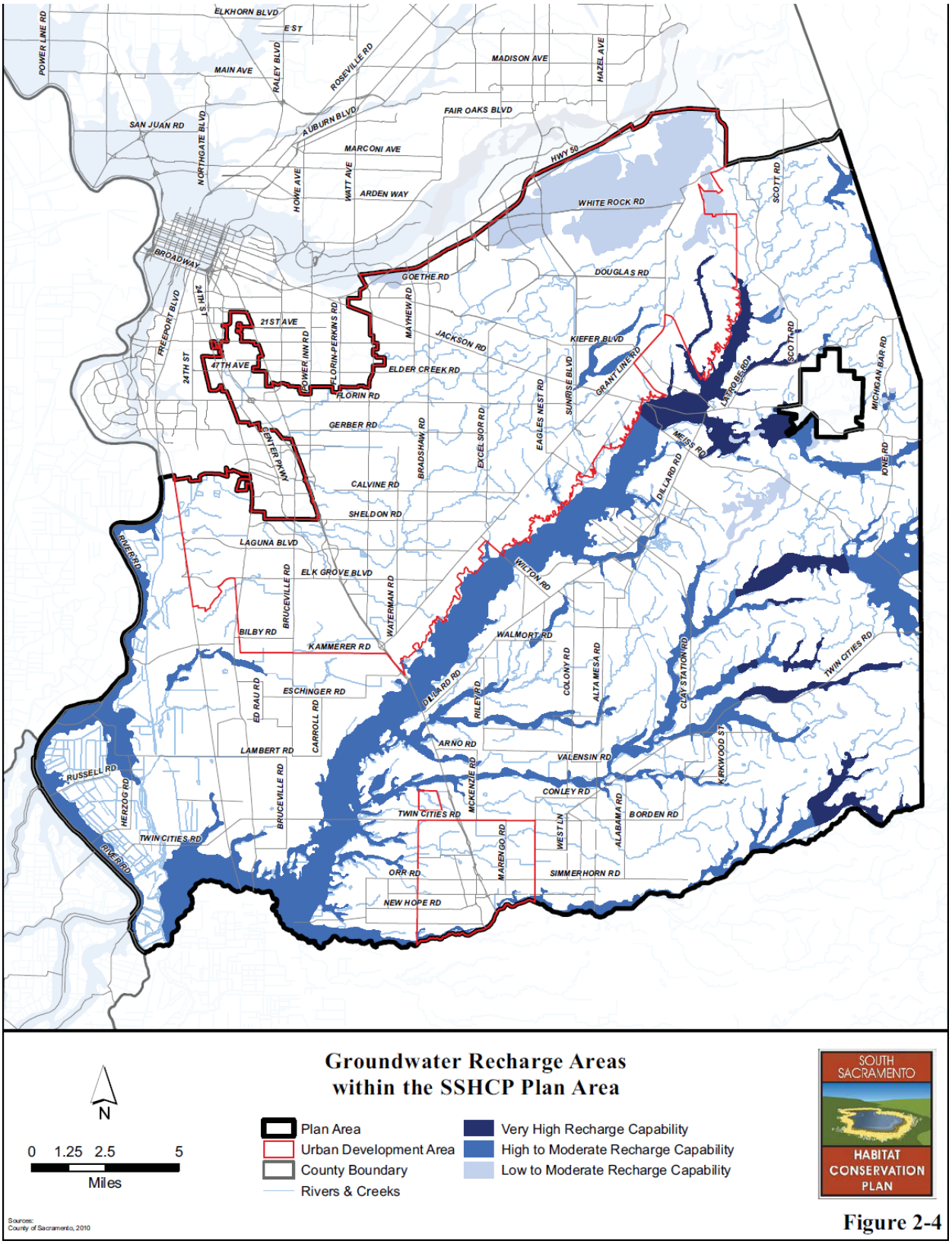
The SSHCP Plan Area includes lands that have already been preserved through past mitigation or conservancy acquisitions. The largest grouping of conservation sites inside the Urban Development Area (UDA) occurs in the Sacramento Valley Vernal Pool Preserve area located south of Jackson Highway between Excelsior and Eagles Nest roads north of Grant Line Road. The preserve area includes lands under conservation easement or owned by the Sacramento Valley Conservancy and three mitigation banks: Klotz, Arroyo Seco, and Bryte Ranch. Outside the UDA, significant preserves and mitigation banks are established at or near the Stone Lakes National Wildlife Refuge, within the Cosumnes River floodplain, and in eastern Sacramento County.

Groundwater Recharge

The SSHCP Plan Area is entirely within the 20,000-square-mile Central Valley Aquifer System, but is split between two basins, the Sacramento Valley Groundwater Basin and the San Joaquin Valley Groundwater Basin. Precipitation that does not run off, or is not lost through evaporation and transpiration, travels beneath the surface as subsurface water. The pattern of movement of water, from the time it enters the ground to the time it emerges either naturally or by pumping from a well, is controlled by the subsurface conditions encountered. Upon entering the ground, water moves downward until it reaches a zone of saturation. This happens whenever water from precipitation, stream flow, applied irrigation, and various other water sources sinks into the ground through the open spaces in permeable materials. The size of these open spaces ranges from minute pores in clays to intergranular openings in deposits of sand and gravel, and open crevices along bedrock fractures. The area over which this is accomplished is called a recharge area.

Within the SSHCP Plan Area, most recharge occurs in locations along river channel deposits where they cross exposures of water-transmitting rocks. Here the channel deposits are very permeable, allowing for rapid infiltration of water down to water-bearing materials. Water flows over these recharge areas during the entire year and affords partial replenishment of the groundwater body (Figure 4-69). In addition to river channel recharge, recharge can occur through percolation of precipitation, percolation of irrigation return flows, and subsurface boundary inflow from adjacent aquifers.

Figure 4-69 Groundwater Recharge in Sacramento County



Source: South Sacramento Habitat Conservation Plan

Special Status Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the planning area. The Fish and Game Department maintains a list of threatened and endangered species in California. State and federal laws protect the habitat of these species through the environmental review process. Several additional species are of special concern or candidates to make the protected list. The Department's classification scheme is defined as follows:

- A species is a candidate when the Fish and Game Commission has formally noticed it as being under review by the Department to determine whether listing as threatened or endangered is warranted, or when it is the subject of a proposed rulemaking by the Commission to list as threatened or endangered.
- A species is threatened when although not presently threatened with extinction, it is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts.
- A species is endangered when it is in serious danger of becoming extinct throughout all, or a significant portion of, its range due to one or more causes, including loss of habitat, change of habitat, overexploitation, predation, competition or disease.

Table 4-45 summarizes Sacramento's special status animal species.

Table 4-45 California Native Plant Society's Threatened and Endangered Plant Classification for Sacramento County

Scientific Name Common Name	Legal Status (Federal/State)	CNPS	Habitat
Aster chilensis var lentus Suisun marsh aster	C/-	RE	Brackish marsh
Downingea humilis Dwarf downingea	-/-	RE	Vernal pools
Gratiola heterosepal Boggs lake hedgehyssop	C/E	RE	Vernal pools
Hibiscus californicus California hibiscus	C/-	RE	Freshwater marsh
Lathyrus jepsonii var jepsonii Delta tule pea	C/-	RE	Brackish marsh
Legenere limosa Green's legenere	C/R	RE	Vernal pools
Lilaeopsis masonii Mason's liaeopsis	-/E	RE	Brackish marsh
Orcuttia viscida Sacramento orcutt grass	E/E	RE	Vernal pools
Orcuttia tenuis Slender orcutt grass	E/E	RE	Vernal pools
Oenothera deltoides howellii Antioch dunes evening primrose	E/E	RE	Inland dunes

Scientific Name Common Name	Legal Status (Federal/State)	CNPS	Habitat
Plagiobothrys hystriculus Bearded popcorn flower	C/-	RE	Vernal pools

Source: California Native Plant Society
Legal status abbreviations are C = Candidate, R = Rare, E = Endangered

The California Native Plant Society's inventory of rare and endangered vascular plants in California lists 10 species that have been found in Sacramento County, which are characterized as rare or endangered according to either federal, state or California Native Plant Society definitions (Table 4-46). Six species are vernal pool species. California Hibiscus is found along the Sacramento River and is severely threatened by channelization of the river. The Antioch Dunes Evening Primrose is extremely rare and known from only one site in Sacramento County.

Table 4-46 Endangered, Threatened, and Candidate Animal Species in Sacramento County

Species	Legal Status (Federal/State)	Habitats	Occurrence
Valley elderberry longhorn beetle (Desmocerus californicus dimorphus)	T/C	Elderberry shrubs in riparian habitats.	At least 7 reported sites in Sacramento
Giant garter snake	C/T	Marshlands, ditches, and adjacent uplands	At least 20 reported sites in Sacramento
American white pelican	-/SSC	Feeds in shallow waters	Migrants occur in spring & early summer
Double-crested cormorant	-/SSC	Nests in trees; forages in water bodies	Year-round resident Nesting sites reported at North Stone Lake
Bald eagle	E/E	Feeds in winter at lakes visitor.	An irregular winter Nesting sites at Folsom Lake just outside County
Northern harrier	-/SSC	Dense, tall grasslands or seasonal marsh for nesting; grasslands & marsh for feeding	Beach Lake/Stone Lake & treatment plant breeding areas.
Cooper's hawk	-/SSC	Riparian and oak woodland;	Regular migrant and winter resident; breeds in oak woodland of east County and American River.
Swainson's hawk	C/T	Large trees for nesting; alfalfa or hay fields for feeding	Common throughout the County
Peregrine falcon	E/E	Marsh, grassland	Possible irregular migrant.
Prairie falcon	-/SSC	Grassland	Possible irregular migrant and wintering bird.
California gull	-/SSC	Water bodies	Non-breeding resident
California yellow-billed cuckoo	C/T	Extensive riparian woodland	No records.
Burrowing owl	-/SSC	Natural or artificial burrows for nesting; grasslands for foraging	Nests at several locations in Sacramento County.

Species	Legal Status (Federal/State)	Habitats	Occurrence
Short-eared owl	-/SSC	Dense grasslands and marshlands	Probable irregular winter visitor
Willow flycatcher	-/SSC	Willow scrub	Probable migrant
Purple martin	-/SSC	Riparian woodland	Reported nesting sites found in or near downtown Sacramento
Tricolored blackbird	-/SSC	Emergent wetlands for breeding; marsh and nesting sites in grasslands for feeding.	At least 24 reported in Sacramento
Bank swallow	-/T	Riparian river bluffs	Reported nesting site on Cosumnes River near Rancho Murieta.
Longeared Owl	-/SSC	Riparian woodland	Known to nest in Sacramento County.
Black Shouldered Kite	-/P	Grasslands	Roost in Sacramento County

Source: US Fish and Wildlife Service

Legal status abbreviations are: E = Endangered, T = Threatened, C = Candidate for listing, and SSC = Species of special concern. P = Protected

Significant Natural Areas of Sacramento County

From information provided in the Sacramento County General Plan Background Report, Table 4-47 below outlines the location and rationale for listing of significant natural areas in Sacramento County.

Table 4-47 Description of Significant Natural Areas in Sacramento County

Location	Comments
Mokelumne/Cosumnes Drainage	
Lower Cosumnes River	Support more than 100,000 waterfowl; sandhill crane here; important and unique natural area; variety of hydrological conditions in small area at merging of Valley River and Delta systems; undammed, represents unaltered valley ecosystem; system of sloughs and marshes each slightly different in its ecological balance; intermixing of habitats enhances ecological diversity.
Deer Creek - Cosumnes Riparian Corridor	Good riparian woodland cover along most of both banks of both water courses; occasional clear spots; generally is narrow band along each watercourse, occasionally widens to hardwood forest in valley portion.
Badger Creek	Wetlands, riparian and valley oaks amid valley grassland. Excellent example of historical Sacramento Valley habitat. Especially scenic from Highway 99.
Lower Mokelumne, Dry Creek, Grissley and Bear Sloughs	Riparian vegetation along all water courses; excellent grassland, riparian, woodland mix along Bear Slough; some of grassland and woodland along Mokelumne has been leveled since 1973.
Mokelumne River	Riparian vegetation on levee side of river.
Dry Creek	Riparian corridor occasionally widening to woodland areas.
Laguna Creek	Intermittent stream with riparian habitat; two miles of riparian woodland with large trees; lower reaches include seasonal marsh along creek and tributaries.

Location	Comments
Stones Lake/Delta	
Beach Lake/ Morrison Creek*	Permanent and seasonal marsh in what used to be Beach Lake; riparian forest along Morrison Creek, essentially intact since 1937, dominated by cottonwood and willow; a riparian area abundantly rich in wildlife and plant communities.
Lower Laguna Creek*	Seasonal wetland, ponds and vernal pools with adjacent grassland; channel modifications in conjunction with upstream improvements along Laguna Creek.
North Stone Lake*	Morrison Creek levee on north, I-5 on east, Hood-Franklin Road on south and Southern Pacific Railroad on west.
South Stone Lake	Includes 93 acres riparian, 446 acres marsh, 186 acres upland, 121 acres water; rest of 3,480 acres is agriculture; supports excellent warm water fishery; supplements North Stone Lake as important wildlife area; part of number one ranked site for new western National Wildlife Refuge; with North Stone Lake, is one of the most important ecological complexes in Delta.
Snodgrass Slough	Shrub brush and occasional riparian woodland along northernmost Delta slough in Sacramento.
Delta Meadows*	Significant prime natural resource area; remnant of valley oak woodland; in excess of 110 bird species, abounds with small mammals; state park acquisition project.
Lost Slough	Waterway and adjacent riparian habitat linking Lower Cosumnes and Delta Meadows, Snodgrass Slough and the Delta river system.
Steamboat Slough	Riparian shrub-brush and woodland at south end near Howard Landing and along north portion.
Grand Island Tip	Mason's lilaeopsis, Delta tule pea, and Sacramento anthacid beetle found here; state designated significant natural area.
Georgiana Slough	Shrub-brush and occasional woodland riparian along open slough.
Seven Mile Slough	Riparian trees and shrub-brush along a little-used slough.
Brannan Island*	Site of Antioch Dunes evening primrose, very rare plant; state designated significant nature area.
Mayberry Slough	Deadend slough, isolated for wildlife habitat.
Southwest Tip of County	Upland habitat; blue heron rookery; several rare and endangered species.
Chain Island	Isolated island, formerly diked with coastal brackish marsh habitat; Mason's ilaeopsis and Suisun marsh aster; state designated significant natural area.
Eastern Sacramento County	
Upper Laguna Creek	Dense stand of riparian vegetation listed as one of three most important sections on Laguna Creek (the other two are now urban creek sections).
Sloughhouse South	One of best sites of valley elderberry longhorn beetle habitat; state designated significant natural area.
Meiss-Ione Road Overlook	Only lesser nighthawks in Sacramento County; vernal pools with unusual dwarf plant.
Scott Road Raptor Area	Open shortgrass prairie with sparse to dense valley and blue oak thickets, mostly in southern area; dense cottonwood-willow riparian vegetation along stream courses; habitat for one of largest concentrations of raptoral birds in Sacramento region; grand wildflower displays in spring.
Sloughhouse Vernal Pools	Concentrations of vernal pools; very rare Sacramento orcutt grass found near County dump; state designated significant natural area.
Rancho Seco Lake*	About 500 plants of Sacramento orcutt grass; state designated significant natural area.

Location	Comments
Jackson Highway Oak Woodland	None
Twin Cities Road Oak Woodland	None
South Area Vernal Pools	Quality of pools is unknown; may contain rare and endangered plants.
North Sacramento	
Garden Highway	Greatest concentration of riparian woodland in Sacramento County along Sacramento River; riparian woodlands are seven times greater in extent than disturbed riprap areas to south; coexists with several homes; Swainson's hawk nests.
Alder Creek	Excellent riparian area; diverse vegetation and wildlife; spillway and marsh; upstream ponds add diversity; good beaver and muskrat habitat.
Fair Oaks Bald Spot*	Excellent examples of vernal pools with Sacramento orcutt grass; state designated significant natural area.
Lake Natoma*	American River bluffs, 100 feet high, cut by several small canyons; rich foothill woodland plant community; some of most varied and dense floral displays in Sacramento County; cottonwood dredger tailing riparian at Negro Bar with jungle-like mixture of oak, buckeye, elderberry, et al on higher ground.
East Main Drain*	Waterfowl habitat; year round habitat; much disturbance, dumping.
Dry Creek*	Dual channel with grassland/farming in between creates good wildlife habitat. Good riparian cover along creek channels.
American River Parkway*	Mix of riparian, freshwater marsh, oak woodland, grassland, inhabited by great variety of plant and wildlife species.

Source: Sacramento General Plan Background Report

* indicates all or a major part of the area is in public or quasi-public ownership

Williamson Act

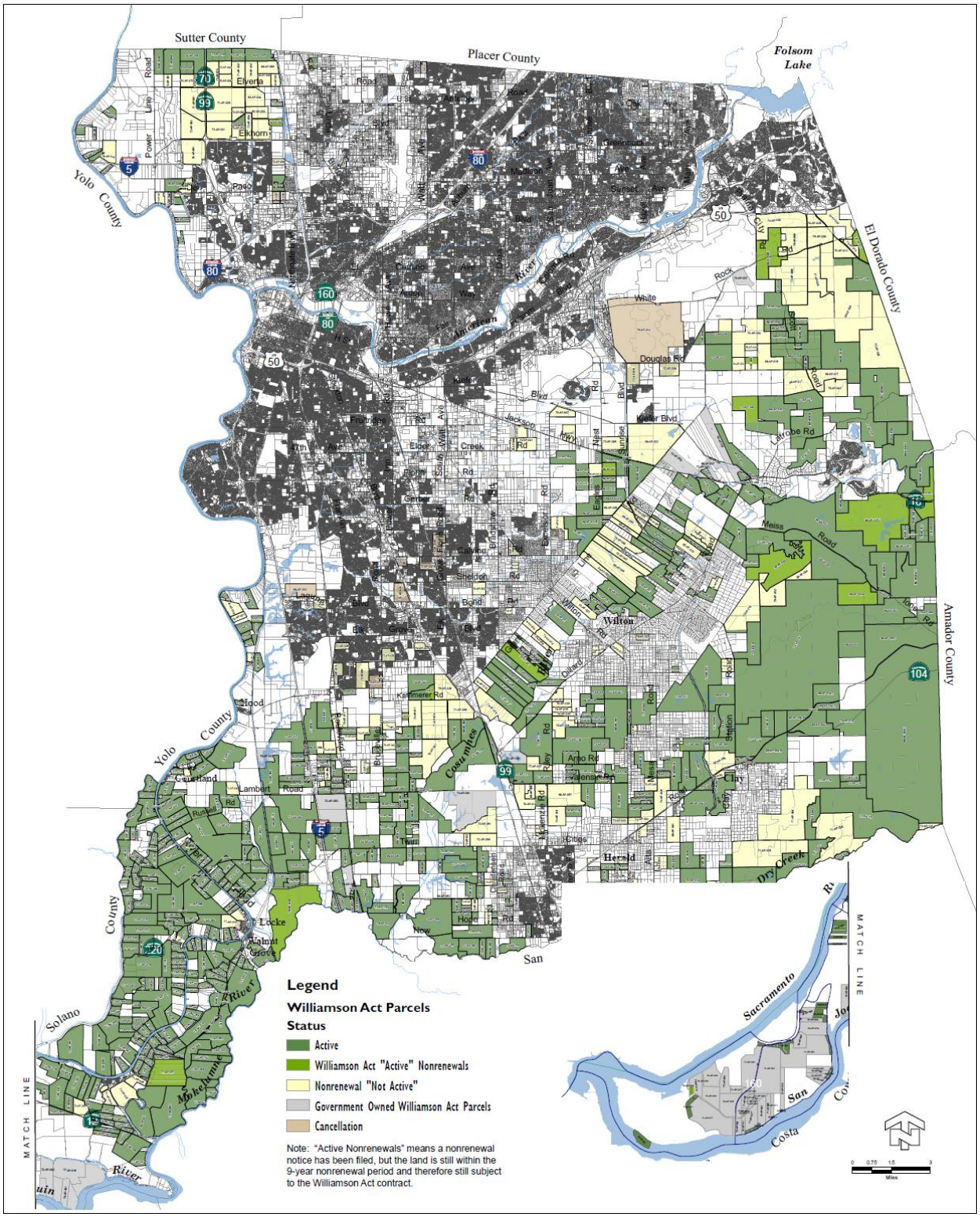
The Williamson Act, also known as the California Land Conservation Act of 1965, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. When the County enters into a contract with the landowners under the Williamson Act, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least ten years and the County agrees to tax the land at a rate based on the agricultural production of the land rather than its real estate market value. The County has designated areas as agricultural preserves within which the county will enter into contracts for the preservation of the land in agriculture. The County has 164,162 acres under Williamson Act Contract as of 2016. This is tabulated in Table 4-48 shown in Figure 4-70.

Table 4-48 Williamson Act Parcels Acreage 2016

STATUS	ACRES
Active	164,161.92
Active Nonrenewal	11,217.58
Cancellation	5,505.85
Nonrenewal	62,179.93

Source: Sacramento County GIS

Figure 4-70 Williams Act Contracts in Sacramento County as of 2016



Source: Sacramento County

State Inventory of Important Farmland

The Farmland Mapping and Monitoring Program was established in 1984 to document the location, quality, and quantity of agricultural lands and conversion of those lands over time. The program provides impartial analysis of agricultural land use changes throughout California. For inventory purposes, several categories were developed to describe the qualities of land in terms of its suitability for agricultural production. The State Department of Conservation utilizes the following classification system:

- The Prime Farmland category describes farmland with the best combination of physical and chemical features able to sustain long term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.
- Farmland of Statewide Importance is farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.
- Unique Farmland is farmland of lesser quality soils used for the production of the state's leading agricultural crops. This land is usually irrigated, but may include nonirrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the four years prior to the mapping date.
- Farmland of Local Importance is either currently producing crops or has the capability of production. This farmland category is determined by each county's board of supervisors and a local advisory committee.

For Sacramento County, this classification refers to lands which do not qualify as Prime, Statewide, or Unique designation but are currently irrigated crops or pasture or non-irrigated crops; lands that would be Prime or Statewide designation and have been improved for irrigation but are now idle; and lands which currently support confined livestock, poultry operations, and aquaculture.

Growth and Development Trends

As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability. Information from the Sacramento County General Plan Housing Element, the California Department of Finance, and the Sacramento County Planning Department form the basis of this discussion.

More specific information on growth and development for each participating jurisdiction can be found in the jurisdictional annexes.

Current Status and Past Development

The estimated population of Sacramento County for January 1, 2015 was 1,470,912, representing a ten-fold increase from just over 141,000 people in 1930. Table 4-49 and Table 4-50 illustrate the pace of population growth in Sacramento County dating back to 1930 along with more recent population trends for each jurisdiction. The data on population and housing growth shows that Sacramento County has seen consistent growth during the last decades, with major periods of growth in the 1950s and 1960s.

Table 4-49 Sacramento County Population Growth 1930-2015

Year	Population	Percent Change
1930	141,199	–
1940	170,333	20.0%
1950	277,140	62.7%
1960	502,778	81.4%
1970	631,498	25.6%
1980	783,381	24.1%
1990	1,041,219	32.9%
2000	1,223,499	17.5%
2010	1,445,327	18.1%
2015	1,470,912	1.8%

Sources: US Census Bureau, California Department of Finance

Table 4-50 Population Growth for Jurisdictions in Sacramento County, 2000-2015

Area	2000	2010	2015	% Change 2000 to 2015
Citrus Heights	85,071	87,752	85,147	0.1%
Elk Grove*	0	121,803	162,899	–
Folsom	51,884	66,242	74,909	44.4%
Galt	19,472	22,856	24,607	26.4%
Isleton	828	822	820	-0.9%
Rancho Cordova*	0	55,099	69,112	–
Sacramento	407,018	453,592	480,105	18.0%
Unincorporated	659,226	560,483	573,313	-13.0%**
Total	**1,223,499**	**1,445,327**	**1,470,912**	**20.2%**

Source: US Census Bureau, California Department of Finance

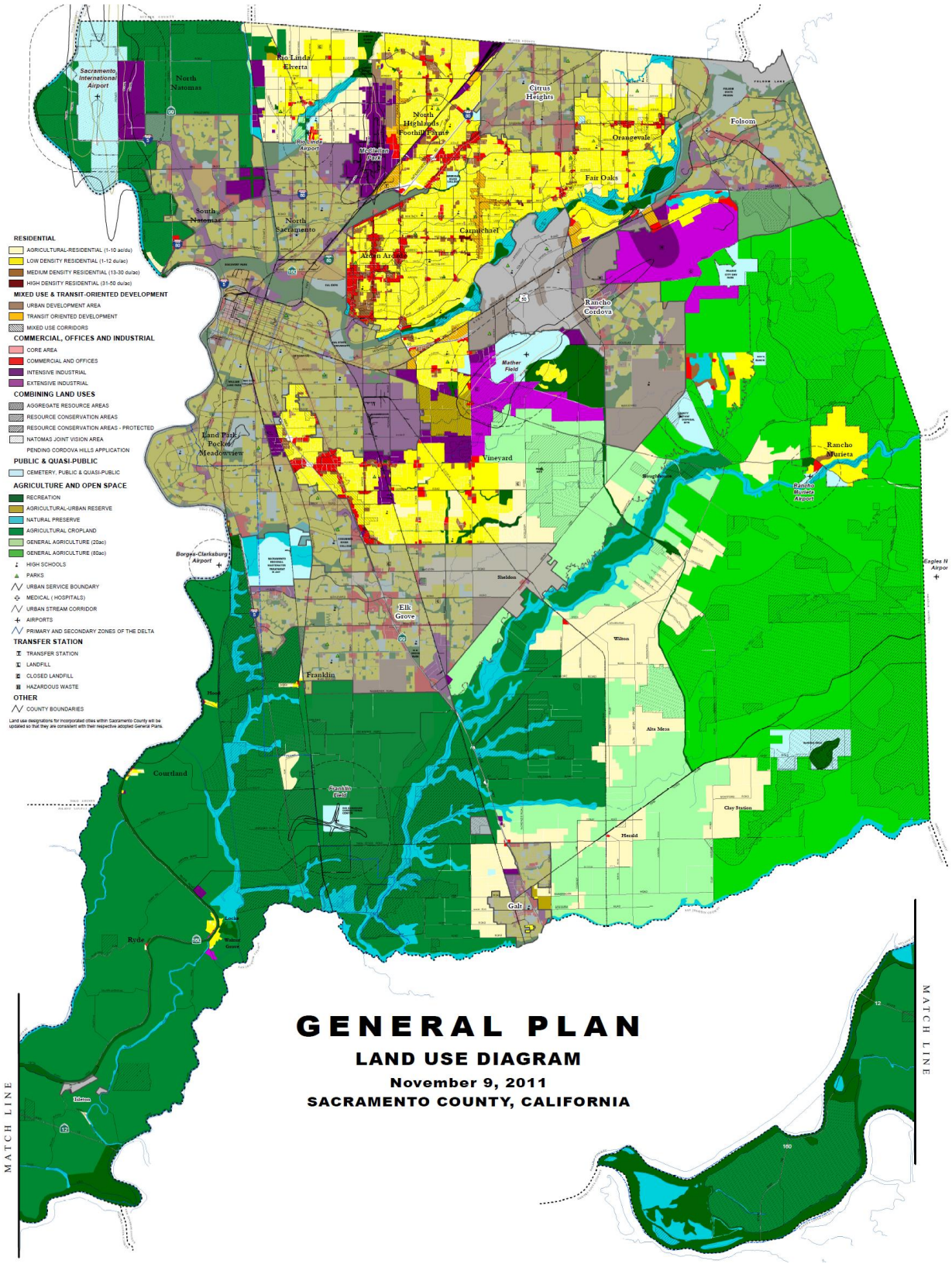
*Elk Grove was incorporated in 2000; Rancho Cordova was incorporated in 2002

**This number is misleading, as two current cities were unincorporated County in 2000.

Current Land Use/Zoning

Future land use and growth management strategies in Sacramento County aim to concentrate future development into and toward existing communities through various policies relating to zoning and minimum development standards and requirements. Zoning designations prescribe allowed land uses and minimum lot sizes for the purpose of supporting efficient infrastructure design, conservation of natural resources, and to avoid conflicting uses. Figure 4-71 shows current land use designations in Sacramento County.

Figure 4-71 Sacramento County Land Use Diagram



Source: Sacramento County General Plan

Development since 2011 Plan

As shown in Table 4-51, the Sacramento County Planning Area has seen a growth of about 2% between 2010 and January 1, 2015.

Table 4-51 Sacramento County Planning Area Population Growth Since 2010

Year	Population	Population Change	Percent Change
2010	1,445,327	–	–
2015	1,470,912	25,585	1.8%

Sources: US Census Bureau California Department of Finance

The Sacramento County Building Department tracked total building permits issued since 2011 for Unincorporated Sacramento County. These are tracked by total development, property use type, and hazard risk area. These are shown in Table 4-52 and Table 4-53. All development in the identified hazard areas, including the 1% annual chance floodplains, areas protected by levees, and high wildfire risk areas, were completed in accordance with all current and applicable development codes and standards and should be adequately protected. Thus, with the exception of more people living in the area potentially exposed to natural hazards, this growth should not cause a significant change in vulnerability of the unincorporated County to identified priority hazards.

Table 4-52 Unincorporated Sacramento County Total Development Since 2011

Property Use	2011	2012	2013	2014	2015
Residential	755	732	674	870	1,338
Commercial/ Industrial	588	400	464	491	558
Other	0	0	0	0	0
Total	**1,343**	**1,132**	**1,138**	**1,361**	**1,896**

Source: Sacramento County Building Department

Table 4-53 Unincorporated Sacramento County Development in Hazard Areas since 2011

Property Use	1% Annual Chance Flood	Area Protected by Levee	Wildfire Risk Area[1]	Other
Residential	38 (SFD only)	N/A	unknown	N/A
Commercial	Pending	N/A	unknown	N/A
Industrial	Included w' commercial	N/A	unknown	N/A
Other	N/A	N/A	unknown	N/A
Total		N/A	unknown	N/A

Source: Sacramento County Building Department

[1]Moderate or higher wildfire risk area

Future Development

As indicated in the previous section, Sacramento County has been steadily growing over the last seven decades. Long term forecasts by the California Department of Finance project population growth in Sacramento County continuing through the 2060. Table 4-54 shows the population projections for the County as a whole through 2060.

Table 4-54 Population Projections for Sacramento County Planning Area, 2010-2060

Year	Sacramento County Population Projection
2010	1,421,236
2015	1,475,381
2020	1,554,022
2025	1,639,613
2030	1,730,276
2035	1,823,985
2040	1,912,838
2045	1,989,722
2050	2,047,662
2055	2,100,788
2060	2,153,833

Source: California Department of Finance, P-1 Report

GIS Analysis

New Growth Areas

The County identified one distinct new growth area in the General Plan, West of Watt, in addition to those areas for which Specific Plans and Comprehensive Plans have been adopted, identified below. Additionally, the County prepared visioning concept maps for the Natomas, Jackson Highway and Grant Line East Visioning Areas. The visioning process is a way of gaging how landowners view the future development of an area. It involves no changes to General Plan designations or zoning, and does not provide any entitlement. It is included here as an indication of potential future development.

Since the adoption of the 2030 General Plan in 2011, the Board of Supervisors has initiated five growth area Master Plans including Mather South, Natomas North Precinct and the Jackson Corridor Master Plans: NewBridge, West Jackson and Jackson Township. No plans have yet been adopted for these identified new growth areas.

Specific Plan and Comprehensive Plan Areas

Specific Plans provide direction for entire communities or other defined new geographic areas. They take different forms depending on the specific needs of our communities and typically set forth policy and implementation strategies for such items as land use, transportation, urban design, parks, school facilities

and public services. Comprehensive Plans are very similar in nature to Specific Plans, but may not include a detailed financing plan which is required under state law to be considered a Specific Plan. These plans help implement the County General Plan on area-specific basis. In addition, the County has initiated and implemented special planning programs for projects that are unique and controversial in nature. Specific Plans and Comprehensive Plans are shown in Figure 4-72. Specific Plans and Comprehensive Plans adopted prior to the update of the 2030 General Plan are:

- Specific Plans
  - ✓ Cordova Hills
  - ✓ Easton Project
  - ✓ East Antelope
  - ✓ Elverta
  - ✓ Mather Field
  - ✓ Metro Airpark
  - ✓ North Vineyard Station

- Comprehensive Plans
  - ✓ Florin Vineyard Gap (2010)
  - ✓ Vineyard Springs (2000)

No Specific Plans or Comprehensive Plans have been adopted since the adoption of the 2030 General Plan. Those in process are part of the Master Plan projects, identified above.

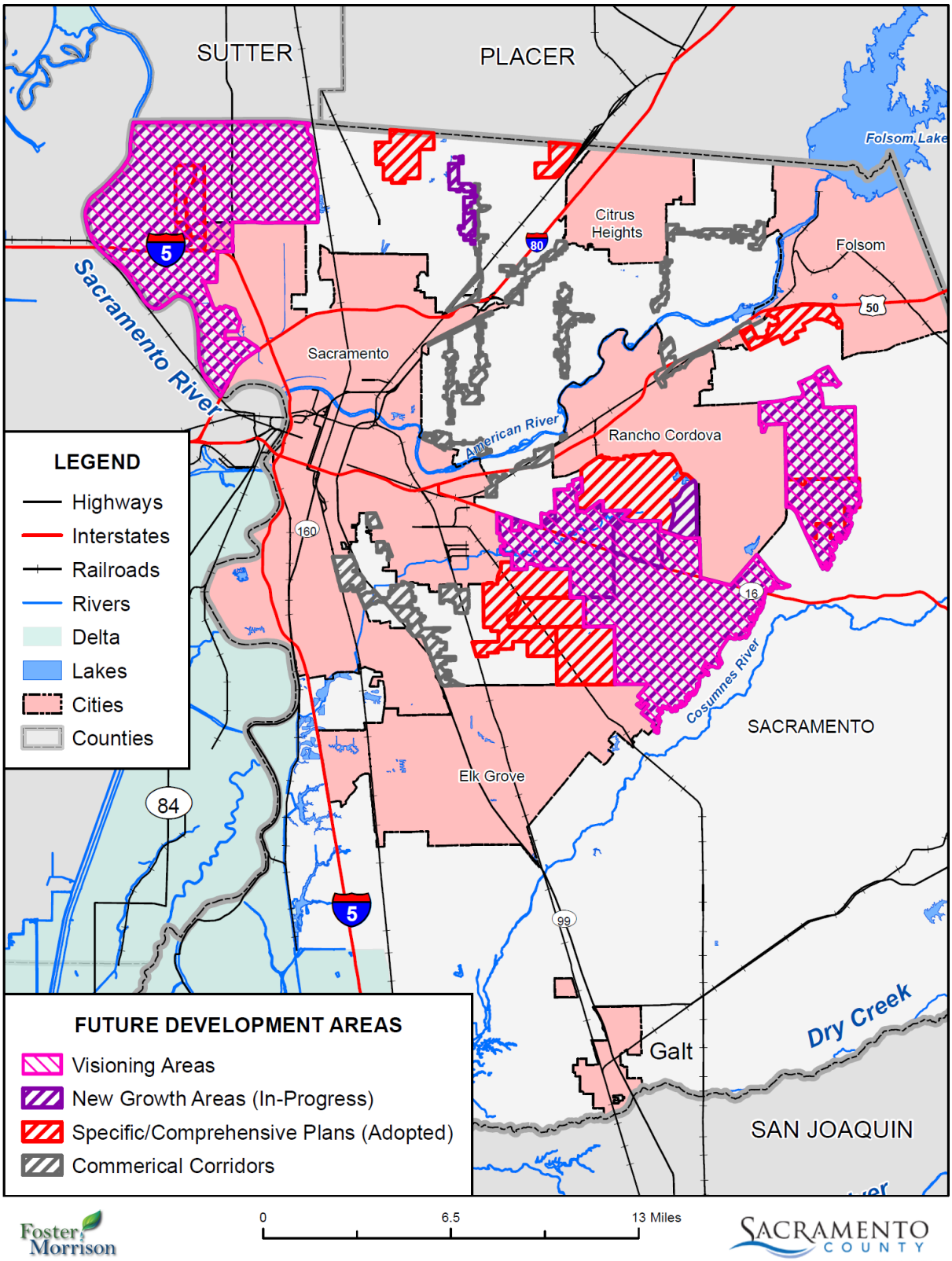
Commercial Corridors

The General Plan Update Land Use Element identifies the following fourteen commercial corridors for redevelopment, reinvestment, and/or intensification.

- North Watt Area
- Florin Road Area
- Auburn Blvd. North
- Fair Oaks Blvd. Central
- Franklin Blvd.
- Greenback Lane
- Stockton Blvd South
- Auburn Blvd. Central
- Fair Oaks Blvd. East
- Fair Oaks Blvd. West
- Fulton Avenue
- Stockton Blvd. Central
- Watt Avenue Central
- Folsom Blvd.

These corridors, shown in green on Figure 4-72, were identified as having substantial vacant and underutilized land, which could accommodate additional commercial and mixed use growth. Potential scenic resources on some of these properties may include landmark trees, native trees, heritage oak trees, urban streams, and/or historic structures of local interest.

Figure 4-72 New Growth Areas in Sacramento County



Data Source: Sacramento County GIS, Cal-Atlas; Map Date: 05/2016.

New growth areas, specific plan and comprehensive plan areas, and commercial corridors data is maintained by Sacramento County, and was made available for this plan. A simple analysis was performed to quantify parcels within these development areas that are also in flood and fire threat hazard areas. Results can serve as a vulnerability analysis guide for future development.

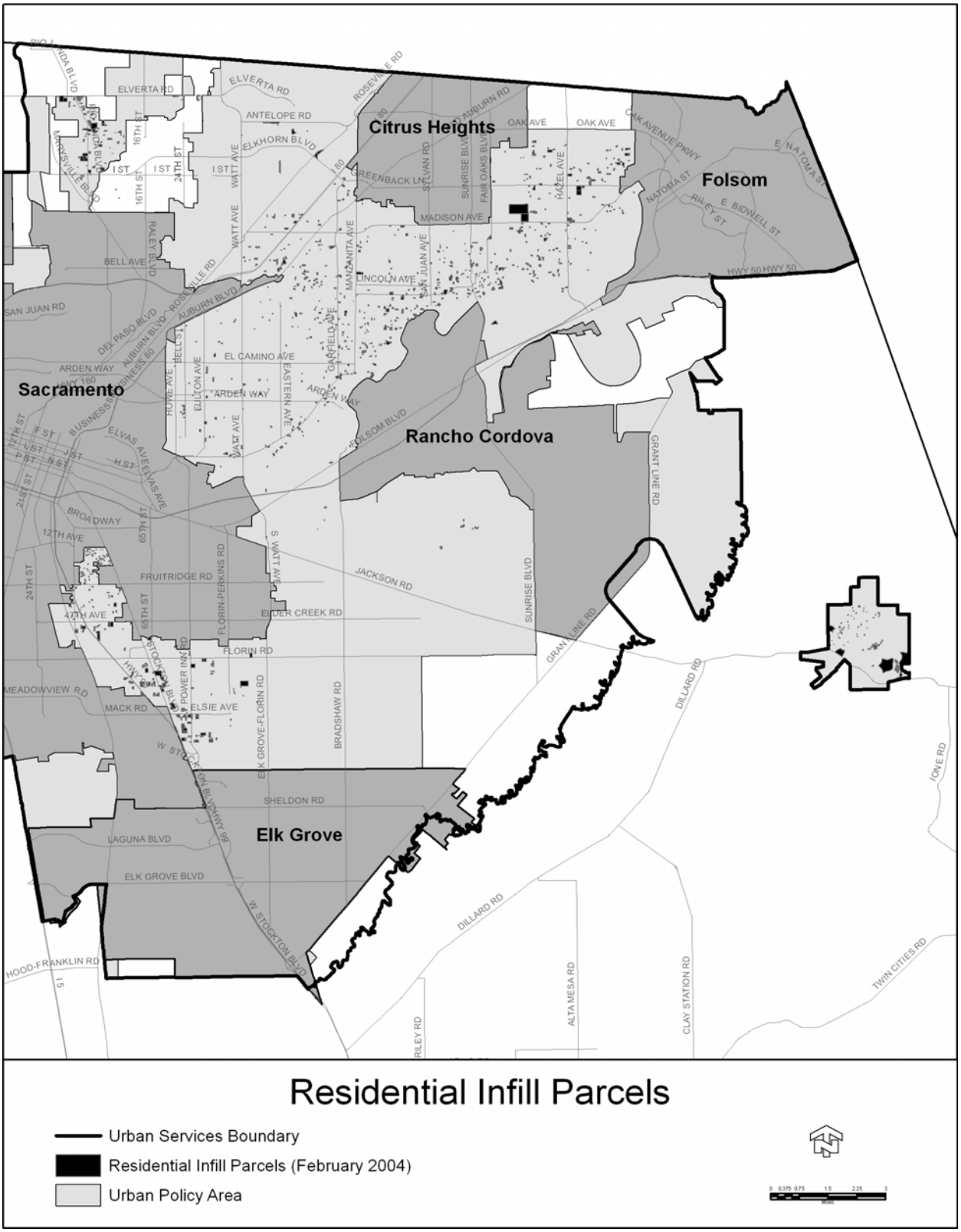
Methodology and analysis of vulnerability of new growth areas to flood, levee failure, and wildfire can be found in their respective hazard vulnerability assessments:

- Dam Failure (Section 4.3.6)
- Flood (Section 4.3.10)
- Levee Failure (Section 4.3.12)
- Wildfire (Section 4.3.16)

Infill

Finally, the County has developed an infill strategy. The County's infill strategy is comprised of four components: 1) maximize residential development opportunity on vacant lands planned for residential use in the established urban community; 2) reuse or redevelop abandoned, unsafe or blighted structures; 3) when appropriate, support rezoning of excess commercial and/or industrial lands to residential uses; 4) increase intensity and density of development on underutilized lands when found to be appropriate. The residential infill parcels identified in the 2030 General Plan Update Land Use Element (Figure 4-73) are scattered throughout established urban communities within Urban Policy Area (UPA) of the unincorporated County. The UPA is intended to provide an adequate supply of developable land sufficient to accommodate projected growth.

Figure 4-73 Sacramento County Infill Parcels



Source: Sacramento County General Plan Environmental Impact Report

Climate Change and Future Development

Sacramento County in general could see population fluctuations as a result of climate impacts relative to those experienced in other regions, and these fluctuations are expected to impact demand for housing and other development. For example, sea level rise may disrupt economic activity and housing in coastal communities, resulting in migration to inland urban areas like the Sacramento region. Other interior western states may experience an exodus of population due to challenges in adapting to heat even more extreme than that which is projected to occur here. While there are currently no formal studies of specific migration patterns expected to impact the Sacramento region, climate-induced migration was recognized within the UNFCCC Conference of Parties Paris Agreement of 2015 and is expected to be the focus of future studies.

Climate change, coupled with shifting demographics and market conditions, could impact both the location of desired developments and the nature of development. Demand may increase for smaller dwellings that are less resource intensive, more energy efficient, easier to maintain and can be more readily adapted or even moved in response to changing conditions. Compact, mixed-use and infill developments that can help residents avoid long commutes and vulnerabilities associated with the transportation system will likely continue to grow in popularity. The value of open space and pressure to preserve it will likely increase, due in part to its restorative, recreational, environmental and habitat benefits but also for its ability to sequester carbon, help mitigate the accumulation of greenhouse gas in the atmosphere and slow down the global warming trend.

Higher flood risks, especially if coupled with increased federal flood insurance rates, may decrease market demand for housing and other types of development in floodplains, while increased risk of wildfires may do the same for new developments in the urban-wildland interface. Flood risks may also inspire new development and building codes that elevate structures while maintaining streetscapes and neighborhood characteristics.

Climate change will stress water resources. Water is an issue in every region, but the nature of the potential impacts varies. Drought, related to reduced precipitation, increased evaporation, and increased water loss from plants, is an important issue in many U.S. regions, especially in the West. Floods, water quality problems, and impacts on aquatic ecosystems and species are likely to be amplified by climate change. Declines in mountain snowpack are important in Sacramento County the Sierra Nevada Mountains and across the state, where snowpack provides vital natural water storage and supply. The ability to secure and provide water for new development requires on-going monitoring and assurances. It is recommended that the ability to provide a reliable water supply from the appropriate water purveyor, continue to be in the conditions for project approval, and such assurances shall be verified and in place prior to issuing building permits.

Similarly protecting and enhancing water supply will also need to be addressed. California's Sustainable Groundwater Management Act (SGMA) will contribute to addressing groundwater and aquifer recharge needs. Good groundwater management will provide a buffer against drought and climate change, and contribute to reliable water supplies regardless of weather patterns. California depends on groundwater for a major portion of its annual water supply, and sustainable groundwater management is essential to a reliable and resilient water system. Protection of critical recharge areas should be addressed across the

County in the respective Groundwater Management Plans. Further, these plans should include provisions that guide development or curtail development in areas that would harm or compromise recharge areas. In South Sacramento County the South Sacramento Habitat Conservation Plan (SSHCP) covers a significant area of prime groundwater recharge areas. Including SGMA Plans that overlap with SSHCP for purposes of protecting these areas and having a robust mitigation program makes sense and should be further explored.

Climate Change will affect Transportation. The transportation network is vital to the county and the region's economy, safety, and quality of life. While it is widely recognized that emissions from transportation have impacts on climate change, climate will also likely have significant impacts on transportation infrastructure and operations Examples of specific types of impacts include softening of asphalt roads and warping of railroad rails; damage to roads; flooding of roadways, rail routes, and airports from extreme events; and interruptions to flight plans due to severe weather. Sacramento Area Council of Governments (SACOG) adopted a Transportation Climate Adaptation Plan that discusses the vulnerabilities associated with climate. Climate change impacts considered in the plan include: extreme temperatures; increased precipitation, runoff and flooding; increased wildfires; and landslides. Although landslides are not a direct result of climate change, these events are expected to increase in frequency due to increased rainfall, runoff, and wildfire. These events have the potential to cause injuries or fatalities, environmental damage, property damage, infrastructure damage, and interruption of operations. Separately, new communities currently being master planned are including amenties such as bike and walking trails, separated facilities from roadways. During flood events, these trails serve as secondary transportation facilities when roadways are blocked or otherwise impassible. During Hurricane Sandy, bicycles were one of the primary modes used to deliver food and water to residents stranded in their homes due to flood. Including dual or multi-purpose facilities and amenities as part of all new development provides not just desirable community amenities but critical infrastructure for climate resiliency.

Climate change will affect land uses and planning. Climate change coupled with shifting demographics and market conditions, could impact both the location of desired developments and the nature of development. Demand may increase for smaller dwellings that are less resource intensive, more energy efficient, easier to maintain and can be more readily adapted or even moved in response to changing conditions. Compact, mixed-use and infill developments that can help residents avoid long commutes and vulnerabilities associated with the transportation system will likely continue to grow in popularity. The value of open space, urban greening, green infrastructure, tree canopy expansion and pressure to preserve it will likely increase, due in part to its restorative, recreational, environmental, habitat, and physical and mental health benefits but also for its ability to sequester carbon and cool the surrounding environment.

Climate change will affect Utilities. California is already experiencing impacts from climate change such as an increased number of wildfires, sea level rise and severe drought1. Utility efforts to deal with these impacts range from emergency and risk management protocols to new standards for infrastructure design and new resource management techniques. Utilities are just beginning to build additional resilience and redundancy into their infrastructure investments from a climate adaptation perspective, but have been doing so from an overall safety and reliability perspective for decades. Significant efforts are also being made in those areas that overlap with climate change mitigation2 such as diversification of resources, specifically the addition of more renewables to the portfolio mix, as well as implementation of demand response efforts to curb peak demand. Efforts are also under way to upgrade the distribution grid infrastructure, which

should add significant resilience to the grid as well. Through the DOE Partnership for Energy Sector Climate Resilience member utilities including SMUD and PG&E are preparing Vulnerability Assessments to identify priority climate and weather-related vulnerabilities. Next, they will issue a guidance document that expands upon the vulnerability assessments phase and includes plans for resilience solutions including cost/benefit analysis methodologies. The outcomes of this work will help to inform next steps on how infrastructure, the grid and other related operations will be modified to address climate change. New development will have to adapt and incorporate these new approaches as they evolve. Existing and new development will be affected from impacts that includes not only diminished capacity from all of the utility assets from generation to transmission and distribution, but also the cost consequences resulting from prevention, replacement, outage, and energy loss. These have the potential for greatly impacting not just residential development but commercial and industrial and all utility users.

Addressing Urban Heat Islands and Heat Events. New development will contribute to urban heat island (UHI) impacts and will need to incorporate urban greening methods into all aspects of development; interior and exterior of buildings, surrounding environment and beyond. The Sacramento County Phase 1 Vulnerability Assessment already described that heat generated from the developed and urbanized areas of Sacramento moves across the county and region, settling and impacting the lower foothill communities. New development will need to reduce its impacts to the overall UHI impacts affecting the county and surrounding region. On-going and expanding heat wave awareness and assistance will also affect new development. During heat waves in Sacramento, a heat alert is issued and news organizations are provided with tips on how vulnerable people can protect themselves. Programs used by health departments to engage with thousands of block captains to check on elderly and other vulnerable residents, along with public cooling places extending their hours, or local businesses welcoming residents into their businesses for purposes of staying cool are examples of programs and services that will be necessary. Other programs to consider that could further involve hospitals and clinics are operating a “heatline” with nurses or other healthcare professionals ready to assist callers with heat-related health problems. In addition, continued funding for weatherization, reduced utility rates and similar programs that offers assistance to elderly, low-income residents to install roof insulation, solar, trees and cool surfaces to save energy and lower indoor temperatures.

4.3.2. Sacramento County Vulnerability to Specific Hazards

The Disaster Mitigation Act regulations require that the HMPC evaluate the risks associated with each of the hazards identified in the planning process. This section summarizes the possible impacts and quantifies, where data permits, the Sacramento County Planning Area’s and unincorporated Sacramento County’s vulnerability to each of the hazards identified as a priority hazard in Section 4.2.22 Natural Hazards Summary. Where specific hazards vary across the County, additional information can be found in the jurisdictional annexes. Based on information developed for the hazard profiles, the priority hazards evaluated further as part of this vulnerability assessment include:

- Agricultural Hazards
- Bird Strike
- Climate Change
- Dam Failure
- Drought and Water Shortage

- Earthquake
- Earthquake: Liquefaction
- Flood: 100/200/500-year
- Flood: Localized/Stormwater Flooding
- Levee Failure
- River/Stream/Creek Bank Erosion
- Severe Weather: Extreme Temperatures – Heat
- Severe Weather: Heavy Rain and Storms
- Wildfire

An estimate of the vulnerability of the Planning Area and Unincorporated County to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Other information can be collected in regard to the hazard area, such as the location of critical community facilities, historic structures, and valued natural resources. Together, this information conveys the impact, or vulnerability, of that area to each hazard.

The HMPC identified five hazards in the Planning Area for which specific geographical hazard areas have been defined and for which sufficient data exists to support a quantifiable vulnerability analysis. These five hazards are dam failure, earthquake, flood, levee failure, and wildfire. Because these hazards have discrete hazard risk areas, their risk varies by jurisdiction. The vulnerability of the dam failure, flood (100/500-year), levee failure, and wildfire were analyzed using GIS and County parcel and assessor data. For dam failure, flood (100/500 year), levee failure, and wildfire, the HMPC inventoried the following for each community, to the extent possible, to quantify vulnerability in identified hazard areas:

- General hazard-related impacts, including impacts to life, safety, and health
- Assets at risk (i.e., types, numbers, and value of land and improvements)
- Identification of population at risk
- Identification of cultural and natural resources at risk

- Identification of critical facilities at risk
- Overall community impact
- Future development/development trends within the identified hazard area

The HMPC used FEMA's loss estimation software, HAZUS-MH, to analyze the County's vulnerability to earthquakes.

Though not fully mapped, a limited analysis was performed on the localized flood hazard to estimate possible damages to localized flooding.

The vulnerability and potential impacts from priority hazards that do not have specific mapped areas nor the data to support additional vulnerability analysis are discussed in more general terms. These include:

- Bird Strike
- Climate Change
- Drought and Water Shortage
- Earthquake: Liquefaction
- River/Stream/Creek Bank Erosion
- Severe Weather: Extreme Temperatures – Heat
- Severe Weather: Heavy Rain and Storms

The vulnerability sections below are presented alphabetically.

4.3.3. Agricultural Hazard Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Medium

According to the US Department of Agriculture (USDA), every year natural disasters, such as droughts, earthquakes, extreme heat and cold, floods, fires, earthquakes, hail, landslides, and tornadoes, challenge agricultural production. Because agriculture relies on the weather, climate, and water availability to thrive, it is easily impacted by natural events and disasters. Agricultural impacts from natural events and disasters most commonly include: contamination of water bodies, loss of harvest or livestock, increased susceptibility to disease, and destruction of irrigation systems and other agricultural infrastructure. These impacts can have long lasting effects on agricultural production including crops, forest growth, and arable lands, which require time to mature. Specific impacts by hazard are listed below:

- Drought's most severe effects on agriculture include water quality and quantity issues. Other impacts include decreased crop yields, impact to feed and forage, and altered plant populations.
  - ✓ The County has been in a drought for the last 5 years. The County Agricultural Commissioner has written a "Letter of Loss" to the USDA/FSA (USDA/Farm Services Agency) for the Livestock Forage Disaster Program, every year since 2011 due to losses in pasture or forage areas. The FSA has various ag insurance programs to assist growers. Growers can enroll in crop insurance programs for all natural causes of loss listed in their policies (such as fire, flood, extreme temperatures). For those without insurance, NAP (the Non-insured Crop Disaster Assistance Program) managed by USDA's Farm Service Agency provides financial assistance to producers of

non-insurable crops when low yields, loss of inventory or due to natural disasters. The county agricultural commissioners can write a "Letter of Ag Loss", identifying the crop & % of loss, to allow growers to receive either low cost loans or monetary compensation.

- Earthquakes can strike without warning and cause dramatic changes to the landscape of an area that can have devastating impacts on agricultural production and the environment. These impacts could include loss of harvest or livestock and destruction of irrigation systems and other agricultural infrastructure.
- Extreme cold may result in loss of crops, livestock, increased deicing, downed power lines, and increased use of generators. Deicing can impact agriculture by damaging local ecosystems and contaminating water bodies.
- Hot weather and extreme heat can worsen ozone levels and air quality as well as leading to drought conditions. Excessive heat and prolonged dry or drought conditions can impact agriculture by creating worker safety issues for farm field workers, severely damaging crops, and reducing availability of water and food supply for livestock.
- Wildfires can spread quickly and devastate thousands of acres of land, which may include agricultural lands. This devastation could lead to large losses in crops, forestry, livestock, and agricultural infrastructure.
- Flooding causes many impacts to agricultural production, including water contamination, damage to crops, loss of livestock, increased susceptibility of livestock to disease, flooded farm machinery, and environmental damage to and from agricultural chemicals.
  - ✓ Reclamation Districts and Flood Control Districts are responsible for maintenance of levees. There are also private levees maintained by the landowners. Vegetation and vertebrates (ground squirrels) are controlled to maintain the integrity of the levees. There are permanent crops and winter crops which may be affected during the times of year when flooding is most likely to occur. Permanent crops such as vineyards and orchards can withstand temporary flooding, such as 1-2 days, before permanent damage may begin to occur. Winter wheat and young plantings may be washed away in a flood event.
- Landslides and debris flows occur in all 50 states and commonly occur in connection with other major natural disasters such as earthquakes, volcanoes, wildfires, and floods. Some of the threats from landslides and debris flow include rapidly moving water and debris that can cause trauma; broken electrical, water, gas, and sewage lines; and disrupted roadways and railways. This can lead to agricultural impacts including contamination of water, change in vegetation, and harvest and livestock losses.
- High Winds and microbursts can appear without much warning and have the potential to devastate an area very quickly. This devastation can impact agriculture by contaminating water and destroying crops, livestock, and other farm property.

In addition to impacts from natural hazards, the County noted that invasive pests can cause economic damage, affecting the ability to ship agricultural commodities oversees, inter-state and intra-state. Trade can be impacted significantly. The California Department of Food & Agriculture (CDFA) is responsible for managing invasive pests statewide. CDFA works closely with the CAC's to manage the pests through quarantines, detection and eradication programs. USDA is also responsible for managing invasive pests which have the potential to impact agriculture nationally. USDA works in partnership with CDFA and the CACs to manage pests.

The County also noted that there are possible threats of bioterrorism. Bioterrorism threats to agriculture would be handled by the USDA, in cooperation with CDFA and the CAC's.

Future Development

Future development in the County is not likely to have an impact on agricultural hazards in Sacramento County.

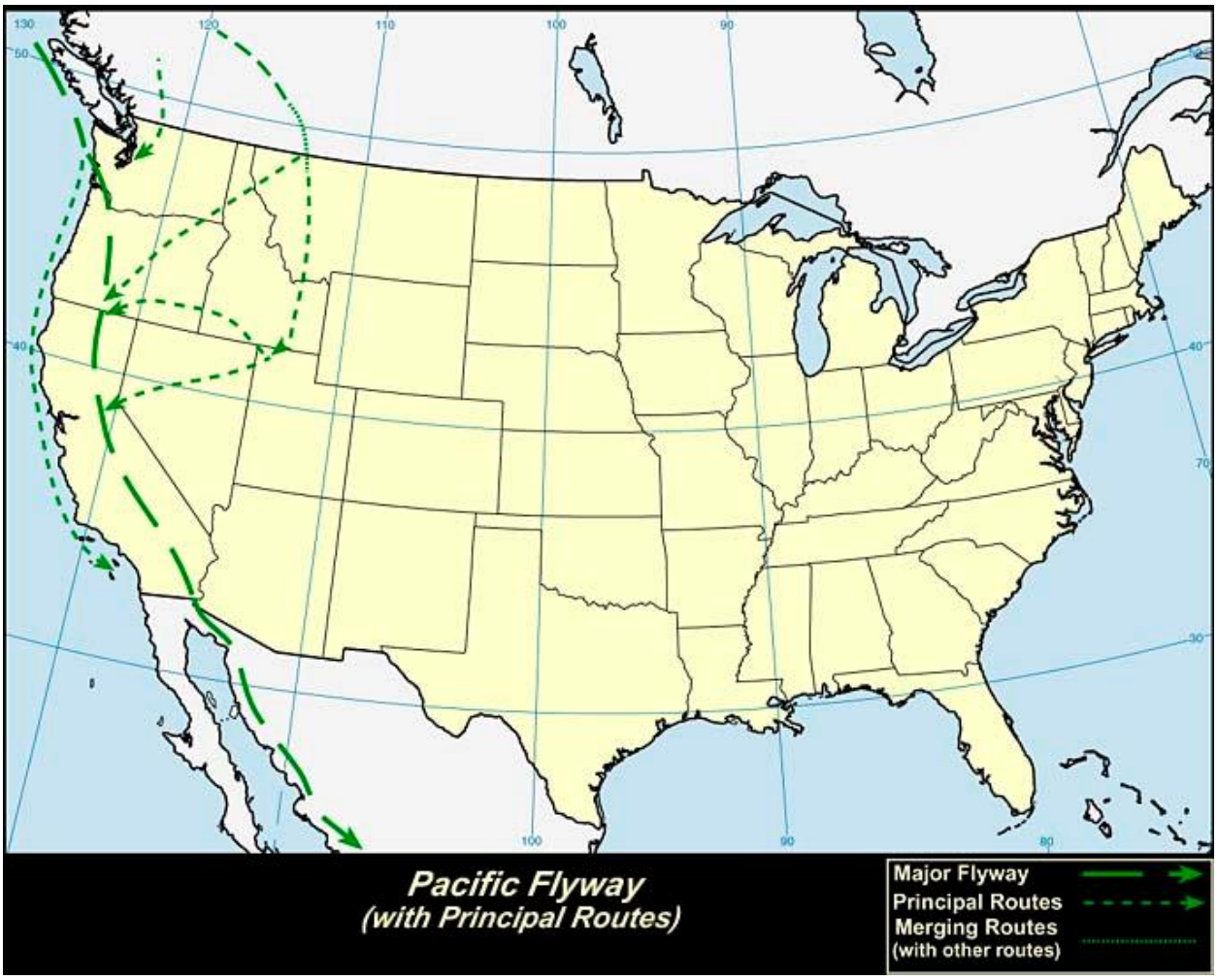
4.3.4. Bird Strike Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Medium

Collisions between wildlife and aircraft (wildlife strikes) are a threat to civil and military aircraft, causing billions of dollars in aircraft damage. Globally, wildlife strikes killed 229 people and destroyed over 210 aircraft between 1988 and 2008. According to the Federal Aviation Administration (FAA) National Wildlife Database (Wildlife Database), almost 90,000 reported wildlife strikes occurred in the United States (U.S.) 1990 through 2008, with 7,516 strikes in 2008 alone. Birds account for more than 97 percent of wildlife strikes. Most bird strikes happen fairly close to the ground, with sixty percent occurring within 100 feet or less above ground level (AGL), 73 percent at 500 feet AGL or less, and 92 percent at 3,000 feet AGL or less.

In Sacramento County, there are five public, and 17 private airports. The Sacramento airports are in the Pacific flyway for migratory birds and reports more bird strikes annually than any other airport in the Western U.S. (see Figure 4-74).

Figure 4-74 Pacific Flyway Routes



Source: birdnature.com. http://www.birdnature.com/pacific.html

Not only are airplane passengers and crew vulnerable to bird strike, downed aircraft can cause possible death and damage to property should the plane not be able to return to the airport runway. Most vulnerable are those who live or work within the direction of the takeoff or landing zones under 3,000 feet above ground level, as 92 percent of bird strikes occur in that zone.

The California State Aeronautics Act (codified in the CA Public Utilities Code) provides guidance for conducting airport land use compatibility planning. Thus, even though on a national average 92 percent of strikes occur below 3,000 feet AGL, in California there is a mechanism for minimizing incompatible land uses, such as residential housing, within the area where aircraft would operate at this elevation.

In the case of SMF, the airport is comprised of about 6,000 acres, about half of which comprises the airport itself. The remaining acreage, located north and south of the airport in alignment with approaching and departing aircraft, is undeveloped land under the operational control of the Sacramento County Airport System. No incompatible land uses occur in this area. It is managed exclusively for safe aircraft approach, departure, and circling operations.

The area adjacent to SMF is rural, consisting primarily of agriculture. Thus, if an unfortunate combination of circumstances were to occur, an aircraft experiencing a damaging bird strike below 3,000 AGL would be unlikely to have an uncontrolled landing in a developed area. In all likelihood, damage to property and people on the ground would be minimal, with most or all of the damage occurring to the aircraft.

Unlike other some other airports like JFK or LAX, SMF is surrounded by neither large bodies of water nor dense urban development. The area encompassed within aircraft overflights below 3,000 AGL is therefore quite different here than at those airports.

Future Development

Future development is not expected to be affected by the bird strike hazard in Sacramento County.

4.3.5. Climate Change Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Low

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change.

The APG: Defining Local and Regional Impacts focuses on understanding the ways in which climate change can affect a community. According to this APG, climate change impacts (temperature, precipitation, sea level rise, ocean acidification, and wind) affect a wide range of community structures, functions and populations. These impacts further defined by regional and local characteristics are discussed by secondary impacts and seven sectors found in local communities: Public Health, Socioeconomic, and equity impacts; Ocean and Coastal Resources; Water Management; Forest and Rangeland; Biodiversity and Habitat; Agriculture; and Infrastructure.

Sacramento County Climate Change Impacts

The APG: Understanding Regional Characteristics identified the following impacts specific to the Bay-Delta region in which the Sacramento County Planning Area is part of:

- Temperature increases
- Reduced precipitation
- Sea level rise
- Flooding – increased flows in areas below sea level, exacerbated by levee failure
- Reduced agricultural productivity
- Reduced water supply
- Public health – heat & air pollution
- Decline in Biodiversity

Ascent Environmental Climate Change Vulnerability Assessment

According to the Preliminary Draft – Climate Change Vulnerability Assessment for the Sacramento County Climate Adaptation Plan (CAP) prepared by Ascent Environmental (Ascent), climate change is already affecting and will continue to alter the physical environment throughout the Central Valley and Sacramento County; however, specific implications of climate change effects vary with differing physical, social, and economic characteristics within the County. Their report followed the nine-phase APG process for local and regional climate vulnerability assessment and adaption strategy development. The APG vulnerability assessment is a five step process of determining: Exposure, Sensitivity, Potential Impacts, Adaptive Capacity, and Risk and Onset.

At the time of this LHMP Update, Ascent had completed the initial exposure assessment for Sacramento County. The methodology for the exposure assessment is described below and Information specific to the exposure assessment is included in each of the affected natural hazard profiles. Additional County-specific vulnerability assessment data developed through preparation of Sacramento County's CAP will be included in the next five-year update to this LHMP.

CAP Exposure Methodology

Where predictive data exists, climate change effects are characterized by two milestone years: midcentury (2050) and end of century (2100). Historical data are used to set the baseline for describing the degree of change occurring by these two future dates. This exposure assessment evaluated the direct, or primary, effects of climate change in Sacramento to include deviations in average temperature, annual precipitation and seal-level rise. Secondary impacts, which could occur as result of one or more of these effects are also analyzed and include extreme heat and its frequency, wildfire risk, flooding, and snowpack amount and retention. Ascent utilized Cal-Adapt to forecast potential climate change impacts over time. Cal-Adapt is a climate change scenario planning tool developed by the California Energy Commission and the University of California Berkeley Geospatial Innovation Facility. Cal-Adapt downscales global climate simulation model data to local and regional resolution under two emissions scenarios: the A-2 scenario represents a higher, future global greenhouse gas (GHG) emissions scenario, and the B-1 scenario represents a lower future GHG emissions scenario. Which scenario occurs in the future depends on the effectiveness of programs implemented to reduce GHG emissions. Because the degree of effectiveness is not yet known, results from both emissions scenarios are considered in this vulnerability assessment and distinguished, where possible.

Future Development

HOW WILL FUTURE DEVELOPMENT BE AFFECTED BY CLIMATE CHANGE?

4.3.6. Dam Failure Vulnerability Assessment

Likelihood of Future Occurrence—Occasional
Vulnerability—Medium

Dam failure flooding can occur as the result of partial or complete collapse of an impoundment. Dam failures often result from prolonged rainfall and flooding. The primary danger associated with dam failure is the high velocity flooding of those properties downstream of the dam.

A dam failure can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to dam failures is confined to the areas subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the facility and associated revenues that accompany those functions.

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Based on the risk assessment, it is apparent that a major dam failure could have a devastating impact on the Planning Area. Dam failure flooding presents a threat to life and property, including buildings, their contents, and their use. Large flood events can affect crops and livestock as well as lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies.

According to the Sacramento County General Plan Background report, there are four major and two minor dams which, if they fail, may impact the people and resources of this jurisdiction. The major dams are comprised of Shasta on the Sacramento, Oroville on the Feather, Comanche on the Mokelumne and Folsom on the American. The minor dams include Nimbus and Rancho Seco. All of these 6 dams are high hazard dams. More specific information about these dams can be found in Figure 4-22 and Table 4-25 in Section 4.2.9. According to the report, a catastrophic failure of any of these dams could have a significant impact on the County. The failure of any of these dams would cause downstream flooding and would likely result in loss of life and property. The potential magnitude of a dam failure depends on the time of year and the base flow of the river when the failure occurs. During the winter months, when river flows are higher, the impact to the area would be much greater and evacuation times much less.

Folsom Dam (including the earth-filled dikes) would have the greatest impact on the population of Sacramento County should it fail. The flood waters from this system would affect the cities of Sacramento and Folsom and the surrounding unincorporated area. Due to limited availability of data, of these six dams with the potential to impact the County, further vulnerability analyses was limited to a catastrophic failure of Folsom Dam.

The earthen dikes to the north of Folsom Dam would impact those people in the relatively low areas of Sacramento County leading to Roseville. The water would then flow into the Natomas Area of the City of Sacramento and then, depending on which levees held, this water could fill the old Lake Natomas bed and possibly flood the North Highlands and Rio Linda areas. Failure of the earthen dikes to the south of Folsom Dam would impact the City of Folsom immediately. Water would then flow into the American River basin, eventually arriving in downtown Sacramento.

Nimbus Dam has a capacity of 8,760 acre-feet. The Flood Operations Branch, Department of Water Resources, State of California, believes that the American River Channel will not flood unless the levees fail or there is a catastrophic release. The Sacramento Municipal Utility District (SMUD) inundation map indicates that a failure of the Rancho Seco Dam would flow to the Laguna Creek Basin and stop approximately at Stockton Boulevard. Failure of Shasta Dam would affect populations south along the Sacramento River basin to about Knights Landing where it would lose momentum. An Oroville Dam failure would impact populations southwest along the Feather River basin to about the Yolo Bypass. Sacramento County would not be affected unless all dams fail at once. A failure at Comanche Dam would affect the Delta and possibly slow the flow of other rivers through the Delta. The Bureau of Reclamation indicated the water would stop short of the Sacramento-San Joaquin County line at Interstate 5.

Assets at Risk

GIS was used to quantify assets at risk to dam failure in the County. Sacramento County provided inundation as a GIS layer for the Folsom Dam system, as part of the following breaks:

- Folsom Right Wing
- Folsom Mormon
- Folsom Dike 4
- Folsom Dike 5
- Folsom Dike 6
- Folsom Dike 7
- Folsom Dike 8
- Folsom Dam

Description of Facilities

The Folsom Dam and Reservoir Project is located on the American River, about 20 miles upstream of the City of Sacramento, California. It was designed and built by the Corps of Engineers during the period 1948 to 1956, and is now owned and operated by the U.S. Bureau of Reclamation. The reservoir has a storage capacity of 1 million acre-ft at gross pool. The project includes about 4.5 miles of man-made water retaining structure that have a crest elevation of 480.5ft above sea level.

Purpose of Study

The Bureau of Reclamation performed a study in an attempt to determine the magnitude of flooding that would result from various breach scenarios of structures located around the reservoir. The structures are Folsom Dam itself, its right wing dam, dikes 4, 5, 6, 7, 8, and Mormon Island. The results of hydrodynamic simulations are used to generate potential inundation maps that can aid in the development of emergency actions plans.

Inundation Mapping

Sacramento's parcel and associated secured roll assessor 2015 data was used as the basis for the countywide inventory of parcels and structure value. GIS was used to create a centroid, or point representing the center of the parcel polygon. The Folsom Inundation data was then overlaid on the parcel centroids to determine how much value is at risk to a worst case scenario failure. Based on FEMA guidance for dam failures,

contents value is estimated at 50 percent of the improved structure value and shown in Table 4-55 for the Planning Area and in Table 4-56 for the unincorporated County. Structure and contents values are summed, and then a projected loss estimate can generally be calculated. Losses are related to a number of potential factors including inundation depth, velocity, and building type and construction. However, due to data limitations associated with this dam break scenario, combined with the potentially catastrophic nature of this event, potential losses are based on the total value (structure + contents) of affected improved parcels.

Values at Risk

Table 4-55 Sacramento County Planning Area – Parcel Count and Structure Value Vulnerability to Folsom Dam Break Inundation

Jurisdiction	Total Parcel Count	Imp. Parcel Count	Total Land Value	Improved Structure Value	Total Value	Contents Value	Total Loss Estimate
Citrus Heights	4,555	4,287	$290,331,369	$618,773,206	$909,104,575	$309,386,603	$928,159,809
Elk Grove	16,339	15,626	$1,373,897,822	$3,812,723,768	$5,186,621,590	$1,906,361,884	$5,719,085,652
Folsom	17,081	15,661	$2,174,391,545	$5,660,120,896	$7,834,512,441	$2,830,060,448	$8,490,181,344
Galt	0	0	$0	$0	$0	$0	$0
Isleton	0	0	$0	$0	$0	$0	$0
Rancho Cordova	15,601	14,480	$1,417,291,859	$3,788,739,950	$5,206,031,809	$1,894,369,975	$5,683,109,925
City of Sacramento	140,666	127,533	$11,337,851,499	$28,474,069,514	$39,811,921,013	$14,237,034,757	$42,711,104,271
Unincorporated Sacramento County	69,494	63,782	$6,106,346,512	$13,467,145,529	$19,573,492,041	$6,733,572,765	$20,200,718,294
Total	**263,736**	**241,369**	**$22,700,110,606**	**$55,821,572,863**	**$78,521,683,469**	**$27,910,786,432**	**$83,732,359,295**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data

Table 4-56 Unincorporated Sacramento County – Parcel Count and Structure Value Vulnerability to Folsom Dam Break Inundation

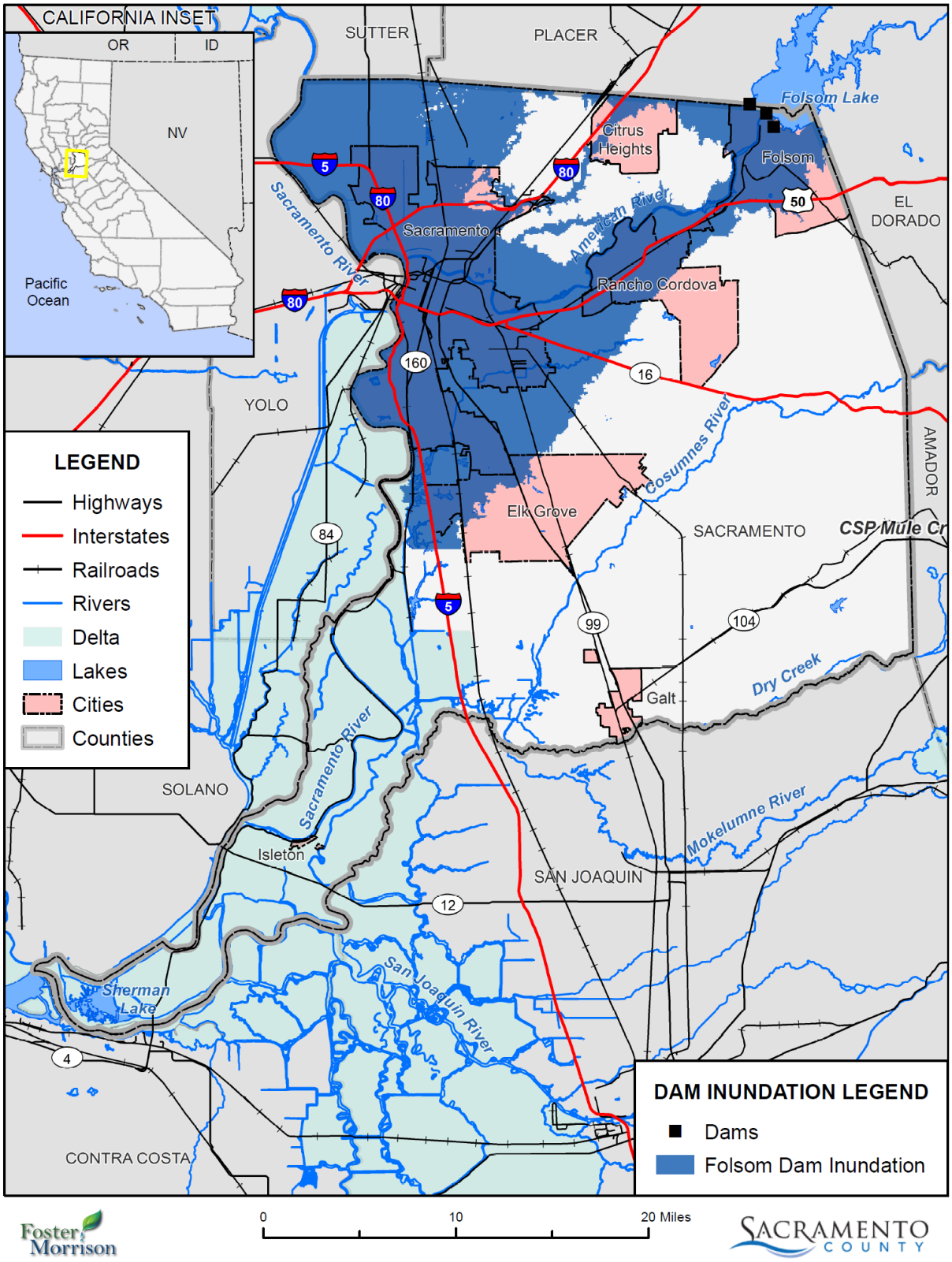
Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	190	44	$70,372,280	$5,367,678	$75,739,958
Care / Health	119	110	$35,649,284	$207,960,127	$243,609,411
Church / Welfare	216	189	$67,899,492	$277,779,355	$345,678,847
Industrial	898	756	$344,047,576	$907,010,158	$1,251,057,734
Miscellaneous	535	3	$2,424,367	$33,114	$2,457,481
Office	564	509	$267,400,116	$842,663,098	$1,110,063,214
Public / Utilities	1,394	13	$6,055,285	$3,390,584	$9,445,869
Recreational	49	39	$24,751,939	$33,940,139	$58,692,078
Residential	61,968	61,049	$4,382,324,854	$10,184,187,333	$14,566,512,187

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Retail / Commercial	1,038	963	$537,962,843	$996,790,236	$1,534,753,079
Vacant	2,519	107	$367,379,968	$8,023,707	$375,403,675
No Data	4	0	$78,508	$0	$78,508
Total	**69,494**	**63,782**	**$6,106,346,512**	**$13,467,145,529**	**$19,573,492,041**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data

Figure 4-75 depicts possible dam inundation areas in the County from a failure of the Folsom Dam.

Figure 4-75 Sacramento County Planning Area Folsom Dam Inundation Scenario



Data Source: Sacramento County GIS, Cal-Atlas, National Inventory of Dams; Map Date: 05/2016.

Population at Risk

A separate analysis was performed to determine population in the dam inundation area. Using GIS, the Folsom Dam Inundation Zone was overlaid on the improved residential parcel data. Those parcel centroids that intersect the dam inundation area were counted and multiplied by the Census Bureau Sacramento County household factor for each jurisdiction; results were tabulated by jurisdiction (see Table 4-57). According to this analysis, there is a total population of 622,929 in the Folsom Dam Inundation Zone. There are 165,443 people in the Unincorporated County in the Folsom Dam Inundation Zone.

Table 4-57 Population in the Folsom Dam Inundation Area

Jurisdiction	Improved Residential Parcels	Total Population*
Citrus Heights	5,221	13,209
Elk Grove	15,475	49,211
Folsom	15,082	39,364
Galt	0	0
Isleton	0	0
Rancho Cordova	13,548	37,257
Sacramento	121,544	318,445
Unincorporated	61,049	165,443
Total	**231,919**	**622,929**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data, US Census Bureau

*Census Bureau 2010 average household sizes are: Citrus Heights – 2.53; Elk Grove – 3.18; Folsom – 2.61; Galt – 3.24; Isleton – 2.43; Rancho Cordova – 2.75; City of Sacramento – 2.62; Unincorporated County – 2.71

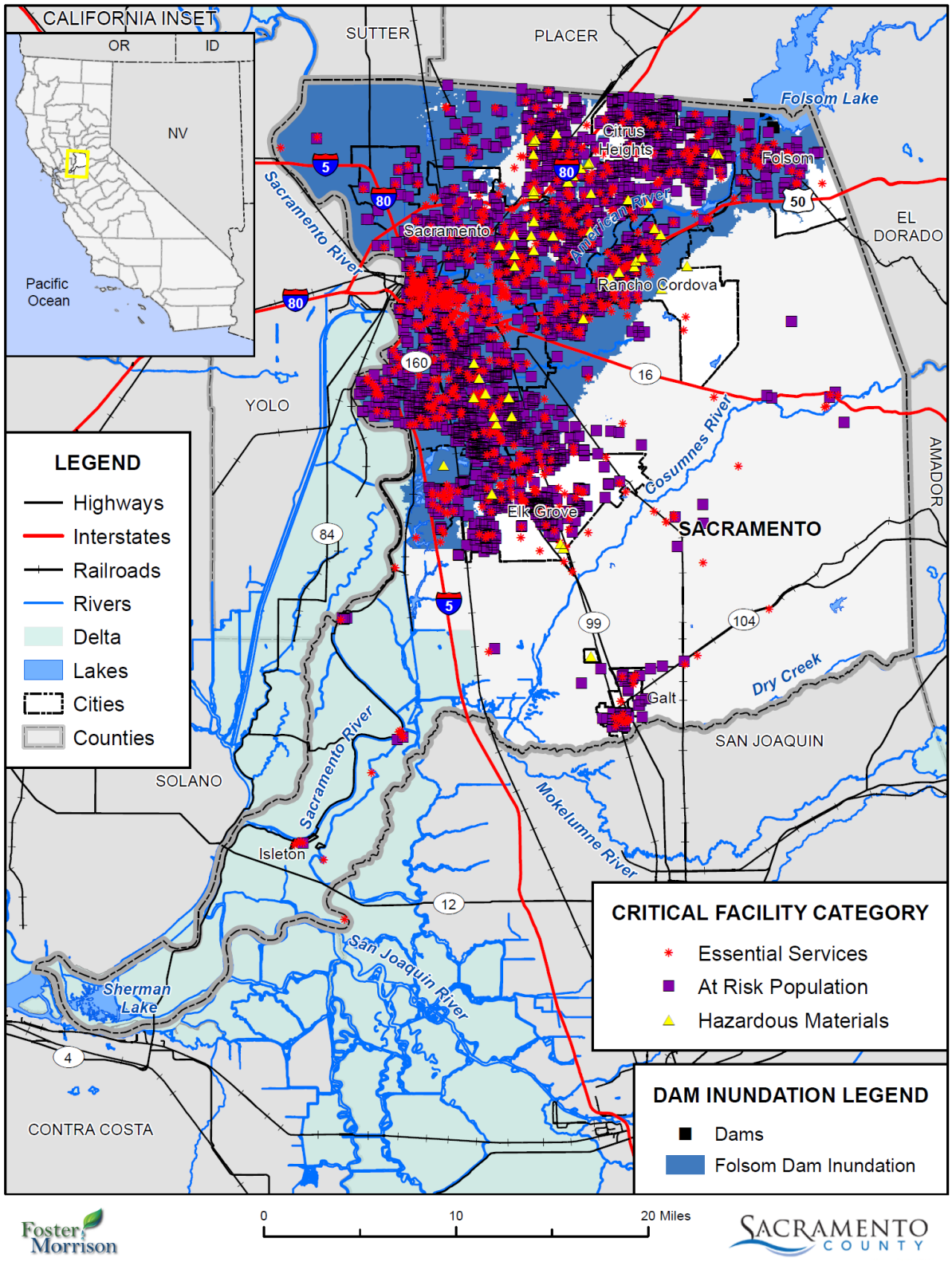
Cultural and Natural Resources at Risk

The Sacramento County Planning Area has significant cultural and natural resources located throughout the County as previously described. Vulnerability analysis of these resources specific to dam failure was not possible due to data limitations.

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Sacramento County and all jurisdictions. GIS was used to determine whether the facility locations intersect the dam inundation hazard area. There are 1,845 facilities in the inundation area, as shown in Figure 4-76, Table 4-58 (for the Planning area), and Table 4-59 (for the unincorporated County). Details of critical facility definition, type, name and address and jurisdiction in the Folsom dam inundation area are listed in Appendix E.

Figure 4-76 Sacramento County Planning Area Critical Facilities in the Folsom Dam Inundation Zone



Data Source: Sacramento County GIS, Cal-Atlas, National Inventory of Dams; Map Date: 05/2016.

Table 4-58 Sacramento County Planning Area – Critical Facilities in the Folsom Dam Inundation Zone

Critical Facility Category	Facility Type	Facility Count
Essential Services Facilities	Airport	5
	Arena	1
	Bus Terminal	7
	Convention Center	1
	Detention Basin	25
	Dispatch Center	1
	Drainage	6
	Emergency Evacuation Shelter	150
	Emergency Rooms	1
	EOC	1
	Fire Station	54
	Gas Storage	1
	General Acute Care Hospital	9
	Government Facilities	48
	Hospitals	1
	Light Rail Stop	52
	Medical Health Facility	156
	Police	9
	Sand Bag	2
	Stadium	3
	State Facility	1
	Traffic Operations Center	1
	Train Station	1
	Vehicle and Equipment Storage	1
	Water Treatment Plant	3
	Total	540
At Risk Population Facilities	Adult Day Care	16
	Adult Education School	8
	Adult Residential	222
	Alternative Education School	2
	Assisted Living Centers	14
	Charter School	18
	Children's Home	1
	College/University	7
	Community Day School	5

Critical Facility Category	Facility Type	Facility Count
	Day Care Center	291
	Detention Center	1
	Group Home	53
	Hotel	44
	Independent Study School	2
	Infant Center	25
	JAIL	1
	Prison	1
	Private Elementary School	36
	Private High School	20
	Private K-12 School	18
	Public Continuation High School	12
	Public Elementary School	147
	Public High School	20
	Public Middle School	27
	Residential Care/Elderly	210
	School	10
	School-Age Day Care Center	62
	Social Rehabilitation Facility	2
	Special Education School	4
	Total	**1,279**
Hazardous Materials Facilities	Oil Collection Center	25
	Sewer Treatment Plant	1
	Total	26
Total		**1,845**

Source: Sacramento County GIS

Table 4-59 Unincorporated Sacramento County – Critical Facilities in the Folsom Dam Inundation Zone

Critical Facility Category	Facility Type	Facility Count
Essential Services Facilities Total	Airport	4
	Bus Terminal	1
	Detention Basin	3
	Emergency Evacuation Shelter	48
	Fire Station	23
	General Acute Care Hospital	1

Critical Facility Category	Facility Type	Facility Count
	Government Facilities	12
	Light Rail Stop	6
	Medical Health Facility	37
	Police	3
	Stadium	1
	Traffic Operations Center	1
	Vehicle and Equipment Storage	1
	Total	**141**
At Risk Population Facilities Total	Adult Day Care	4
	Adult Education School	3
	Adult Residential	83
	Charter School	4
	College/University	1
	Community Day School	3
	Day Care Center	77
	Detention Center	1
	Group Home	28
	Hotel	4
	Infant Center	9
	Private Elementary School	6
	Private High School	9
	Private K-12 School	8
	Public Continuation High School	7
	Public Elementary School	37
	Public High School	5
	Public Middle School	9
	Residential Care/Elderly	82
	School-Age Day Care Center	14
	Social Rehabilitation Facility	1
	Special Education School	1
	Total	**396**
Hazardous Materials Facilities	Oil Collection Center	14
	Sewer Treatment Plant	1
	Total	**15**
Total		**552**

Source: Sacramento County GIS

Overall Community Impact

Dam failure floods and their impacts vary by location, antecedent rainfall, type of dam failure, and will likely only affect certain areas of the County during specific times. Based on the risk assessment, it is evident that a dam failure floods could have potentially devastating economic impacts to certain areas of the County. Impacts that are not quantified, but can be anticipated in large future events, include:

- Injury and loss of life;
- Commercial and residential structural and property damage;
- Disruption of and damage to public infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Damage to roads/bridges resulting in loss of mobility;
- Significant economic impact (jobs, sales, tax revenue) to the community;
- Negative impact on commercial and residential property values; and
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.
- Impact on the overall mental health of the community.

Future Development

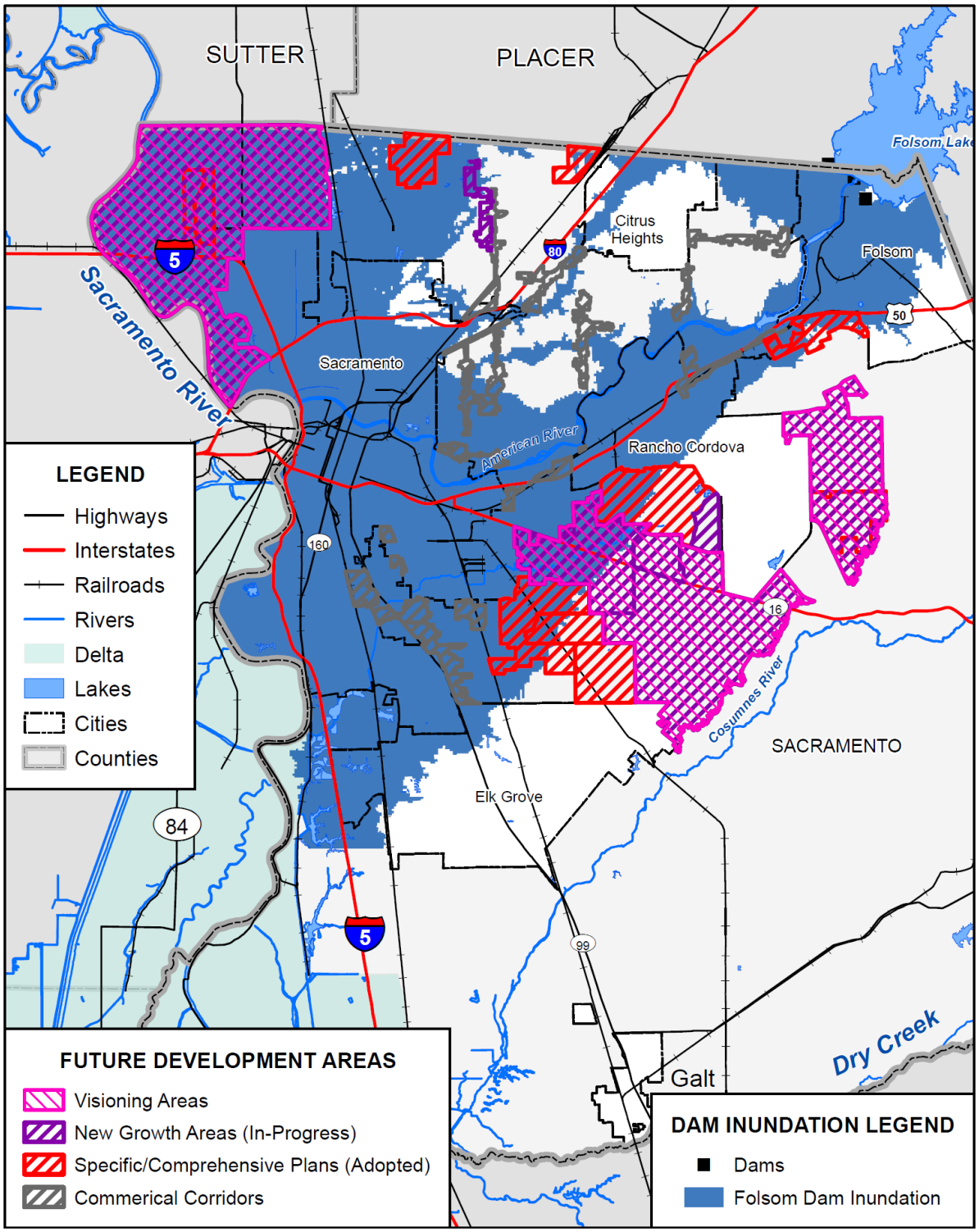
Although new growth and development corridors would fall in the area flooded by a dam failure, given the limited potential of total dam failure and the large area that a dam failure would affect, development in the dam inundation area will continue to occur.

Future Development GIS Analysis

Visioning areas, new growth areas, specific plan areas, commercial corridors data is maintained by Sacramento County, and was made available for this plan. A simple analysis was performed to quantify parcels within these development areas that are also in flood hazard areas. Results can serve as confirmation for future development.

GIS was used to determine the number of parcels in the dam inundation zones within visioning areas, specific plan areas, new growth areas, and commercial corridor areas. GIS was used to create a centroid, or point representing the center of the parcel polygon. Those parcels centroids that fall inside the future development areas and that were within the dam inundation zones were selected and shown on Figure 4-77 and tabulated in Table 4-60.

Figure 4-77 Sacramento County Planning Area – Future Development in Dam Inundation Zones



Data Source: Sacramento County GIS, Cal-Atlas, National Inventory of Dams; Map Date: 05/2016.

Table 4-60 Sacramento County Planning Area – Future Development in Dam Inundation Zones

Area	Parcels	Acres	Dam Inundation Area
Visioning Area			
Jackson	1,099	21,670	Yes
Natomas	907	24,504	Yes
Grantline East	48	8,198	No
Plan Areas			
Cordova Hills Master Plan	26	2,436	No
East Antelope Specific Plan	1,425	601	Yes
Easton Project	19	1,409	Yes
Elverta Specific Plan	158	1,581	Yes
Florin-Vineyard Gap Community Plan	827	3,875	Yes
Jackson Township Master Plan	61	1,909	Yes
Mather Field	1,421	5,493	Yes
Mather South Master Plan	12	1,299	No
Metro Airpark	78	1,810	Yes
New Bridge Master Plan	27	1,339	No
North Vineyard Station Specific Plan	1,320	1,553	Yes
Vineyard Springs Comprehensive Plan	2,732	2,344	No
West Jackson Highway Master Plan	455	6,181	Yes
West of Watt	383	609	Yes
Corridor Areas			
Corridor 1	1,277	554	Yes
Corridor 2	533	226	Yes
Corridor 3	1,033	625	Yes
Corridor 4	626	532	Yes
Corridor 5	516	621	Yes
Corridor 6	579	311	Yes
Corridor 7	722	460	Yes
Corridor 8	126	136	Yes
Corridor 9	946	290	Yes
Corridor 10	593	101	Yes
Corridor 11	266	76	Yes
Corridor 12	2,537	1,929	Yes
Corridor 13	325	402	Yes
Corridor 14	30	155	Yes
Corridor 15	224	465	Yes

Area	Parcels	Acres	Dam Inundation Area
Corridor 16	31	11	Yes
Corridor 17	203	254	Yes
Corridor 18	3	1	Yes
Corridor 19	48	130	Yes
New Growth Areas			
Mather South Master Plan	12	1,299	No
Natomas North	907	24,504	Yes
Jackson Township	61	1,909	Yes
West Jackson Highway	455	6,181	Yes
New Bridge	27	1,339	No
West of Watt	383	609	Yes

Source: Sacramento County GIS

4.3.7. Drought and Water Shortage Vulnerability Assessment

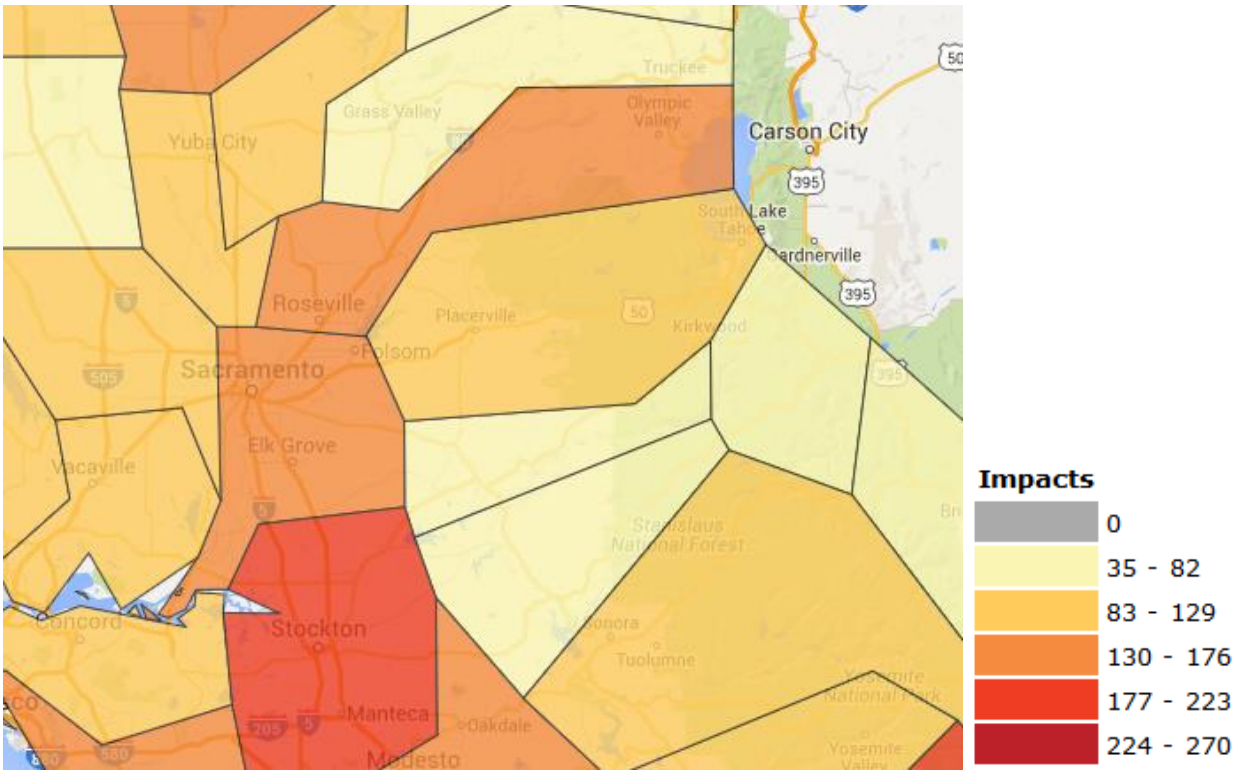
Likelihood of Future Occurrence—Likely
Vulnerability—Medium

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue for agricultural, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Based on historical information, the occurrence of drought in California, including Sacramento County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of Sacramento County to drought is countywide, but impacts may vary and include reduction in water supply, agricultural losses, and an increase in dry fuels.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. Tracking drought impacts can be difficult. The Drought Impact Reporter from the NDMC is a useful reference tool that compiles reported drought impacts nationwide. Figure 4-78 and Table 4-61 show drought impacts for the Sacramento County Planning Area from 1850 to June 2016. The data represented is skewed, with the majority of these impacts from records within the past 15 years.

Figure 4-78 Drought Impact Monitor for Sacramento County, 1850 to 2016



Source: National Drought Mitigation Center

Table 4-61 Sacramento County Drought Impacts

Category	Number of Impacts
Agriculture	43
Business and Industry	8
Energy	3
Fire	14
Plants & Wildlife	49
Relief, Response, and Restrictions	84
Society and Public Health	41
Tourism and Recreation	12
Water Supply and Quality	95
Total	**349**

Source: National Drought Mitigation Center

The most significant qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures are typically implemented during extended droughts. A reduction of electric power generation and water quality deterioration are also

potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

It is difficult to quantitatively assess drought impacts to Sacramento County because not many county-specific studies have been conducted. Some factors to consider include: the impacts of fallowed agricultural land, habitat loss and associated effects on wildlife, and the drawdown of the groundwater table. The most direct and likely most difficult drought impact to quantify is to local economies, especially agricultural economies. The State has conducted some empirical studies on the economic effects of fallowed lands with regard to water purchased by the State's Water Bank; but these studies do not quantitatively address the situation in Sacramento County. It can be assumed, however, that the loss of production in one sector of the economy would affect other sectors.

The drawdown of the groundwater table is one factor that has been recognized to occur during repeated dry years. Lowering of groundwater levels results in the need to deepen wells, which subsequently lead to increased pumping costs. These costs are a major consideration for residents relying on domestic wells and agricultural producers that irrigate with groundwater and/or use it for frost protection. Land subsidence can also occur when the groundwater table is depleted.

Drought and Bark Beetles

One of the specific vulnerabilities of drought in Sacramento County is the increased risk to trees from beetle kill. Bark beetles mine the inner bark (the phloem-cambial region) on twigs, branches, or trunks of trees and shrubs. This activity often starts a flow of tree sap in conifers, but sometimes even in hardwoods like elm and walnut. Bark beetles frequently attack trees weakened by drought, disease, injuries, or other factors that may stress the tree. Bark beetles can contribute to the decline and eventual death of trees; however only a few aggressive species are known to be the sole cause of tree mortality (see Figure 4-79).

Figure 4-79 Monterey Pine Killed by Engraver Beetles

Source: University of California

In addition to attacking larger limbs, some species such as cedar and cypress bark beetles feed by mining twigs up to 6 inches back from the end of the branch, resulting in dead tips. These discolored shoots hanging on the tree are often referred to as "flagging" or "flags." (see Figure 4-80) Adult elm bark beetles feed on the inner bark of twigs before laying eggs. If an adult has emerged from cut logs or a portion of a tree that is infected by Dutch elm disease, the beetle's body will be contaminated with fungal spores. When the adult beetle feeds on twigs, the beetle infects healthy elms with the fungi that cause Dutch elm disease. Elms showing yellowing or wilting branches in spring may be infected with Dutch elm disease.

Figure 4-80 Flag Tips from Cypress Bark Beetle Feeding

Source: University of California

More information regarding tree mortality is discussed in the wildfire vulnerability in Section 4.3.16.

Future Development

According to the 2010 Urban Water Management Plan, Sacramento County, through the Sacramento County Water Agency, has access to large quantities of water through surface water, groundwater, and recycled water. However, population growth in the County will add additional pressure to water companies during periods of drought and water shortage. Water companies will need to continue to plan for and add infrastructure capacity for population growth.

4.3.8. Earthquake Vulnerability Assessment

Likelihood of Future Occurrence—Occasional
Vulnerability—Medium

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while uninhabited areas are less vulnerable.

Ground shaking is the primary earthquake hazard. Many factors affect the survivability of structures and systems from earthquake-caused ground motions. These factors include proximity to the fault, direction of rupture, epicentral location and depth, magnitude, local geologic and soils conditions, types and quality of construction, building configurations and heights, and comparable factors that relate to utility, transportation, and other network systems. Ground motions become structurally damaging when average peak accelerations reach 10 to 15 percent of gravity, average peak velocities reach 8 to 12 centimeters per second, and when the Modified Mercalli Intensity Scale is about VII (18-34 percent peak ground acceleration), which is considered to be very strong (general alarm; walls crack; plaster falls).

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault. In general, newer construction is more earthquake resistant than older construction because of improved building codes and their enforcement. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry, as was seen in the Oroville, Coalinga, Santa Cruz, and Paso Robles earthquakes.

Common impacts from earthquakes include damage to infrastructure and buildings (e.g., crumbling of unreinforced masonry, failure of architectural facades, rupturing of underground utilities, and road closures). Earthquakes also frequently trigger secondary hazards, such as dam failures, landslides and rock falls, explosions, and fires that can become disasters themselves.

A Hazus earthquake scenarios was developed for the Planning Area as presented in the 2011 LHMP. This scenario still provides a valid representation of potential impacts to the Planning Area and are captured below.

Estimating Potential Losses

Earthquake losses will vary across the Sacramento County Planning Area depending on the source and magnitude of the event. The earthquake scenarios run for the 2011 LHMP for the County provides a good estimate of loss to the Planning Area based on a realistic earthquake scenario. The results of these scenarios are reproduced below.

2011 Earthquake Scenario

HAZUS-MH MR-4 was utilized to model earthquake losses for Sacramento County. Specifically, the probable magnitude used for Sacramento County utilized a 7.0 magnitude earthquake. Level 1 analyses were run, meaning that only the default data was used and not supplemented with local building inventory or hazard data. There are certain data limitations when using the default data, so the results should be interpreted accordingly; this is a planning level analysis.

The methodology for running the probabilistic earthquake scenario used probabilistic seismic hazard contour maps developed by the U.S. Geological Survey (USGS) for the 2002 update of the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS maps provide estimates of potential ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively. The 2,500 year return period analyzes ground shaking estimates with a 2 percent probability of being exceeded in 50 years,

from the various seismic sources in the area. The International Building Code uses this level of ground shaking for building design in seismic areas and is more of a worst case scenario.

The results of the probabilistic scenario are captured in Table 4-62. Key losses included the following:

- Total economic loss estimated for the earthquake was $8.3 billion, which includes building losses and lifeline losses based on the HAZUS-MH inventory.
- Building-related losses, including direct building losses and business interruption losses, totaled $8.0 billion.
- Over 17 percent of the buildings in the County were at least moderately damaged. 3,041 buildings were completely destroyed.
- Over 57 percent of the building- and income-related losses were residential structures.
- 4 percent of the estimated losses were related to business interruptions.
- The mid-day earthquake caused the most casualties: 179.
- 48 percent of the households experienced a loss of potable water the first day after the earthquake.

Table 4-62 HAZUS-MH Earthquake Loss Estimation 2,500-Year Scenario Results

Type of Impact	Impacts to County	
Total Buildings Damaged	Slight: 133,703 Moderate: 57,825 Extensive: 11,039 Complete: 3,041	
Building Related Losses	$8,001,220,000	
Total Economic Losses (Includes building, income and lifeline losses)	$8,322,590,000	
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 1,345 Requiring hospitalization: 228 Life Threatening: 21 Fatalities: 39	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 2,595 Requiring hospitalization: 626 Life Threatening: 95 Fatalities: 179	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 1,995 Requiring hospitalization: 494 Life Threatening: 154 Fatalities: 135	
Transportation and Utility Lifeline Damage	One bridge and one ferry with at least moderate damage	
Households without Power/Water Service (Based on 252,940 total households)	Power loss @ Day 1: 1,159 Power loss @ Day 3: 647 Power loss @ Day 7: 227 Power loss @ Day 30: 36	Water loss @ Day 1: 217,486 Water loss @ Day 3: 204,011 Water loss @ Day 7: 174,736 Water loss @ Day 30: 1,705
Displaced Households	6,081	
Shelter Requirements	4,176	
Debris Generation	2.0 million tons	

Source: HAZUS-MH MR4

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 51,500 ignitions that will burn about 1.36 sq. mi (0.14 % of the region's total area.) The model also estimates that the fires will displace about 6,142 people and burn about $481 million of building value.

Future Development

Although new growth and development corridors would fall in the area affected by earthquake, given the small chance of major earthquake and the building codes in effect, development in the earthquake area will continue to occur.

4.3.9. Earthquake: Liquefaction

Likelihood of Future Occurrence—Occasional
Vulnerability—Medium

Earthquake is discussed in the Section 4.3.8, but is primarily focused on the vulnerability of buildings and people from earthquake shaking. This section deals with a secondary hazard associated with earthquake – the possible collapse of structural integrity of the ground underneath downtown City of Sacramento buildings and the possible collapse of delta levees, due to liquefaction. This levee failure differs from the levee failure discussion in Section 4.3.12 which focuses on levee failure due to high water conditions or other types of structural failure.

There are two areas of Sacramento County that are at risk to liquefaction – an area of downtown Sacramento, and the Delta area.

Downtown

A geological and seismological study in 1972 indicated that the Housing and Redevelopment Agency building site located downtown at the intersection of 7th and I Streets has a potential for liquefaction. This study also concluded that potential liquefaction problems may exist throughout the downtown area where loose sands and silts are present below the ground water table. Exact property value estimates are not available. Due to the fact that downtown Sacramento is located away from active faults, there is limited vulnerability to damage from liquefaction.

Delta

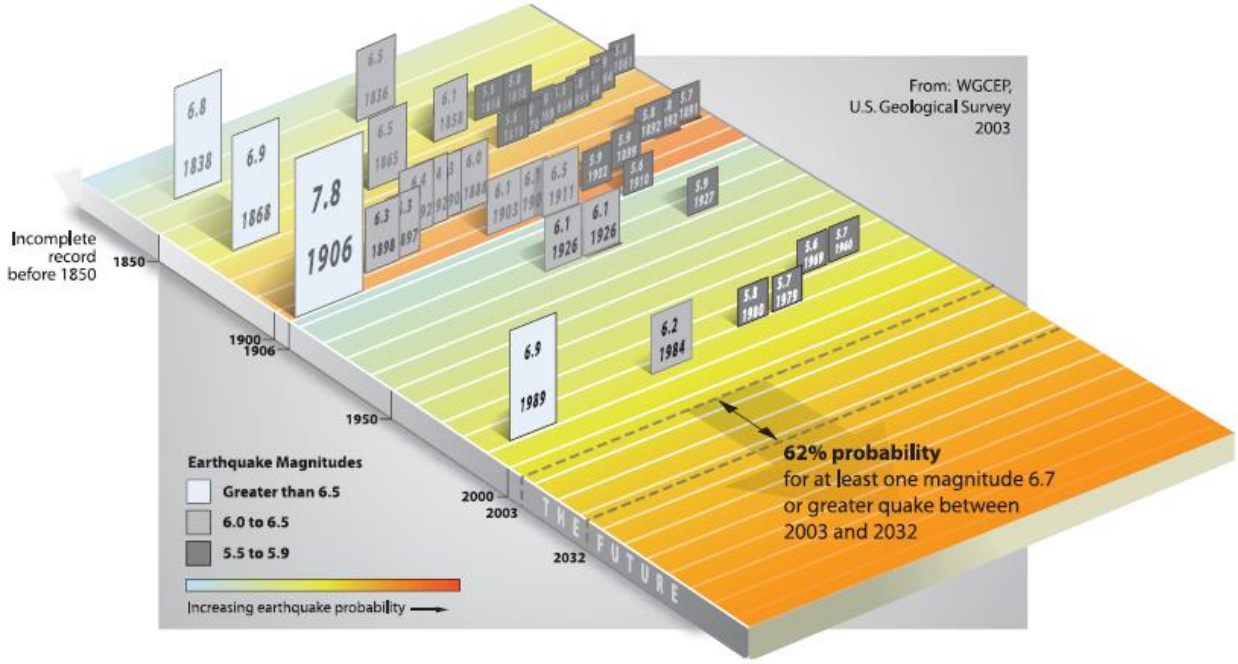
Historically, there have been 165 Delta and Suisun Marsh flood-induced levee failures leading to island inundations since 1900. Most of these failures occurred prior to 1990. Also, many of these failures were outside of Sacramento County. Since that time, there have been few levee failures due to improvements on the levee system in Sacramento as a whole.

No reports could be found to indicate that seismic shaking had ever induced significant damage or were the cause of the levee failures mentioned above. However, the lack of historical damage is not a reliable

indicator that Delta levees are not vulnerable to earthquake shaking. Furthermore, the present-day Delta levees, at their current size, have not been significantly tested by moderate to high seismic shaking.

The U.S. Geological Survey estimates that an earthquake of magnitude 6.7 or greater has a 62 percent probability of occurring in the San Francisco Bay Area between 2003 and 2032 (see Figure 4-81). Such an earthquake is capable of causing multiple levee failures in the Delta Region which could result in fatalities, extensive property damage and the interruption of water exports from the Delta for an extended period of time. Potential earthquakes on the Hayward, Calaveras or San Andreas faults pose the highest risk to Delta Region levees.

Figure 4-81 Past and Future Earthquakes in the San Francisco Bay Area and the Delta



Source: DRMS Risk Report (URS/JBA 2008c) Figure 13-8

The largest earthquakes experienced in recent history in the region include the 1906 Great San Francisco Earthquake and the 1989 Loma Prieta Earthquake. The 1906 earthquake occurred while the levees were in their early stages of construction. They were much smaller than they are today, and were not representative of the current configuration. The epicenter of the 1989 Loma Prieta earthquake was too distant and registered levels of shaking in the Delta too small to cause perceptible damage to the levees. In 2009, the California Department of Water Resources, in their document titled Delta Risk Management Strategy, performed a special simulation analysis of the 1906 Great San Francisco Earthquake to evaluate the potential effects of that event on the current levees.

In addition to the simulation of these largest regional earthquakes, recent smaller and closer earthquakes were also evaluated. They include: the 1980 Livermore Earthquake (M 5.8) and the 1984 Morgan Hill Earthquake (M 6.2). Except for the 1906 earthquake, which would have caused deformations of some of the weakest levees, the other earthquakes were either too small or too distant to cause any significant

damage to the Delta levees. These results are consistent with the seismic vulnerability prediction model developed for this study.

General seismic performance observations were:

- The areas most prone to liquefaction potential are in the northern region and the southeastern region of the Delta. The central and western regions of the Delta and Suisun Marsh show discontinuous areas of moderate to low liquefaction potential.
- The vulnerability classes 1 through 4 are the most vulnerable levees to seismic loading. These include islands with liquefiable levee fill, and peat/organic soil deposits and potentially liquefiable sand deposits in the foundation. Such islands include but are not limited to Sherman, Brannan-Andrus, Twitchel, Webb, Venice, Bouldin, and many others.
- The majority of the islands have at least one levee reach in vulnerability classes 1 to 4,
- Levees composed of liquefiable fill are likely to undergo extensive damage as a result of a moderate to large earthquake in the region.
- The median probabilities of failure for classes with no liquefiable foundation sand and no liquefiable levee fill increase with peat thickness under the levee. When peat is absent, generally the probabilities of failure are small (less than 22 percent) for the largest ground motions of 0.5g. However, the probabilities of failure at the locations of the thickest peat (more than 25 feet) range from 30 percent to 60 percent for a PGA of 0.5g.
- Levees founded on liquefiable foundations are expected to experience large deformations (in excess of 10 feet) under a moderate to large earthquake in the region.

Flooding Risk

A major earthquake can cause extensive damage to large sections of levees on multiple islands at the same time. As a result, many islands could be flooded simultaneously. For example, the DRMS report indicated that there is a 40 percent probability of a major earthquake causing 27 or more islands to flood at the same time in the 25-year period from 2005 to 2030. It is not specified which islands in Sacramento County would be included in this flooding.

The duration and cost of levee repairs increases with the number of islands that are flooded due to an earthquake, as shown in Table 4-63. This is not only due to the extensive amount of repairs required, but also to the availability of labor and materials to make the repairs. These numbers from the DRMS report are applicable to Sacramento County.

Table 4-63 Duration and Cost of Repairs for Earthquake-Induced Levee Failures

Number of flooded islands	Estimated range of cost of repair and dewatering	Estimated range of time to repair breaches and dewater [days]
1	$43,000,000 – $240,000,000	136 – 276
3	$204,000,000 – $490,000,000	270 – 466
10	$620,000,000 – $1,260,000,000	460 – 700
20	$1,400,000,000 – $2,300,000,000	750 – 1,020
30	$3,000,000,000 – $4,200,000,000	1,240 – 1,660

Source: DRMS Risk Report [URS/JBA 2008c], Table 13-9

In addition to dewatering costs, the Delta contains improved parcels at risk to flooding. More information about the Delta and its risk may be found in the Delta annex to this plan.

Water Quality Risk

Earthquake damage to levees and to the islands they protect could take years to repair following a major earthquake. One significant impact of levee failures would be to the state's water supply. For example, if 20 islands were flooded as a result of a major earthquake, the export of fresh water from the Delta could be interrupted for about a year and a half. Water supply losses of up to 8 million acre-feet would be incurred by State and federal water contractors and local water districts.

If subsided Delta islands are flooded due to levee breaches, significant amounts of dissolved organic carbon [DOC] would be released into Delta waters from the highly organic peat soils on these islands. Disinfectants used during the drinking water treatment process react with DOC to produce disinfection byproducts in treated water. Many of these chemical byproducts can increase cancer risks or cause other health effects.

Other water quality problems resulting from island flooding include increased algae blooms. Algae blooms can complicate drinking water treatment processes and can adversely affect some aquatic species.

Some soils in the Delta Region contain moderate levels of mercury due, among other things, to historical gold mining activities that occurred upstream of the Delta during the Gold Rush. Mercury in soils can, under certain circumstances, be converted to the highly toxic methylated form when islands are flooded. Methylated mercury can accumulate in the food chain potentially affecting fish. Humans and animals that consume fish contaminated with methylated mercury are at risk of poisoning.

Natural Resources at Risk

In all seismic levee failure scenarios, the area of vegetation impacted increases with the area flooded. The degree of impact depends on the type of vegetation flooded. Results of the DRMS Project indicate potential losses of up to 39 percent of herbaceous wetland, seasonal grasses and low-lying vegetation, 29 percent of non-native trees, and 24 percent of shrub wetland due to an event where multiple islands are flooded. In addition, in Sacramento County, the Delta area at risk to liquefaction contains highly productive farmland. Should a levee fail, loss of crops would have a large economic impact. Information specific to the losses in Sacramento County were not available.

Population at Risk

The Delta levees most likely to fail due to earthquakes and earthquake liquefaction are generally located in the central-west area of the Delta, some of which is likely to be in the Sacramento County portion of the Delta. Their failure will cause rapid flooding and leave little time for evacuation.

The greatest immediate public safety concern is for the people working and living on Delta islands, and for people traveling through the Delta on various roads and highways. According to the DRMS report, there is a 40 percent probability of 90 or more fatalities in the Delta from levee failures due to a seismic event in the 25-year period from 2005 through 2030. The expected fatalities from earthquake-related island flooding

is high due to the lack of warning for earthquakes and because of the rapid rate of flooding likely to occur after an earthquake. It should be noted that these fatality figures are for the Delta as a whole, and not limited to those areas of the Delta lying within Sacramento County.

Future Development

The consequences of a major earthquake in the Delta Region will also increase with time. Because of increasing water demand and the state's growing population and economy, the economic consequences of an interruption in Delta water supply operations due to an earthquake will increase. Consequences to the Delta Region will also increase due to additional development. According to the DRMS report, total expected economic losses are anticipated to increase by about 200 percent by 2050 and by about 500 percent by 2100. The risk of fatalities is expected to increase, on average, by about 250 percent from 2005 to 2050. It should be noted that these economic figures are for the Delta as a whole, and not limited to those areas of the Delta lying within Sacramento County.

4.3.10. Flood: 100/200/500-year Vulnerability Assessment

Likelihood of Future Occurrence—100-year – Occasional; 200-/500-year – Unlikely
Vulnerability—High

Historically, Sacramento County has always been vulnerable to flooding because of its relatively flat terrain and the number of water courses that traverse the County. Flood zones in Sacramento County are quite extensive. High water levels are a common occurrence in winter and spring months due to increased flow from stormwater runoff and snowmelt. Several areas of the County are subject to flooding by the overtopping of rivers and creeks, levee failures, and the failure of urban drainage systems that cannot accommodate large volumes of water during severe rainstorms.

River flooding is the most significant natural hazard that Sacramento County faces. The Sacramento area has a good working knowledge of the 100-year flood, however, the statistical outlier flood is not well quantified. Sacramento is not just at high risk of flooding, but is at low risk of catastrophic flooding. When the 100-year event is exceeded, the consequences could be great as flood depths behind levees can range up to many feet deep in some urban areas.

In addition to the major rivers, there are many streams, channels, canals, and creeks that serve the drainage needs of the County. There is significant threat of flooding in large areas of the county from several of these streams. Many of these streams are prone to rapid flooding with little notice.

According to SAFCA, Sacramento's risk of flooding is the greatest of any major city in the country. Sacramento's flood risk is exceptionally high for two reasons:

1. The cores of today's levees are often the levees built by farmers and settlers as much as 150 years ago. Early levees were not constructed to current engineering standards, and little care was given to the suitability of foundation soils. It was believed prior to 1986 that the levees containing the Sacramento River and the American River were of sufficient height and stability to protect the county from 100-year or greater storms. The storms that occurred in February 1986 demonstrated that those levees are not always sufficient.

2. The quantity of water flowing out of the Sierra Nevada Mountains during large floods appears to be increasing. Folsom Dam was designed, based on historical data, to reduce flood flows in the American River to a flow rate that could be safely contained by the downstream levees. The first storm that occurred after beginning the construction of Folsom Dam was larger than any occurring in the prior 45 years. Since that 1951 storm, Sacramento has experienced four more 'record floods' each somewhat larger than the previous. A comparative analysis run on the two periods (1905 to 1950 and 1950 to 2000) shows that a storm with one chance in 500 of occurring in any year based on the earlier period is approximately the same size as a storm with one chance in 50 of occurring using the entire 95-year period.

Historically, much of the growth in the County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Flooding has been frequent in the Sacramento County planning area and the vulnerability to flood damages is high to extremely high. This section quantifies the vulnerability of the planning area to floods.

Flood Hazard Assessment

This risk assessment for the Sacramento County LHMP Update assessed the flood hazard specific to Sacramento County. This included an evaluation of multiple flood hazards including the Special Flood Hazard Area (SFHA) shown on the DFIRM; Repetitive Loss (RL) Areas; localized, stormwater flooding areas; other areas that have flooded in the past, but not identified on the DFIRM; other areas of shallow flooding identified through other studies and sources; levee failure flooding; dam failure flooding; erosion based flooding, and flooding caused by land subsidence especially in the Delta areas. This comprehensive flood risk assessment included an assessment of less-frequent flood hazards, areas likely to be flooded, and flood problems that are likely to get worse in the future as a result of changes in floodplain development and demographics, development in the watershed, and climate change or sea level rise. Existing studies, maps, historical data, and federal, state, and local community expertise and knowledge contributed to this current flood assessment for Sacramento County. An evaluation of the success of completed and ongoing flood control projects and associated maintenance aspects contributed to this flood hazard assessment and the resulting flood mitigation strategy for the Sacramento County planning area. This flood risk assessment for this LHMP Update includes an assessment of future flooding conditions based on historic development in the floodplains, proposed future development, climate change influences, and worst case flood scenarios such as the ARkStorm as further described throughout this plan. Due to GIS mapping constraints, the remainder of this flood vulnerability assessment focuses on the flood hazard based on the updated FEMA DFIRMs.

Assets at Risk

Unincorporated Sacramento County and its incorporated jurisdictions have mapped FEMA flood hazard areas. GIS was used to determine the possible impacts of flooding within the County and how the risk

varies across the Planning Area. The following methodology was followed in determining improved parcel counts and assets at risk to the 1% annual chance flood event and 0.2% annual chance flood events. Analysis on assets at risk to floods in the County is provided for two different areas in this base plan:

- Sacramento County Planning Area
- Unincorporated Sacramento County

The Sacramento County Planning Area includes both the unincorporated County and each jurisdiction, essentially the entire geographical area of Sacramento County. Summary tables for the Planning Area are presented below. For the unincorporated County, both summary and detail tables are shown and discussed below. Detail tables for the participating jurisdictions are included in their respective annexes to this plan.

Methodology

Sacramento County's 2016 parcel layer and 2015 Assessor's data were used as the basis for the countywide inventory of developed parcels, acres, and values. Sacramento County has a FEMA DFIRM dated June 16, 2015 which was utilized to perform the flood analysis.

In some cases there are parcels in multiple flood zones, such as Zone A, Zone X, or Shaded X. GIS was used to create a centroid, or point representing the center of the parcel polygon. DFIRM flood data was then overlaid on the parcel layer. For the purposes of this analysis, the flood zone that intersected a parcel centroid was assigned the flood zone for the entire parcel. The parcels were segregated and analyzed in this fashion for the entire Sacramento County Planning Area.

The model assumes that every parcel with a structure or other improved value greater than zero is improved in some way. This approach was used to support the parcel layer analysis as there was no associated building layer available for this analysis. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessors database and the GIS parcel layer.

The property use summary categories (derived from the Use Code categories) previously assigned to the detailed assessor database were used to develop content value and show potential loss from hazards. Content values estimations are based on FEMA Hazus methodologies, which estimates value as a percent of improved structure values by property type/use. Table 4-64 shows the breakdown of the different property types in Sacramento County and their estimated content replacement value percentages.

Table 4-64 Content Replacement Factors

Property Use	Content Replacement Values
Residential	50%
Agricultural	100%
Commercial	100%
Institutional	100%
Other	100%
Industrial	150%

Property Use	Content Replacement Values
Vacant Land	0%

Source: Hazus

The loss estimate for flood is based on the total of improved and contents value. Improved parcels include those with structures as well as other improvements identified in the Assessor's database such as mobile homes and winery equipment. Only improved parcels and the value of their improvements were included in the flood loss analysis. The value of land is not included in the loss estimates as generally the land is not at loss to floods, just the value of improvements and structure contents. The land value is represented in the detailed flood tables, but are only present to show the value of the land associated with each flood zone.

Once the potential value of affected parcels was calculated, a damage factor was applied to obtain loss estimates by flood zone. When a flood occurs, seldom does the event cause total destruction of an area. Potential losses from flooding are related to a variety of factors including flood depth, flood velocity, building type, and construction. The percent of damage is primarily related to the flood depth. FEMA's flood benefit/cost module uses a simplified approach to model flood damage based on building type and flood depth. The assets at risk in the flood analysis tables were refined by applying an average damage estimation of 20% of the total building value. The 20% damage estimate utilized FEMA's Flood Building Loss Table based on an average flood depth of 2 feet.

It also should be noted that the resulting flood loss estimates may actually be more or less than that presented in the below tables as the Planning Area may include structures located on parcels within the 100-year floodplain that are actually outside the floodplain boundaries or otherwise elevated at or above the level of the base flood elevation, according to local floodplain development requirements. Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the 100-year floodplain.

Each of the DFIRM flood zones that begins with the letter 'A' depict the Special Flood Hazard Area, or the 1% annual chance flood event (commonly referred to as the 100-year flood). Table 4-65 explains the difference between DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the Planning Area. The effective DFIRM maps for the Sacramento County Planning Area are shown on Figure 4-82.

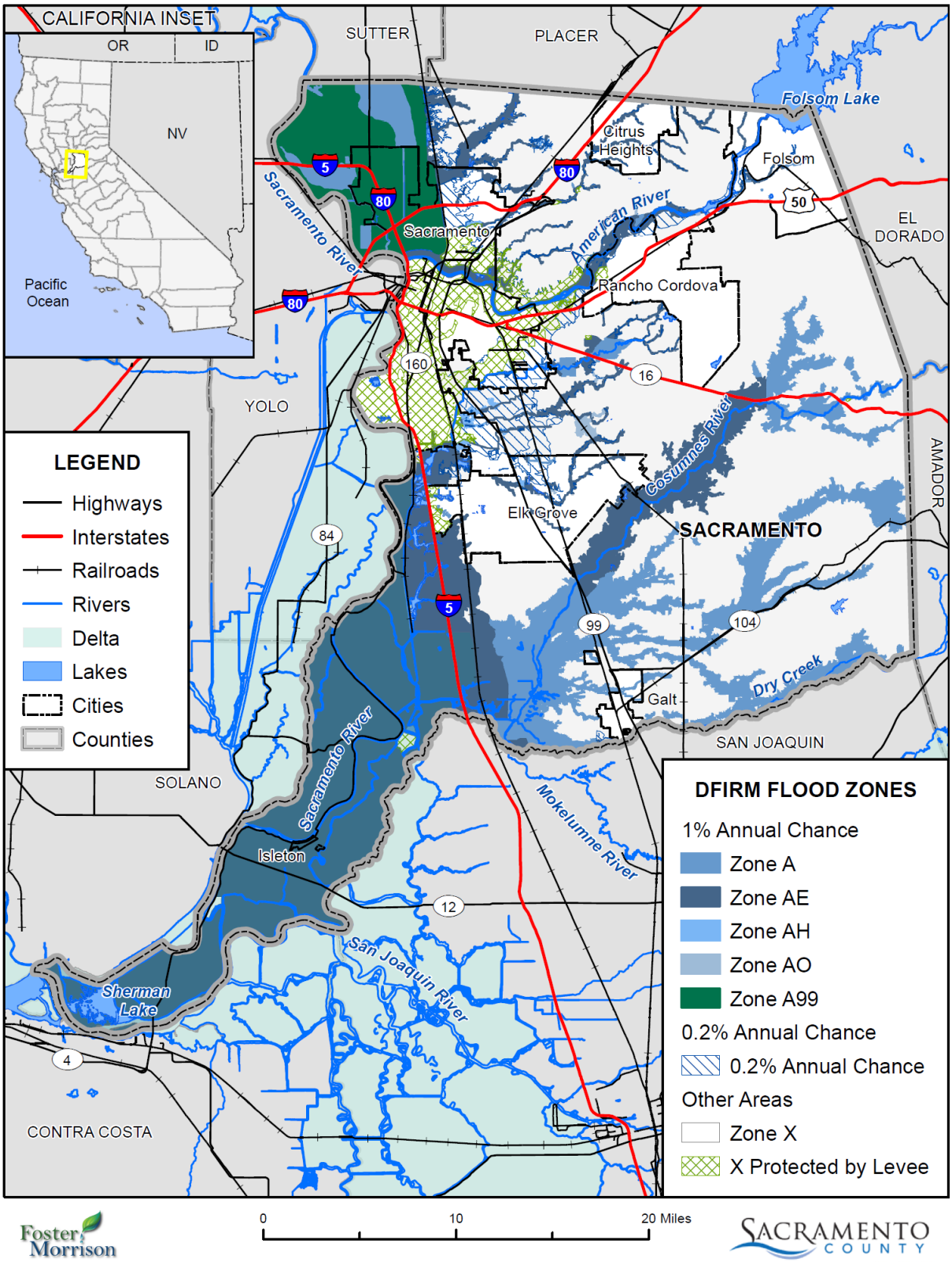
Table 4-65 Sacramento County Planning Area – DFIRM Flood Hazard Zones

Flood Zone	Description
A	100-year Flood: No base flood elevations provided
AE	100-year Flood: Base flood elevations provided
AH	An area inundated by 1% annual chance flooding (usually an area of ponding), for which BFEs have been determined; flood depths range from 1 to 3 feet
AO	Areas subject to inundation by 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones

Flood Zone	Description
Shaded X	500-year flood the areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood
X Protected by Levee	An area determined to be outside the 500-year flood and protected by levee from 100-year flood
X	No flood hazard

Source: FEMA

Figure 4-82 Sacramento County Planning Area – DFIRM Flood Zones



Data Source: Sacramento County GIS, Cal-Atlas, FEMA NFHL 04/16/2016; Map Date: 05/2016.

The end result of the flood hazard analysis is an inventory of the numbers, types, and values of parcels subject to the flood hazard. Results are presented here first for the Sacramento County Planning Area and secondly for unincorporated County. Results for the incorporated jurisdictions and the Delta are presented in their respective annexes to the plan.

In addition to the centroid analysis used to obtain numbers of parcels and assets at risk to flood hazards, parcel boundary analysis was performed to obtain total acres and flooded acres by flood zone for each parcel. The parcel layer was intersected with the FEMA DFIRM data to obtain the acres flooded. The results of the flooded acres analysis methodology and results are presented at the end of this section.

Sacramento County Planning Area

Table 4-66 and Table 4-67 contain flood analysis results for the entire Sacramento County Planning Area. This includes unincorporated Sacramento County and the incorporated jurisdictions. These tables show the number of parcels and assets at risk to the 1% and 0.2% annual chance event. Table 4-66 shows the value of improved parcels by jurisdiction. Table 4-67 shows the improved parcels by property use category in each flood zone for the entire Planning Area.

Table 4-66 Sacramento County Planning Area – Count and Improved Value of Parcels by 1% and 0.2% Annual Chance Flood Zones by Jurisdiction

Jurisdiction	1% Annual Chance			0.2% Annual Chance		
	Total Parcel Count*	Improved Parcel Count*	Total Improved Value	Total Parcel Count	Improved Parcel Count	Total Improved Value
Citrus Heights	250	156	$29,175,678	303	276	$54,097,103
Elk Grove	389	265	$116,719,110	4,225	4,025	$945,205,830
Folsom	31	8	$2,357,379	194	122	$153,125,451
Galt	23	1	$315,000	3	0	$0
Isleton	504	325	$27,074,049	0	0	$0
Rancho Cordova	60	21	$10,205,817	989	971	$158,395,013
City of Sacramento	29,693	24,861	$6,675,340,607	16,165	14,495	$2,822,713,159
Unincorporated Sacramento County	7,051	3,862	$1,504,417,212	23,182	21,778	$3,992,497,296
Total	**38,001**	**29,499**	**$8,365,604,852**	**45,061**	**41,667**	**$8,126,033,852**

Source: FEMA DFIRM June 16, 2015, Sacramento County 2016 Parcel/2015 Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Table 4-67 Sacramento County Planning Area – Count and Improved Value by Property Use and 1% and 0.2% Annual Chance Flood Zone

Property Use	1% Annual Chance Flood Zone			0.2% Annual Chance Flood Zone		
	Total Parcel Count*	Improved Parcel Count*	Total Improved Value	Total Parcel Count	Improved Parcel Count	Total Improved Value
Agricultural	1,467	816	$267,807,574	6	4	$318,391
Care/Health	26	18	$54,069,366	49	46	$420,425,623
Church/Welfare	63	51	$85,344,771	125	105	$130,813,240
Industrial	351	255	$536,138,980	819	772	$828,718,388
Miscellaneous	983	5	$12,426	388	1	$935
Office	203	187	$704,911,767	171	150	$219,646,504
Public/Utilities	1,930	3	$2,211,598	651	1	$38,057
Recreational	99	73	$80,087,473	22	19	$10,103,789
Residential	28,212	27,636	$6,176,867,614	40,694	39,998	$5,827,191,977
Retail/Commercial	379	359	$449,769,895	558	513	$682,412,409
Vacant	4,286	96	$8,383,388	1,578	58	$6,364,539
No Data	2	0	$0	0	0	$0
Total	**38,001**	**29,499**	**$8,365,604,852**	**45,061**	**41,667**	**$8,126,033,852**

Source: FEMA DFIRM June 16, 2015, Sacramento County 2015 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Table 4-68 shows potential losses summarized by the 1% and 0.2% annual chance flood event with loss estimate and loss ratios for the Planning Area. The loss ratio is the loss estimate divided by the total potential exposure (i.e., total of improved and contents value for all parcels located in the Planning Area) and displayed as a percentage of loss. FEMA considers loss ratios greater than 10% to be significant and an indicator that a community may have more difficulties recovering from a flood. The County should keep in mind that the loss ratio could increase with additional development in the 1% and 0.2% annual chance floodplain, unless development is elevated in accordance with the local floodplain management ordinance.

Table 4-68 Sacramento County Planning Area – Flood Loss Estimates

Flood Zone	Improved Parcel Count*	Total Improved Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance	29,499	$8,365,604,852	$4,182,802,426	$12,548,407,278	$2,509,681,456	1.93%
0.2% Annual Chance	41,667	$8,126,033,852	$4,063,016,926	$12,189,050,778	$2,437,810,156	1.88%
Total	**71,166**	**$16,491,638,704**	**$8,245,819,352**	**$24,737,458,056**	**$4,947,491,611**	**3.81%**

Source: FEMA DFIRM June 16, 2015, Sacramento County 2015 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

According to the information in Table 4-66 through Table 4-68, the Sacramento County Planning Area has 29,499 improved parcels and roughly $12.5 billion of structure and contents value in the 1% annual chance floodplain. There are 441,667 improved parcels and roughly $12.2 billion of structure and contents value in the 0.2% annual chance flood event. A loss ratio of 3.81% indicates that while the County does have assets at risk, those asset values do not indicate a disproportionate number of assets in the FEMA regulated floodplains.

Unincorporated Sacramento County

Table 4-69 and Table 4-70 contain information for unincorporated Sacramento County only. Table 4-69 shows the number of improved parcels and associated structure and other improved assets at risk to the each of the FEMA flood zones using the DFIRM data in the unincorporated areas and Table 4-70 shows potential losses summarized by 1% and 0.2% annual chance flood events with loss estimates and loss ratios.

Table 4-69 Unincorporated Sacramento County – Count and Improved Value by Property Use and Detailed Flood Zone

Flood Zone	Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value*
A	Agricultural	314	$116,787,770	164	$68,069,670	$184,857,440
	Care / Health	0	$0		$0	$0
	Church / Welfare	0	$0		$0	$0
	Industrial	36	$13,904,226	3	$919,625	$14,823,851
	Miscellaneous	14	$11,617	0	$0	$11,617
	Office	0	$0			$0
	Public / Utilities	134	$455,096	1	$81,598	$536,694
	Recreational	4	$2,815,805	1	$2,003,644	$4,819,449
	Residential	187	$20,825,433	178	$35,660,701	$56,486,134
	Retail / Commercial	1	$198,216	1	$105,744	$303,960
	Vacant	84	$24,772,786	10	$276,033	$25,048,819
	No Data	0	$0		$0	$0
	Total	**774**	**$179,770,949**	**358**	**$107,117,015**	**$286,887,964**
AE	Agricultural	1,013	$237,154,495	629	$196,659,181	$433,813,676
	Care / Health	4	$999,696	3	$913,650	$1,913,346
	Church / Welfare	22	$3,350,133	16	$33,288,981	$36,639,114
	Industrial	84	$16,292,372	40	$20,716,328	$37,008,700
	Miscellaneous	277	$759,968	5	$12,426	$772,394
	Office	29	$15,123,953	27	$27,540,122	$42,664,075
	Public / Utilities	816	$1,124,615	0	$0	$1,124,615

Flood Zone	Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value*
	Recreational	73	$16,108,472	56	$15,847,312	$31,955,784
	Residential	2,273	$275,269,730	2,130	$509,854,352	$785,124,082
	Retail / Commercial	64	$8,477,968	60	$13,784,241	$22,262,209
	Vacant	672	$51,116,873	48	$5,307,705	$56,424,578
	No Data	1	$0	0	$0	$0
	Total	**5,328**	**$625,778,275**	**3,014**	**$823,924,298**	**$1,449,702,573**
AH	Agricultural	0	$0	0	$0	$0
	Care / Health	0	$0	0	$0	$0
	Church / Welfare	1	$253,064	1	$437,444	$690,508
	Industrial	0	$0	0	$0	$0
	Miscellaneous	0	$0	0	$0	$0
	Office	1	$64,608	1	$72,064	$136,672
	Public / Utilities	9	$0	0	$0	$0
	Recreational	0	$0	0	$0	$0
	Residential	104	$4,791,627	104	$11,214,428	$16,006,055
	Retail / Commercial	5	$2,582,709	3	$1,751,382	$4,334,091
	Vacant	7	$746,462	0	$0	$746,462
	No Data		$0	0	$0	$0
	Total	**127**	**$8,438,470**	**109**	**$13,475,318**	**$21,913,788**
AO	Agricultural	0	$0	0	$0	$0
	Care / Health	0	$0	0	$0	$0
	Church / Welfare	3	$538,580	3	$1,274,398	$1,812,978
	Industrial	0	$0	0	$0	$0
	Miscellaneous	0	$0	0	$0	$0
	Office	0	$0	0	$0	$0
	Public / Utilities	3	$0	0	$0	$0
	Recreational	0	$0	0	$0	$0
	Residential	70	$9,210,884	70	$9,295,754	$18,506,638
	Retail / Commercial	0	$0	0	$0	$0
	Vacant	15	$1,999,748	1	$5,225	$2,004,973
	No Data	0	$0	0	$0	$0
	Total	**91**	**$11,749,212**	**74**	**$10,575,377**	**$22,324,589**

Flood Zone	Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value*
A99	Agricultural	128	$38,469,123	22	$2,928,106	$41,397,229
	Care / Health	4	$3,204,228	1	$14,856,000	$18,060,228
	Church / Welfare	4	$834,959	4	$2,541,241	$3,376,200
	Industrial	174	$96,891,233	161	$404,210,512	$501,101,745
	Miscellaneous	24	$1,533,789	0	$0	$1,533,789
	Office	35	$19,145,702	32	$88,227,532	$107,373,234
	Public / Utilities	107	$152,106	1	$2,100,000	$2,252,106
	Recreational	4	$2,096,779	3	$2,421,221	$4,518,000
	Residential	75	$9,088,260	69	$20,352,195	$29,440,455
	Retail / Commercial	9	$7,261,001	9	$11,605,951	$18,866,952
	Vacant	166	$70,772,359	5	$82,446	$70,854,805
	No Data	1	$78,407	0	$0	$78,407
	Total	**731**	**$249,527,946**	**307**	**$549,325,204**	**$798,853,150**
Total 1% Annual Chance		**7,051**	**$1,075,264,852**	**3,862**	**$1,504,417,212**	**$2,579,682,064**
Shaded X (0.2% Annual Chance)	Agricultural	5	$848,949	3	$105,144	$954,093
	Care / Health	27	$5,218,074	27	$36,436,591	$41,654,665
	Church / Welfare	51	$22,410,230	46	$85,076,951	$107,487,181
	Industrial	213	$100,697,813	198	$215,886,598	$316,584,411
	Miscellaneous	145	$513,998	1	$935	$514,933
	Office	87	$25,727,530	75	$72,281,415	$98,008,945
	Public / Utilities	281	$2,670,605	1	$38,057	$2,708,662
	Recreational	15	$8,562,883	12	$4,118,758	$12,681,641
	Residential	21,508	$1,217,040,070	21,098	$3,183,717,846	$4,400,757,916
	Retail / Commercial	312	$196,238,125	291	$393,654,669	$589,892,794
	Vacant	538	$75,853,555	26	$1,180,332	$77,033,887
	No Data	0	$0	0	$	$0
	Total	**23,182**	**$1,655,781,832**	**21,778**	**$3,992,497,296**	**$5,648,279,128**
X Protected by Levee	Agricultural	5	$1,160,373	5	$789,744	$1,950,117
	Care / Health	18	$7,758,946	13	$27,721,005	$35,479,951
	Church / Welfare	30	$10,824,424	25	$29,358,299	$40,182,723

Flood Zone	Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value*
	Industrial	95	$28,509,769	92	$69,653,665	$98,163,434
	Miscellaneous	45	$216,140	1	$31,352	$247,492
	Office	168	$88,235,208	145	$285,606,007	$373,841,215
	Public / Utilities	174	$353,474	4	$323,426	$676,900
	Recreational	8	$4,141,597	5	$8,942,031	$13,083,628
	Residential	9,922	$780,382,586	9,829	$1,775,227,193	$2,555,609,779
	Retail / Commercial	315	$143,381,393	297	$298,952,501	$442,333,894
	Vacant	207	$27,903,906	12	$2,997,130	$30,901,036
	No Data	1	$0	0	$0	$0
	Total	**10,988**	**$1,092,867,816**	**10,428**	**$2,499,602,353**	**$3,592,470,169**
X	Agricultural	1,065	$285,499,726	530	$212,369,686	$497,869,412
	Care / Health	267	$106,557,849	253	$480,728,243	$587,286,092
	Church / Welfare	343	$89,373,407	301	$420,347,742	$509,721,149
	Industrial	829	$281,438,674	664	$588,845,257	$870,283,931
	Miscellaneous	1,143	$980,448	6	$66,196	$1,046,644
	Office	794	$264,455,707	739	$730,526,492	$994,982,199
	Public / Utilities	1,596	$5,676,727	12	$12,125,694	$17,802,421
	Recreational	66	$29,955,356	52	$71,024,781	$100,980,137
	Residential	118,931	$9,032,113,350	117,582	$20,266,748,974	$29,298,862,324
	Retail / Commercial	1,483	$716,623,478	1,370	$1,222,616,479	$1,939,239,957
	Vacant	3,903	$480,016,343	237	$17,084,778	$497,101,121
	No Data	9	$1,467,707	4	$807,130	$2,274,837
	Total	**130,429**	**$11,294,158,772**	**121,750**	**$24,023,291,452**	**$35,317,450,224**

Source: FEMA DFIRM June 16, 2015, Sacramento County 2016 Parcel/ 2015 Assessor's Data

**With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Table 4-70 Unincorporated Sacramento County – Flood Loss Estimates

Flood Zone	Improved Parcel Count*	Improved Structure Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance	3,862	$1,504,417,212	$752,208,606	$2,256,625,818	$451,325,164	0.35%
0.2% Annual Chance	21,778	$3,992,497,296	$1,996,248,648	$5,988,745,944	$1,197,749,189	0.92%
Total	**25,640**	**$5,496,914,508**	**$2,748,457,254**	**$8,245,371,762**	**$1,649,074,352**	**1.27%**

Source: FEMA DFIRM June 16, 2015, Sacramento County 2016 Parcel/2015 Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

According to Table 4-69 and Table 4-70, unincorporated Sacramento County has 3,862 improved parcels and roughly $2.25 billion of structure and contents value in the 1% annual chance floodplain. The unincorporated County has 21,778 parcels and roughly $6 billion in structure and contents values in the 0.2% annual chance floodplain. These values can be refined a step further. Applying the 20 percent damage factor as previously described, there is a 1% chance in any given year of a flood event causing roughly $451,325,164 in damage in the unincorporated areas of Sacramento County. Applying the same factor, there is a 0.2% chance of a flood event causing $1.2 billion in damage to the unincorporated County. A loss ratio of 1.27% indicates that while the unincorporated County has assets at risk in the floodplain, flood losses would be limited compared to the total built environment and the community would likely be able to recover adequately.

Flooded Acres

Also of interest is the land area affected by the various flood zones. The following is an analysis of flooded acres in the County in comparison to total area within the unincorporated county and city limits of each jurisdiction.

Methodology

GIS was used to calculate acres flooded by FEMA flood zones and property use categories. The Sacramento County parcel layer and effective DFIRM were intersected, and each segment divided by the intersection of flood zone and parcels was calculated for acres. This process was conducted for 1% flood chance areas, with each segment being defined by zone type (A, AE, AO) and acres, and the process repeated for X Protected by Levee zones and 0.2% flood chance areas. The resulting data tables with flooded acreages were then imported into a database and linked back to the original parcels, including total acres and land/improvement values, by parcel number. Once this was completed, each parcel contained acreage values for flooded acre by zone type within the parcel. In some cases, a single parcel had multiple flooded acres values (e.g. parcels overlapping a 1%-0.2% flood chance boundary). In the tables below each flood zone is represented and then split out by property use, their total flooded acres, total improved acres, and percent of improved acres that are flooded.

Limitations

One limitation created by this type of analysis is that improvements are uniformly found throughout the parcel, while in reality, only portions of the parcel are improved, and improvements may or may not fall within the flood zone portion of a parcel; thus, areas of improvements flooded calculated through this method may be higher or lower than those actually seen in a similar real world event.

The following tables represent a detailed and summary analysis of total acres for each FEMA DFIRM flood zone. Table 4-71gives summary information for the Planning Area. Table 4-72 gives detailed information by property use for the unincorporated County. This information is available for each jurisdiction in their respective annexes.

Table 4-71 Sacramento County Planning Area – Flooded Acres

Jurisdiction	Flood Zone	Total Flooded Acres	Improved Flooded Acres
Citrus Heights	1% Annual Chance	105.75	44.61
	0.2% Annual Chance	66.81	57.09
Elk Grove	1% Annual Chance	775.74	298.96
	0.2% Annual Chance	1,024.34	728.05
Folsom	1% Annual Chance	110.21	2.24
	0.2% Annual Chance	177.15	92.67
Galt	1% Annual Chance	111.92	3.86
	0.2% Annual Chance	5.11	0
Isleton	1% Annual Chance	215.58	57.46
	0.2% Annual Chance	0	0
Rancho Cordova	1% Annual Chance	794.88	44.68
	0.2% Annual Chance	307.17	190.19
City of Sacramento	1% Annual Chance	12,958.27	5,468.67
	0.2% Annual Chance	6,385.63	4,477.68
Unincorporated	1% Annual Chance	179,672.53	86,988.83
	0.2% Annual Chance	8,730.38	6,569.14
Total	1% Annual Chance	**194,744.87**	**92,909.32**
	0.2% Annual Chance	**16,696.59**	**12,114.83**

Source: Sacramento County DFIRM June 16, 2015 Sacramento County 2016 Parcel/2015 Assessor's Data
*This is calculated as the total improved flooded acres divided by the total acres of the jurisdiction.

Table 4-72 Unincorporated Sacramento County – Flooded Acres by Property Use and Detailed Flood Zone

Flood Zone	Property Use	Total Flooded Acres	Improved Flooded Acres
A	Agricultural	32,617.68	19,467.81
	Care / Health	0.00	0.00

Flood Zone	Property Use	Total Flooded Acres	Improved Flooded Acres
	Church / Welfare	0.00	0.00
	Industrial	977.22	83.82
	Miscellaneous	43.26	0.00
	No Data	0.00	0.00
	Office	0.00	0.00
	Public / Utilities	5,065.09	11.76
	Recreational	78.27	46.01
	Residential	1,319.46	1,104.78
	Retail / Commercial	0.61	0.61
	Vacant	1,778.53	125.28
	Total	**41,880.12**	**20,840.07**
AE	Agricultural	84,342.76	57,963.53
	Care / Health	9.27	7.61
	Church / Welfare	78.60	62.63
	Industrial	523.13	205.93
	Miscellaneous	510.43	25.39
	No Data	1.21	0.00
	Office	32.13	30.40
	Public / Utilities	27,099.43	0.00
	Recreational	488.53	365.63
	Residential	3,929.19	3,765.93
	Retail / Commercial	59.41	55.19
	Vacant	4,287.01	431.39
	Total	**121,361.10**	**62,913.63**
AH	Agricultural	0.00	0.00
	Care / Health	0.00	0.00
	Church / Welfare	2.15	2.15
	Industrial	0.00	0.00
	Miscellaneous	0.00	0.00
	No Data	0.00	0.00
	Office	0.15	0.15
	Public / Utilities	74.83	0.00
	Recreational	0.00	0.00
	Residential	23.28	23.28
	Retail / Commercial	7.42	4.99
	Vacant	7.40	-
	Total	**115.23**	**30.57**

Flood Zone	Property Use	Total Flooded Acres	Improved Flooded Acres
AO	Agricultural	0.00	0.00
	Care / Health	0.00	0.00
	Church / Welfare	12.94	12.94
	Industrial	0.00	0.00
	Miscellaneous	0.00	0.00
	No Data	0.00	0.00
	Office	0.00	0.00
	Public / Utilities	7.48	0.00
	Recreational	0.00	0.00
	Residential	253.52	253.52
	Retail / Commercial	0.00	0.00
	Vacant	64.03	4.19
	Total	**337.97**	**270.65**
A99	Agricultural	6,248.57	1,614.31
	Care / Health	15.12	12.38
	Church / Welfare	4.62	4.62
	Industrial	573.43	554.85
	Miscellaneous	278.57	0.00
	No Data	6.56	0.00
	Office	121.29	91.22
	Public / Utilities	4,845.43	33.24
	Recreational	109.30	61.92
	Residential	457.22	397.81
	Retail / Commercial	24.70	24.70
	Vacant	3,293.30	138.86
	Total	**15,978.10**	**2,933.91**
Total 1%		**179,672.53**	**86,988.83**
Shaded X (500-year)	Agricultural	38.56	16.68
	Care / Health	23.57	23.57
	Church / Welfare	152.83	140.27
	Industrial	722.14	647.87
	Miscellaneous	89.04	0.04
	No Data	0.00	0.00
	Office	120.56	84.61
	Public / Utilities	746.85	0.07

Flood Zone	Property Use	Total Flooded Acres	Improved Flooded Acres
	Recreational	40.41	39.38
	Residential	5,210.90	4,990.42
	Retail / Commercial	561.64	547.79
	Vacant	1,023.88	78.44
	Total Shaded X	**8,730.38**	**6,569.14**
X Protected by Levee	Agricultural	315.52	315.52
	Care / Health	27.02	20.70
	Church / Welfare	80.24	63.45
	Industrial	456.42	454.05
	Miscellaneous	12.94	0.23
	No Data	0.64	0.00
	Office	200.94	181.30
	Public / Utilities	499.28	0.15
	Recreational	62.75	15.50
	Residential	2,168.87	2,097.75
	Retail / Commercial	275.26	267.84
	Vacant	192.37	8.35
	Total Levee	**4,292.25**	**3,424.84**
X	Agricultural	113,047.02	44,485.28
	Care / Health	574.02	552.77
	Church / Welfare	1,086.98	907.28
	Industrial	11,984.48	7,659.80
	Miscellaneous	811.66	4.37
	No Data	34.74	10.53
	Office	812.46	768.06
	Public / Utilities	17,998.80	56.63
	Recreational	831.80	745.02
	Residential	60,567.95	58,848.44
	Retail / Commercial	1,832.80	1,755.13
	Vacant	18,137.40	1,763.99
	Total Zone X	**227,720.11**	**117,557.30**

Source: Sacramento County DFIRM June 16, 2015, Sacramento County 2016 Parcel/2015 Assessor's Data

Insurance Coverage, Claims Paid, and Repetitive Losses

Unincorporated Sacramento County joined the NFIP on March 15, 1979, and the CRS on October 1, 1992. There current effective date is May 1, 2013. According to the CRS listing of eligible communities dated May 1, 2014, the County is currently a Class 3, which provides a 35 percent discount on flood insurance

for those located within the special flood hazard area (SFHA) and a 10 percent discount for those located in non-SFHA areas.

2016 NFIP Analysis

NFIP insurance data indicates that as of February 19, 2016, there were 10,468 policies in force in the unincorporated County, resulting in $2,939,536,100 of insurance in force. Of these, 9,698 are for residential properties; 770 are nonresidential. 3,171 of these are in A zones; 7,297 policies are for parcels in the B, C, & X zones.

There have been 1,193 closed paid losses totaling $22,391,339; 1,128 of these were for residential properties and 64 were nonresidential, while 1 was unknown. Of these 1,193 paid losses, 819 were parcels in A zones and 366 parcels were in B, C, & X zones. Information was not provided on the other 8 claims. Of the 1,193 claims, 970 claims were associated with pre-FIRM structures and 213 with post-FIRM structures; 10 claims unknown. There have been 95 substantial damage claims since 1979.

Based on this analysis of insurance coverage, unincorporated Sacramento County has significant assets at risk to the 100-year and greater floods. Of the 3,862 improved parcels within the 100-year floodplain, only 3,171 (or 82.1 percent) of those parcels maintain flood insurance. Information on the unincorporated County and the incorporated jurisdictions can be seen on Table 4-73.

Table 4-73 Sacramento County Planning Area – Percentages of Policy Holders to Parcels in the 1% Annual Chance Floodplain

Jurisdiction	Improved Parcels in 1% Annual Chance Floodplain*	Insurance Policies in the A (1% Annual Chance) Zone	Percentage of 1% Annual Chance Floodplain Parcels Currently Insured
Citrus Heights	156	67	42.9%
Elk Grove	265	8	3.1%
Folsom	8	13	100%
Galt	1	6	100%
Isleton	325	122	37.5%
Rancho Cordova	21	6	28.6%
City of Sacramento	24,861	2,153	8.7%
Unincorporated County	3,862	3,171	82.1%
Total	**29,499**	**5,546**	**18.8%**

Source: FEMA DFIRM June 16, 2015; Sacramento County 2016 Parcel Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

2015 Program for Public Information Flood Insurance Analysis

In addition to the 2016 data, a more detailed analysis of flood insurance by flood zone was performed for the 2015 Program for Public information. That analysis is included here.

Sacramento County had 9,571 as of 12/31/14 active flood insurance policies in effect. Flood insurance is required as a condition of Federal aid or mortgage or loan that is federally insured for a building located in a special flood hazard area. For flood insurance may not be required for properties that do not have a federally backed loan, but it is still advised. Level of coverage is measured in two ways:

- The number of buildings with insurance coverage compared to the number of buildings exposed to a flood hazard (see Table 4-74)
- The average amount of coverage by FIRM Zone and occupancy type compared to the amount of expected flood damage from a base flood (see Table 4-75, Table 4-76, and Table 4-77).

Table 4-74 Percentage of Buildings Insured (as of 9/30/14)

Flood Zone	Policies	Properties	Percent Coverage
Zone AE	2,201	9,197	24%
Zone A	203	1,395	15%
Zone AO	348	823	42%
Zone AH	17	716	2%
Zone AR*	337	0	0%
Zone A99*	424	0	
Zone X	0	159,663	4%
Standard	420	–	–
Preferred	5,992	–	–
Total	**9,942**	**171,794**	**6%**

Source: 2015 Program for Public Information

*There are currently no properties in Zone AR or A99 in Sacramento County.

Table 4-75 Policy Break-down (as of 9/30/14)

Structure Type	Number Policies in Force	Premium	Insurance in Force
Single Family	7,059	$3,899,552	$2,077,759,400
2-4 Family	413	$202,190	$92,290,000
All Other Residential	1,363	$566,396	$220,798,600
Non-Residential	736	$1,075,390	$248,079,800
Total	**9,571**	**$5,743,528**	**$2,638,927,800**

Source: 2015 Program for Public Information

Table 4-76 Pre-FIRM Policies in Force (as of 9/30/14)

Flood Zone	Pre-FIRM	Premium	Insurance in Force
Zone AE	1,579	$1,174,252	$240,551,000
Zone A	123	$134,078	$23,207,400
Zone AO	319	$307,966	$60,462,600
Zone AH	12	$11,405	$2,531,600

Flood Zone	Pre-FIRM	Premium	Insurance in Force
Zone AR*	179	$144,366	$31,323,000
Zone A99*	314	$325,272	$66,997,100
Zone X			
Standard	146	$182,502	$36,442,700
Preferred	3,812	$1,668,465	$1,217,267,000
Total	**6,484**	**$3,948,306**	**$1,678,782,400**

Source: 2015 Program for Public Information

*There are currently no properties in Zone AR or A99 in Sacramento County.

Table 4-77 Post-FIRM Policies in Force (as of 9/30/14)

Flood Zone	Post-FIRM	Premium	Insurance in Force
Zone AE	619	$222,943	$138,974,700
Zone A	80	$47,159	$19,236,600
Zone AO	29	$24,551	$8,008,300
Zone AH	5	$4,777	$1,910,500
Zone AR*	158	$54,322	$34,219,800
Zone A99*	110	$149,525	$28,530,600
Zone X			
Standard	274	$332,115	$75,199,500
Preferred	2,180	$1,206,920	$740,765,000
Total	**3,455**	**$2,042,312**	**$1,046,845,000**

Source: 2015 Program for Public Information

*There are currently no properties in Zone AR or A99 in Sacramento County.

Repetitive Loss Analysis

Unincorporated Sacramento County's vulnerability to flooding can be seen in the number of Repetitive Loss properties. The NFIP considers a property a Repetitive Loss Property if two or more flood insurance claims of more than $1,000 have been paid within any 10-year period since 1978. According to FEMA's records and an analysis in Sacramento County Department of Water Resources' July 2015 Repetitive Loss Area Analysis Report, there are 101 Repetitive Loss Properties within Sacramento County. Several more properties within Sacramento County may have reached the damage threshold for Repetitive Loss Properties, but not all properties are covered by flood insurance and flood insurance claims are not submitted for all flood damage sustained. There are 11 severe repetitive loss properties.

A Repetitive Loss Area (RLA) consists of Repetitive Loss Properties and the surrounding properties that experience the same or similar flooding conditions, whether or not the buildings on those surrounding properties have been damaged by flooding. Figure 4-83 shows the 28 RLAs in Sacramento County based on an analysis of the location of the RL properties. Information by area is shown on Table 4-78 that includes the RL properties, historical loss properties (ie., those properties with one insurance claim), and information

on those RL properties that have been mitigated. Much greater detail can be found in the July 2015 Repetitive Loss Area Analysis Report, as shown in Appendix X.

Figure 4-83 Unincorporated Sacramento County – Repetitive Loss Areas

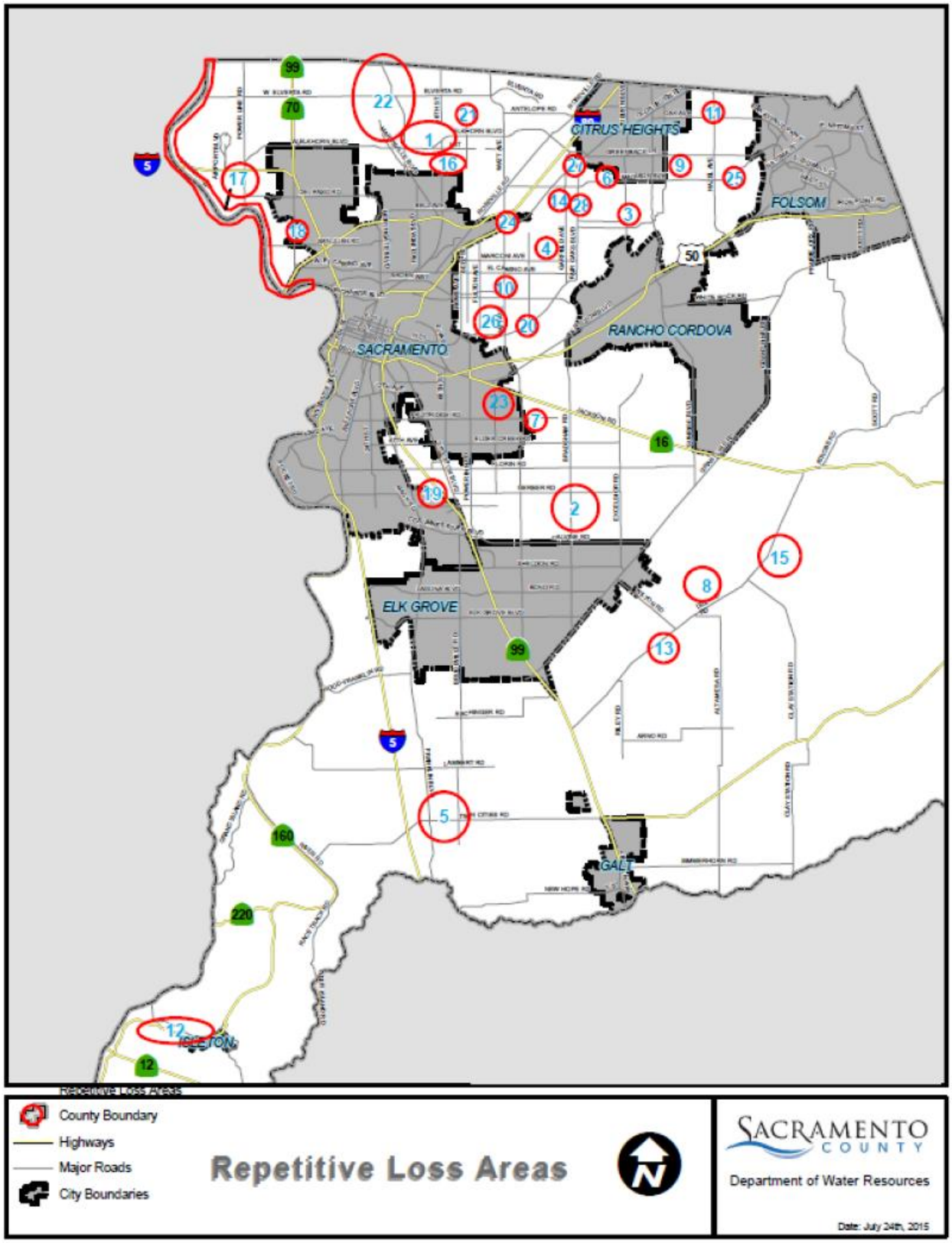


Table 4-78 Repetitive Loss Area Totals and Mitigated Properties

Name	Repetitive Loss Properties	Historical Loss Properties	Repetitive Loss Area Properties	Total Repetitive Loss Properties	Mitigated Properties
Area 1 – Dry Creek Watershed					
Cherry Lane	10	10	8	**28**	12
O Street	2	9	20	**31**	2
Dry Creek Road	2	1	30	**33**	3
10th Street; 16th Street; Eye Street; Front Street	0	0	16	**16**	0
Fallon Woods Way	0	2	35	**37**	0
Curved Bridge Road	0	3	6	**9**	2
Elkhorn Boulvard	9	8	7	**24**	14
Jamie Court	0	0	11	**11**	0
K Street	0	1	24	**25**	0
Vickrey Court; Vickie Theresa La Ne; Linda Lane; Lilac Lane; 14th Street	0	0	17	**17**	1
6th Street; 5th Street	11	2	15	**28**	2
6th Street; 5th Street	0	0	10	**10**	0
Oak Lane	0	2	14	**16**	0
Fallon Place Court; JC Court	0	0	17	**17**	0
Alvilde Court; Castle Creek Way; Q Street	0	0	21	**21**	0
Radalyac Court; Woodwright Way	0	0	17	**17**	4
Total Area 1	**34**	**38**	**268**	**340**	**40**
Repetive Loss Area 2 – Laguna Creek (Interbasin Transfer) and Gerber Creek					
Bar Du Lane	0	2	14	**16**	0
Bradshaw Road	0	4	29	**33**	2
Carmencita Avenue	1	1	27	**29**	0
Rogers Road; Gerber Road; Vineyard Road; Wildhawk West Drive	0	1	24	**25**	0
Total	**1**	**8**	**94**	**103**	**2**
Repetitive Loss Area 3- Andrew Alan Lane					
Andrew Alan Lane; Winding Way	2	3	3	**8**	5

Name	Repetitive Loss Properties	Historical Loss Properties	Repetitive Loss Area Properties	Total Repetitive Loss Properties	Mitigated Properties
Repetitive Loss Area 4 – North Ave (Chicken Ranch Slough)					
North Avenue	3	4	10	**17**	1
McCowan Way; Murchison Way; Oakfield Drive	3	4	10	**17**	1
Total	**6**	**8**	**20**	**34**	**2**
Repetitive Loss Area 5 – Twin Cities Road					
Bruceville Road; Franklin Boulevard; Twin Cities Road	1	0	9	**10**	0
Repetitive Loss Area 6 –Brooktree Creek					
Elsinore Way; Leavitt Way	1	0	10	**11**	1
Southbrook Way; Northbrook Way	1	0	6	**7**	0
Total	**2**	**0**	**16**	**18**	**1**
Repetitive Loss Area 7 – Morrison Creek					
Fruitridge Road	1	0	7	**7**	0
Repetitive Loss Area 8 – Cosumnes River					
Green Road; Jeffcott Road	2	5	26	**33**	0
Repetitive Loss Area 9 – South Branch Of Arcade Creek					
Hoffman Lane	1	6	4	**11**	1
Long Acres Court; Manana Way	0	4	7	**11**	0
Total	**1**	**10**	**11**	**22**	**1**
Repetitive Loss Area 10 – Strong Ranch Slough					
Kincaid Way	2	1	6	**9**	4
Kubel Circle	1	2	3	**6**	0
Maple Glen Road	1	3	23	**27**	0
Ladino Road; Meadow Lane; Riding Club Lane; Rockwood Drive	0	2	16	**18**	0
Winding Creek Road	4	4	11	**19**	0
Total	**8**	**12**	**59**	**79**	**4**
Repetitive Loss Area 11 – Linda Creek					
Creek Oaks Lane; Eden Oaks Avenue	0	2	10	**12**	0

Name	Repetitive Loss Properties	Historical Loss Properties	Repetitive Loss Area Properties	Total Repetitive Loss Properties	Mitigated Properties
Hazel Avenue	1	3	6	**10**	0
Leever Lane; Nipawin Way; Oak Avenue	0	3	19	**22**	0
Total	**1**	**8**	**35**	**44**	**0**
Repetitive Loss Area 12 – Grand Island Road & Vieira's Resort					
Long Island Road; Grand Island Road; Sycamore Drive; Beach Drive; Anchor Drive	8	12	23	**43**	5
Repetitive Loss Area 13 – Badger Creek					
Collings Road; Mann Road	1	0	19	**20**	0
Haggie Road; Dillard Road; Davis Road	0	1	12	**13**	0
Repetitive Loss Area 14 - Arcade Creek					
Manzanita Avenue	0	1	9	**10**	0
Sycamore Avenue	0	1	8	**9**	0
Peppermill Court	0	0	22	**22**	0
Pasadena Avenue; Winding Way	0	1	5	**6**	0
Total	**0**	**3**	**44**	**47**	**0**
Repetitive Loss Area 15 - Dillard Rd/Berry Rd					
Apple Road; Berry Road	2	0	10	**12**	0
Cherry Road; Currant Road; Dillard Road	0	1	11	**12**	0
Early Times Road; Live Oak Road	1	0	10	**11**	0
Orange Road	0	1	5	**6**	0
Total	**3**	**2**	**36**	**41**	**0**
Repetitive Loss Area 16 - Robla Creek					
C Street	2	5	9	**16**	0
16th Street; 20th Street	0	2	12	**14**	0
E Street	2	5	14	**21**	1
Total	**4**	**12**	**35**	**51**	**1**
Repetitive Loss Area 17 -Garden Highway					
Garden Highway*	24	53	222	**300**	3
Repetitive Loss Area 18 – Leona Circle					
Leona Circle	1	0	13	**14**	0

Name	Repetitive Loss Properties	Historical Loss Properties	Repetitive Loss Area Properties	Total Repetitive Loss Properties	Mitigated Properties
Repetitive Loss Area 19 – Tangerine Avenue					
Persimmon Avenue; Tangerine Avenue	1	0	2	**3**	0
Repetitive Loss Area 20 – Treehouse Lane					
Columbia Drive; Cortlandt Drive; Fair Oaks Boulevard; Treehouse Lane	1	7	4	**12**	0
Repetitive Loss Area 21 – Rio Linda Dry Creek					
24th Street; U Street	3	9	7	**19**	8
Repetitive Loss Area 22 – North Natomas East Main Drain Canal					
Burr Av; E Levee Rd; El Modena Av	0	0	15	**15**	0
Marysville Boulevard	1	10	4	**15**	0
Rio Linda Boulevard; Schandoney Avenue; Sorento Road; Straugh Road	9	3	4	**16**	0
M Street; West M Street	0	3	17	**20**	0
Q Street; West Q Street	0	2	10	**12**	0
2nd Street; West 2nd Street; 4th Street; West 4th Street; West 6th Street	1	4	16	**21**	0
Total	**11**	**22**	**66**	**99**	**0**
Repetitive Loss Area 23 – Morrison Creek					
Bradshaw Road	1	0	19	**20**	0
Mayhew Road	0	0	4	**4**	0
Total	**1**	**0**	**23**	**24**	**0**
Repetitive Loss Area 24 – Arcade Creek at Park Road					
Arcade Creek at Park Rd.	3	2	0	**5**	4
Repetitive Loss Area 25 – Madison Avenue at Rollingwood					
Madison Avenue	8	17	44	**69**	0
Repetitive Loss Area 26 – Strong Ranch Slough					
Bell Street; Northrop Avenue	0	5	12	**17**	0
Roselake Avenue; Roselee Way	0	0	12	**12**	0
Villanova Circle	0	8	12	**20**	0

Name	Repetitive Loss Properties	Historical Loss Properties	Repetitive Loss Area Properties	Total Repetitive Loss Properties	Mitigated Properties
Woodside Lane	52	11	87	**150**	0
Total	**52**	**24**	**123**	**199**	**0**
Repetitive Loss Area 27 – Brooktree Creek					
Auburn Boulevard; Devecchi Avenue	0	1	6	**7**	0
Rosebud Lane	1	2	6	**9**	1
Total	**1**	**3**	**12**	**16**	**1**
Repetitive Loss Area 28 – Verda Cruz Creek					
College Oak Drive; Crestview Drive	1	3	14	**18**	0
Moraga Drive	1	0	3	**4**	0
Total	**2**	**3**	**17**	**22**	**0**

Source: Repetitive Loss Area Analysis
*Includes 1 Severe Repetitive Loss structure

Population at Risk

A separate analysis was performed to determine population in flood zones. Using GIS, the DFIRM Flood dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the Census Bureau factor for average household size; results were tabulated by jurisdiction and flood zone (see Table 4-79). According to this analysis, there is a residential population of 72,719 in the 1% annual chance flood event, and 140,353 in the 0.2% annual chance flood event for the Sacramento County Planning Area.

Table 4-79 Sacramento County Planning Area – Population at Risk to Flooding

	1% Annual Chance		0.2% Annual Chance	
Jurisdiction	Improved Residential Parcels*	Population**	Improved Residential Parcels*	Population**
Citrus Heights	146	369	262	663
Elk Grove	251	798	3,977	12,647
Folsom	7	18	76	198
Galt	0	0	0	0
Isleton	244	593	0	0
Rancho Cordova	21	58	963	2,648
Sacramento	24,416	63,970	13,622	35,690
Unincorporated	2,551	6,913	21,098	57,176
Total	**27,636**	**72,719**	**39,998**	**140,353**

Source: Sacramento County DFIRM June 16, 2015; US Census Bureau; Sacramento County 2016 Parcel/2015 Assessor Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**Census Bureau 2010 average household sizes are: Citrus Heights – 2.53; Elk Grove – 3.18; Folsom – 2.61; Galt – 3.24; Isleton – 2.43; Rancho Cordova – 2.75; City of Sacramento – 2.62; Unincorporated County – 2.71

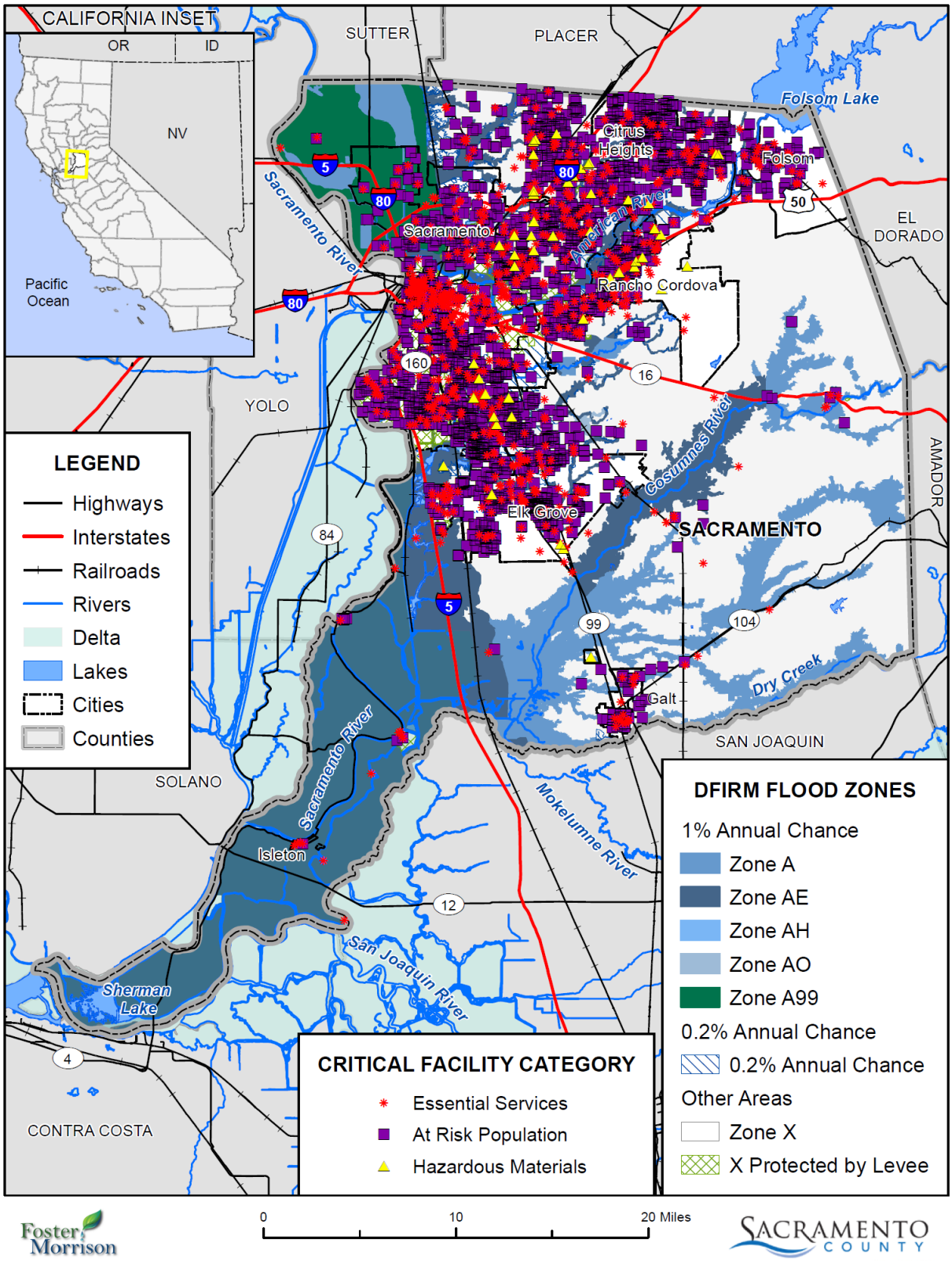
Cultural and Natural Resources at Risk

The Sacramento County Planning Area has significant cultural and natural resources located throughout the County as previously described. Risk analysis of these resources was not possible due to data limitations. However, as previously described, natural areas, such as wetlands and riparian areas within the floodplain, often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Preserving and protecting these areas and associated functions are a vital component of sound floodplain management practices for the Sacramento County planning area.

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Sacramento County and all jurisdictions to determine critical facilities in the 1% and 0.2 annual chance floodplains. Using GIS, the Preliminary DFIRM flood zones were overlayed on the critical facility location data. Figure 4-84 shows critical facilities, as well as the DFIRM flood zones. Table 4-80 details critical facilities by facility type and count for the Planning Area, while Table 4-81 details the critical facilities for the unincorporated County. Details of critical facility definition, type, name and address and jurisdiction by flood zone are listed in Appendix E.

Figure 4-84 Sacramento County Planning Area – Critical Facilities in DFIRM Flood Zones



Data Source: Sacramento County GIS, Cal-Atlas, FEMA NFHL 04/16/2016; Map Date: 05/2016.

Table 4-80 Sacramento County Planning Area – Critical Facilities in DFIRM Flood Zones

Critical Facility Category	Facility Type	Facility Count
Zone A		
Essential Services Facilities	Airport	1
	Detention Basin	13
	Emergency Evacuation Shelter	1
	Total	**15**
At Risk Population Facilities	Detention Center	1
	Public Continuation High School	1
	School-Age Day Care Center	1
	Total	**3**
Zone A Total		**18**
A99		
Essential Services Facilities	Airport	1
	Arena	1
	Emergency Evacuation Shelter	10
	Fire Station	4
	Medical Health Facility	3
	Total	**19**
At Risk Population Facilities	Adult Residential	7
	Alternative Education School	1
	Charter School	3
	Day Care Center	19
	Group Home	1
	Hotel	3
	Private Elementary School	2
	Public Continuation High School	1
	Public Elementary School	10
	Public High School	2
	Public Middle School	3
	Residential Care/Elderly	6
	School-Age Day Care Center	8
	Total	**66**
A99 Total		**85**
Zone AE		
Essential Services Facilities	Airport	3
	Detention Basin	9

Critical Facility Category	Facility Type	Facility Count
	Emergency Evacuation Shelter	11
	Fire Station	3
	Government Facilities	2
	Medical Health Facility	5
	Police	2
	Stadium	1
	Total	**36**
At Risk Population Facilities	Adult Day Care	1
	Adult Residential	3
	Community Day School	1
	Day Care Center	3
	Detention Center	1
	Group Home	2
	Hotel	1
	Private K-12 School	2
	Public Continuation High School	1
	Public Elementary School	3
	Residential Care/Elderly	1
	Total	**19**
Hazardous Materials Facilities	Sewer Treatment Plant	1
	Total	**1**
AE Total		**56**
AH		
Essential Services Facilities	Detention Basin	1
	Emergency Evacuation Shelter	1
	Total	**2**
At Risk Population Facilities	Adult Residential	2
	Residential Care/Elderly	1
	School-Age Day Care Center	1
	Total	**4**
AH Total		**6**
Total 1% Annual Chance		**165**
0.2% Annual Chance		
Essential Services Facilities	Bus Terminal	2
	Detention Basin	6
	Drainage	1

Critical Facility Category	Facility Type	Facility Count
	Emergency Evacuation Shelter	18
	Fire Station	7
	General Acute Care Hospital	2
	Government Facilities	5
	Light Rail Stop	2
	Medical Health Facility	22
	Police	3
	Total	**68**
At Risk Population Facilities	Adult Day Care	2
	Adult Education School	1
	Adult Residential	70
	Alternative Education School	1
	Assisted Living Centers	8
	Charter School	2
	College/University	1
	Community Day School	1
	Day Care Center	51
	Group Home	11
	Hotel	1
	Infant Center	6
	Private Elementary School	7
	Private High School	1
	Private K-12 School	5
	Public Continuation High School	5
	Public Elementary School	25
	Public High School	4
	Public Middle School	4
	Residential Care/Elderly	53
	School	4
	School-Age Day Care Center	11
	Total	**274**
Hazardous Materials Facilities	Oil Collection Center	6
	Total	**6**
0.2% Annual Chance Total		**348**
Zone X		
Essential Services Facilities	Airport	4
	Bus Terminal	2

Critical Facility Category	Facility Type	Facility Count
	Corporation Yard	1
	Detention Basin	16
	Dispatch Center	2
	Drainage	4
	Emergency Evacuation Shelter	133
	Emergency Rooms	1
	EOC	2
	Fire Station	61
	Gas Storage	1
	General Acute Care Hospital	5
	Government Facilities	43
	Hospitals	1
	Light Rail Stop	24
	Medical Health Facility	91
	Police	15
	Sand Bag	3
	State and Fed Facilities	1
	State Facility	1
	Traffic Operations Center	1
	Train Station	1
	Urgent Care Facilities	2
	Vehicle and Equipment Storage	1
	Water Treatment Plant	2
	Total	**418**
At Risk Population Facilities Total	Adult Day Care	12
	Adult Education School	7
	Adult Residential	165
	Alternative Education School	5
	Assisted Living Centers	47
	Charter School	15
	Children's Home	2
	College/University	4
	Community Day School	5
	Day Care Center	236
	Detention Center	1
	Group Home	64
	Hotel	29

Critical Facility Category	Facility Type	Facility Count
	Independent Study School	1
	Infant Center	16
	JAIL	1
	Prison	1
	Private Elementary School	45
	Private High School	23
	Private K-12 School	26
	Public Continuation High School	14
	Public Elementary School	136
	Public High School	24
	Public Middle School	27
	Residential Care/Elderly	308
	Residential Facility Chronically	1
	School	33
	School-Age Day Care Center	55
	Senior Center	1
	Social Rehabilitation Facility	4
	Special Education School	10
	Total	**1,318**
Hazardous Materials Facilities	Oil Collection Center	37
	OTHER	1
	Propane Storage	1
	Sewer Treatment Plant	1
	Total	**40**
X Total		**1,776**
X Protected by Levee		
Essential Services Facilities	Airport	1
	Bus Terminal	4
	Convention Center	1
	Drainage	1
	Emergency Evacuation Shelter	59
	Fire Station	19
	General Acute Care Hospital	2
	Government Facilities	18
	Light Rail Stop	26
	Medical Health Facility	79
	Police	2

Critical Facility Category	Facility Type	Facility Count
	Sand Bag	2
	Stadium	2
	Vehicle and Equipment Storage	1
	Water Treatment Plant	1
	Total	**218**
At Risk Population Facilities	Adult Day Care	11
	Adult Education School	4
	Adult Residential	61
	Assisted Living Centers	3
	Charter School	5
	College/University	2
	Community Day School	2
	Day Care Center	107
	Group Home	18
	Hotel	16
	Independent Study School	1
	Infant Center	11
	Private Elementary School	11
	Private High School	6
	Private K-12 School	4
	Public Elementary School	56
	Public High School	5
	Public Middle School	9
	Residential Care/Elderly	45
	School	1
	School-Age Day Care Center	21
	Total	**399**
Hazardous Materials Facilities Total	Oil Collection Center	2
	Total	**2**
X Protected by Levee Total		**619**
Grand Total		**2,908**

Source: Sacramento County DFIRM, Sacramento County GIS

Table 4-81 Unincorporated Sacramento County – Critical Facilities in DFIRM Flood Zones

Critical Facility Category	Facility Type	Facility Count
A		
Essential Services Facilities	Airport	1
	Emergency Evacuation Shelter	1
	Total	**2**
At Risk Population Facilities	Detention Center	1
	Public Continuation High School	1
	School-Age Day Care Center	1
	Total	**3**
A Total		**5**
A99		
Essential Services Facilities	Airport	1
	Fire Station	2
	Medical Health Facility	3
	Total	**6**
At Risk Population Facilities	Hotel	1
	Total	**1**
A99 Total		**7**
AE		
Essential Services Facilities	Airport	3
	Detention Basin	4
	Emergency Evacuation Shelter	7
	Fire Station	3
	Medical Health Facility	3
	Police	1
	Stadium	1
	Total	**22**
At Risk Population Facilities	Adult Day Care	1
	Adult Residential	2
	Community Day School	1
	Day Care Center	2
	Detention Center	1
	Group Home	2
	Hotel	1
	Private K-12 School	2
	Public Continuation High School	1

Critical Facility Category	Facility Type	Facility Count
	Public Elementary School	2
	Residential Care/Elderly	1
	Total	**16**
Hazardous Materials Facilities	Sewer Treatment Plant	1
	Total	**1**
AE Total		**39**
Total 1% Annual Chance		**51**
0.2% ANNUAL CHANCE		
Essential Services Facilities Total	Bus Terminal	1
	Emergency Evacuation Shelter	9
	Fire Station	4
	Government Facilities	2
	Light Rail Stop	1
	Medical Health Facility	11
	Police	2
	Total	**30**
At Risk Population Facilities	Adult Day Care	1
	Adult Education School	1
	Adult Residential	34
	Community Day School	1
	Day Care Center	26
	Group Home	8
	Infant Center	4
	Private Elementary School	2
	Private High School	1
	Private K-12 School	2
	Public Continuation High School	4
	Public Elementary School	11
	Public High School	1
	Public Middle School	1
	Residential Care/Elderly	31
	School-Age Day Care Center	5
	Total	**133**
Hazardous Materials Facilities	Oil Collection Center	5
	Total	**5**
0.2% Annual Chance Total		**168**

Critical Facility Category	Facility Type	Facility Count
Zone X		
Essential Services Facilities Total	Airport	4
	Emergency Evacuation Shelter	70
	Fire Station	38
	General Acute Care Hospital	1
	Government Facilities	17
	Light Rail Stop	2
	Medical Health Facility	45
	Police	8
	Traffic Operations Center	1
	Vehicle and Equipment Storage	1
	Total	**187**
At Risk Population Facilities	Adult Day Care	6
	Adult Education School	4
	Adult Residential	86
	Alternative Education School	5
	Charter School	9
	College/University	1
	Community Day School	3
	Day Care Center	112
	Detention Center	1
	Group Home	41
	Hotel	5
	Infant Center	8
	Private Elementary School	22
	Private High School	12
	Private K-12 School	16
	Public Continuation High School	7
	Public Elementary School	70
	Public High School	12
	Public Middle School	16
	Residential Care/Elderly	164
	Residential Facility Chronically	1
	School-Age Day Care Center	24
	Social Rehabilitation Facility	2
	Special Education School	6
	Total	**633**

Critical Facility Category	Facility Type	Facility Count
Hazardous Materials Facilities	Oil Collection Center	26
	OTHER	1
	Total	**27**
X Total		**847**
X Protected by Levee		
Essential Services Facilities	Emergency Evacuation Shelter	11
	Fire Station	3
	Light Rail Stop	3
	Medical Health Facility	8
	Police	1
	Vehicle and Equipment Storage	1
	Total	**27**
At Risk Population Facilities	Adult Day Care	2
	Adult Residential	12
	Charter School	1
	Day Care Center	14
	Group Home	5
	Hotel	1
	Infant Center	2
	Private Elementary School	1
	Private High School	2
	Private K-12 School	1
	Public Elementary School	10
	Public High School	1
	Public Middle School	1
	Residential Care/Elderly	6
	School-Age Day Care Center	3
	Total	**62**
Hazardous Materials Facilities	Oil Collection Center	1
	Total	**1**
X Protected by Levee Total		**90**
Grand Total		**1,156**

Source: Sacramento County DFIRM, Sacramento County GIS

Overall Community Impact

Floods and their impacts vary by location and severity of any given flood event and will likely only affect certain areas of the County during specific times. Based on the risk assessment, it is evident that floods will continue to have potentially devastating economic impacts to certain areas of the County. However, many of the floods in the County are minor, localized flood events that are more of a nuisance than a disaster. Impacts that are not quantified, but can be anticipated in large future events, include:

- Commercial and residential structural and property damage;
- Costs incurred due to post-flood clean up and repair of buildings and infrastructure;
- Damage to roads/bridges resulting in loss of mobility;
- Decreased revenue due to loss of income, sales, tourism, and property taxes;
- Deterioration of homes and neighborhoods as floods recur;
- Disruption of and damage to public infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Impact on the overall mental health of the community;
- Injury and loss of life, including first responders rescuing those who did not evacuate or are stranded;
- Loss of historical or unique artifacts;
- Loss of jobs due to businesses closing or cutting back on operating hours;
- Loss of programs or services that are cut to pay for flood recovery;
- Mental health and family impacts, including increased occurrence of suicides and divorce
- Negative impact on commercial and residential property values;
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed; and
- Significant economic impact (jobs, sales, tax revenue) to the community.

Future Development and Future Flood Conditions

This section provides an analysis of the flood hazard and proposed future development within the County based on FEMA DFIRMs and also discusses considerations in evaluating future flooding conditions.

Future Development: General Considerations

Communities that participate in the NFIP adopt regulations and codes that govern development in special flood hazard areas, and enforce those requirements through their local floodplain management ordinances through the issuance of permits. Sacramento County's floodplain management ordinance provides standards for development, subdivision of land, construction of buildings, and improvements and repairs to buildings that meet or exceed the minimum requirements of the NFIP.

The International Residential Code (IRC) and International Building Code (IBC), by reference to ASCE 24, include requirements that govern the design and construction of buildings and structures in flood hazard areas. FEMA has determined that the flood provisions of the I-Codes are consistent with the requirements of the NFIP (the I-Code requirements shown either meet or exceed NFIP requirements). ASCE 24, a design standard developed by the American Society of Civil Engineers, expands on the minimum NFIP requirements with more specificity, additional requirements, and some limitations.

With the adoption of the 2015 International Code, communities will be moving towards a more stringent approach to regulatory floodplain management. The adoption and enforcement of disaster-resistant building codes is a core community action to promote effective mitigation. When communities ensure that new buildings and infrastructure are designed and constructed in accordance with national building codes and construction standards, they significantly increase local resilience now and in the future. With continued advancements in building codes, local ordinances should be reviewed and updated to meet and exceed standards as practicable to protect new development from future flood events and to further promote disaster resiliency.

Master planning will also be necessary to assure that open channel flood flow conveyances serving the smaller internal streams and drainage areas are adequately prepared to accommodate the flows. Preservation and maintenance of natural and riparian areas should also be an ongoing priority to realize the flood control benefits of the natural and beneficial functions of these areas. Also to be considered in reducing flooding in areas of existing and future development is to promote implementation of stormwater program elements and erosion and sediment controls, including the clearing of vegetation from natural and man-made drains that are critical to flood protection. Both native and invasive species can clog drains, and reduce flows of floodwaters, which slow that natural drainage process and can exacerbate flooding.

One of the most effective ways to reduce vulnerability to potential flood damage is through careful land use planning that fully considers applicable flood management information and practices. California's 2007 flood legislation (Senate Bill 5) directly linked system-wide flood management planning to local land use planning, requiring local jurisdictions to demonstrate an urban level of flood protection before approving new development in urban and urbanizing areas. "Urban level of flood protection" means the level of protection necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year (California Government Code Section 65007). DWR has been developing criteria to guide local jurisdiction compliance with the new requirements. In addition to developing criteria to help local jurisdictions in their land use planning, DWR is preparing criteria for use in the design of levees protecting urban and urbanizing areas. DWR is also working with local partners to develop guidance related to nonurban flood protection levels.

Once these standards become effective, cities and counties within the Sacramento-San Joaquin Valley cannot enter into development agreements or issue a permit to construct a new structure in areas located within a flood hazard zone unless the following is established:

- Find that existing facilities protect urban and urbanizing areas to a 1-in 200 chance of flooding in any given year or the FEMA standard of flood protection in non-urbanized areas, or
- Find that the local flood management agency has made adequate progress on the construction of the flood protection system to provide the required level of protection, or
- Impose conditions on the development agreement that will provide the required level of protection.

Sacramento Planning Area SB 5 Compliance Status

In June of 2016, SAFCA released their Engineering Report certifying "Adequate Progress Towards an Urban Level of Flood Protection". This certification is made with respect to the following levee systems:

- Natomas Levee System comprised of Natomas Cross Canal south levee; Sacramento River east levee, Natomas Cross Canal to Powerline Road; Sacramento River east levee, Powerline Road to American River; American River north levee; Natomas East Main Drainage Canal west levee; and Pleasant Grove Creek Canal west levee.
- Dry Creek Levee System comprised of the Dry Creek north levee. Robla-Arcade Levee System comprised of Robla Creek south levee; Natomas East Main Drainage Canal east levee from Robla (Dry) Creek to Arcade Creek; and Arcade Creek north levee.
- American River North Levee System comprised of Arcade Creek south levee; Natomas East Main Drainage Canal east levee from Arcade Creek to American River; and American River north levee from NEMDC east levee to Arden Way (at William B. Pond Recreation Area).
- American River South and Sacramento River East Levee System comprised of American River south levee; from Sacramento River to Mayhew Drain; Sacramento River east levee from American River to Beach Lake north levee; and Beach Lake north levee from Sacramento River to UPRR.
- South Sacramento Streams Levee System comprised of the Morrison Creek right and left bank levees and floodwalls, Florin Creek right and left bank levees and floodwalls, Elder Creek right and left bank levees and floodwalls, and Unionhouse right bank levee and floodwall.

SAFCA has prepared a separate report, titled SAFCA Urban Level of Flood Protection Plan and Adequate Progress Baseline Report (SAFCA, 2016), that demonstrates adequate progress and the identified scope, schedule, and cost of the construction of a flood protection system which will result in flood protection equal to or greater than the urban level of flood protection in urban or urbanizing areas. For urban and urbanizing areas protected by project levees, the urban level of flood protection shall be achieved by 2025.

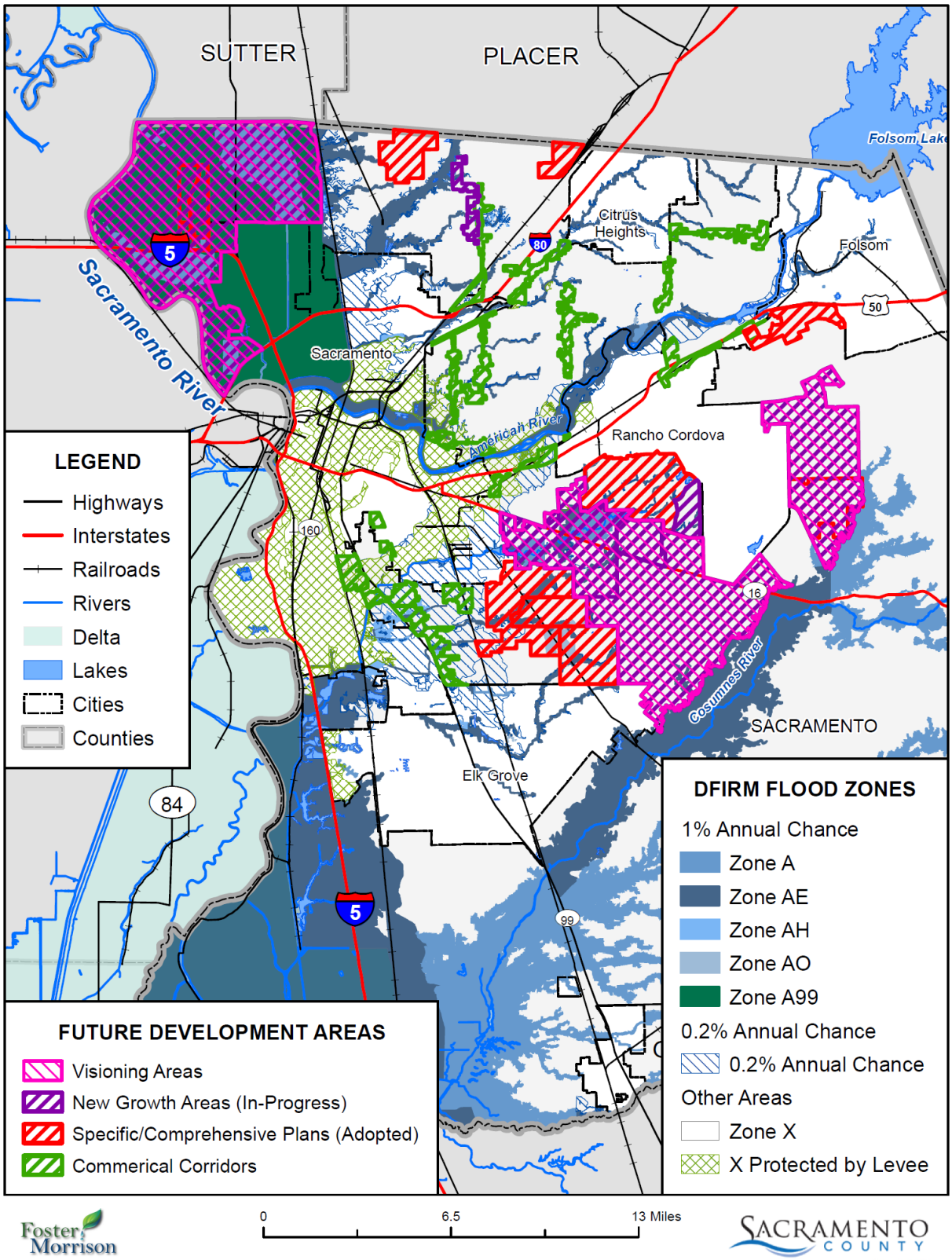
SAFCA's June 2016 Engineering Report, "Adequate Progress Towards an Urban Level of Flood Protection" was developed to provide substantial evidence that, once the planned improvements have been completed, the structural flood control facilities protecting the urban areas of the City and County from flooding from the Sacramento and American Rivers and their tributaries will be able to withstand flooding from a 1-in-200-year flood event in accordance with the State of California's Urban Levee Design Criteria (ULDC), issued in May 2012. To this end, for each of the six levee systems discussed, there is a description of the status for compliance with each criterion for each levee within the levee system.

Future Development: DFIRM GIS Analysis

Vision areas, new growth areas, specific plan areas, commercial corridors data is maintained by Sacramento County, and was made available for this plan. A simple analysis was performed to quantify parcels within these development areas that are also in flood hazard areas. Results can serve as confirmation for future development.

GIS was used to determine the number of parcels in the 1% and 0.2% annual chance flood events within visioning areas, specific plan areas, new growth areas, and commercial corridor areas. GIS was used to create a centroid, or point representing the center of the parcel polygon. Those parcels centroids that fall inside the future development areas and that were within the 1% annual chance flood event or the 0.2% annual chance flood events were selected and tabulated in Figure 4-85 and shown in Table 4-82.

Figure 4-85 Sacramento County Planning Area - Future Development in DFIRM Flood Zones



Data Source: Sacramento County GIS, Cal-Atlas, FEMA NFHL 04/16/2016; Map Date: 05/2016.

Table 4-82 Sacramento County Planning Area – Future Development in FEMA DFIRM Zones

Area	Parcels	Acres	DFIRM Flood Zone
Visioning Area			
Jackson	1,099	21,670	A, AE, AO, 0.2% Annual Chance, X-Protected by Levee, X
Natomas	907	24,504	A, A99, AE, X
Grantline East	48	8,198	A, X
Plan Areas			
Cordova Hills Master Plan	26	2,436	A, X
East Antelope Specific Plan	1,425	601	X
Easton Project	19	1,409	0.2% Annual Chance, X
Elverta Specific Plan	158	1,581	AE, X
Florin-Vineyard Gap Community Plan	827	3,875	A, AE, AO, 0.2% Annual Chance, X
Jackson Township Master Plan	61	1,909	AE, 0.2% Annual Chance, X
Mather Field	1,421	5,493	A, AE, 0.2% Annual Chance, X
Mather South Master Plan	12	1,299	AE, 0.2% Annual Chance, X
Metro Airpark	78	1,810	A, A99
New Bridge Master Plan	27	1,339	AE, 0.2% Annual Chance, X
North Vineyard Station Specific Plan	1,320	1,553	AE, AO, 0.2% Annual Chance, X
Vineyard Springs Comprehensive Plan	2,732	2,344	AE, AO, 0.2% Annual Chance, X
West Jackson Highway Master Plan	455	6,181	A, AE, AO, 0.2% Annual Chance, X-Protected by Levee, X
West of Watt	383	609	AE, 0.2% Annual Chance, X
Corridor Areas			
Corridor 1	1,277	554	AE, 0.2% Annual Chance, X
Corridor 2	533	226	X
Corridor 3	1,033	625	AE, 0.2% Annual Chance, X
Corridor 4	626	532	AE, 0.2% Annual Chance, X
Corridor 5	516	621	AE, AH, 0.2% Annual Chance, X
Corridor 6	579	311	AE, 0.2% Annual Chance, X
Corridor 7	722	460	AE, 0.2% Annual Chance, X
Corridor 8	126	136	X
Corridor 9	946	290	AE, 0.2% Annual Chance, X-Protected by Levee, X
Corridor 10	593	101	X
Corridor 11	266	76	X-Protected by Levee, X
Corridor 12	2,537	1,929	A, AE, AH, 0.2% Annual Chance, X-Protected by Levee, X
Corridor 13	325	402	AE, 0.2% Annual Chance, X
Corridor 14	30	155	X
Corridor 15	224	465	0.2% Annual Chance, X

Area	Parcels	Acres	DFIRM Flood Zone
Visioning Area			
Corridor 16	31	11	X
Corridor 17	203	254	A, 0.2% Annual Chance, X-Protected by Levee, X
Corridor 18	3	1	X-Protected by Levee
Corridor 19	48	130	0.2% Annual Chance, X-Protected by Levee
New Growth Areas			
Mather South Master Plan	12	1,299	AE, 0.2% Annual Chance, X
Natomas North	907	24,504	A, A99, AE, X
Jackson Township	61	1,909	AE, 0.2% Annual Chance, X
New Bridge	27	1,339	AE, 0.2% Annual Chance, X
West Jackson Highway	455	6,181	A, AE, AO, 0.2% Annual Chance, X-Protected by Levee, X
West of Watt	383	609	AE, 0.2% Annual Chance, X

Source: Sacramento County GIS, Sacramento County DFIRM June 16, 2015

Future Flooding Conditions

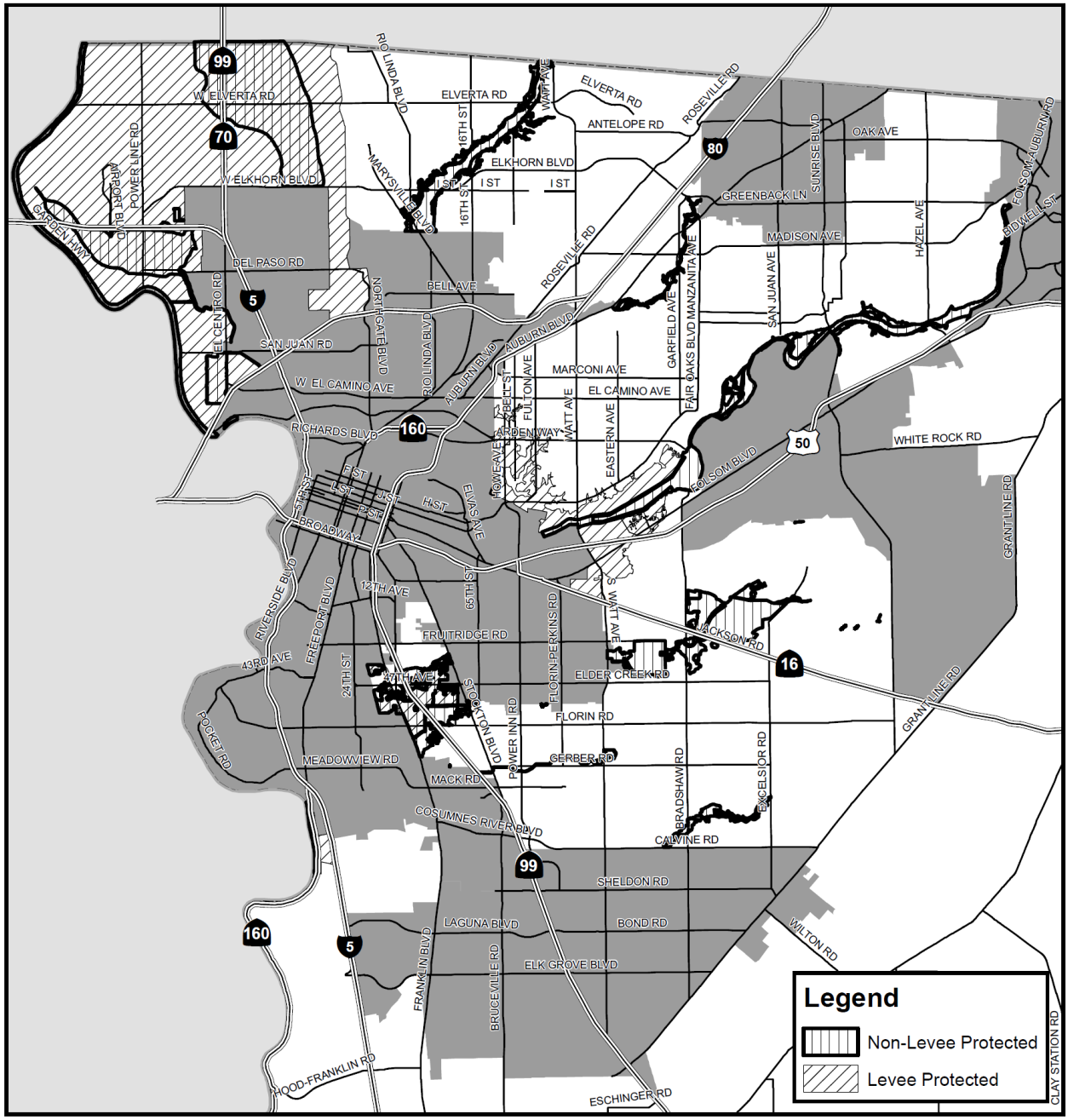
The flood risk assessment included a detailed analysis of historic and existing conditions through documentation of past occurrences and various mapping efforts conducted by multiple agencies, as well as an evaluation of areas likely to flood in the future/future flooding conditions. Future flooding conditions were considered by the County for this assessment using a variety of tools:

- The new FEMA DFIRMs (6/16/2015) and updated FIS provide information on the updated 1% and 0.2% annual chance floods and X-protected by levee areas based on the latest studies and considering recent growth and development in the County. This new mapping is a representation of areas subject to major floods in the future and is used for regulatory and future planning and development purposes.
- Local Flood Mapping prepared by Sacramento County Department of Water Resources. These maps have local floodplains identified throughout the County that are based on high water data, local hydrologic and hydraulic studies, and other reports of flooding.
- The County also maintains a separate database and mapping effort of all RL and historical loss properties in the County. This RL/historical loss analysis is also used to identify areas likely to flood in the future and to assist with the development of mitigation measures to mitigate future flood damage to these areas. This information and analysis is included in the County's and City of Sacramento's updated 2015 RLAA Reports, attached as an Appendix to this plan.
- Also to be considered when evaluating future flood conditions in the Sacramento County planning area, the California DWR developed Best Available Maps (BAM)/Flood Awareness Maps. These maps were developed to provide communities with an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. These preliminary maps include the 100-, 200- and 500-year floodplains to provide information on the true risk of flooding to allow communities to make informed floodplain management and property use decisions. These advisory maps are intended to help communities begin implementing activities to meet SB 5 requirements calling for a minimum of 200-year protection for new development in urban and urbanizing area.

Regulatory Considerations for Future Flood Conditions

As previously described, Sacramento County and participating jurisdictions have been evaluating and determining the impact of both existing and future flood conditions, including development of a local program to address the 200-year state requirement for the ULOP. The County is in the process of finalizing updates to the General Plan and Zoning Code addressing new flood protection requirements that establish a 200-year flood standard of protection in urban areas (e.g., ULOP). This is the primary policy change that will affect construction in urban or urbanizing areas that are in a SFHA or a Moderate Flood Zone. Areas not considered to be urbanizing will remain subject to the FEMA 0.1% standard of flood protection. Figure 4-86 shows the 200-year ULOP applicability areas within the unincorporated County. 200-year studies have been completed or are underway for areas that are non-levee protected. Proposed amendments address: agency coordination, setbacks along levees, elevation and construction standards, flood map data, flood emergency response, floodway management, building design standards, and the process for making legal determinations and project approvals for development in flood hazard zones.

Figure 4-86 Unincorporated Sacramento County – Urban Level of Flood Protection



In addition to the the applicability of the ULOP in unincorporated Sacramento County, the cities of ?????have completed this mapping; the City of ????have declared they are not subject to the State's 200-

year Urban Level of Protection (ULOP) standards due to location considerations which include population and contributing watershed size. The City of??? does not have any floodplains. More specifically within the unincorporated areas, it has been determined that the 200-year requirement through the ULOP is within the 100-year floodplain (according to the requirements of 3 feet of flooding, part of FEMA flood mapping in urban areas of 10,000 or more, and in the Sacramento-San Joaquin Watershed). Mapping of these areas will be part of implementation of the program moving forward

Future Flood Conditions: The Effects of Climate Change

The effects of climate change on future flood conditions should also be considered. While the risk and associated short and long term impacts of climate change are uncertain, experts in this field tend to agree that among the most significant impacts include those resulting from increased heat and precipitation events that cause increased frequency and magnitude of flooding. Changes associated with climate change and flooding could be significant given the effects of snowmelt runoff combined with significant rain events. Increases in damaging flood events may cause greater property damage, public health and safety concerns displacement, and loss of life. In addition, an increase in the magnitude and severity of flood events can lead to potential contamination of potable water and contamination of food crops given the agricultural industry in the County. Displacement of residents can include both temporary and long-term displacement.

Sacramento County will continue to study the risk and vulnerability associated with future flood conditions, both in terms of future growth areas and other considerations such as climate change, as they evaluate and implement their flood mitigation and adaptation strategy for the Sacramento County Planning Area.

Future Flood Conditions: ARkStorm Scenario

Also to be considered in evaluating potential "worst case" future flood conditions, is the ARkStorm Scenario. Although much attention in California's focuses on the "Big One" as a high magnitude earthquake, there is the risk of another significant event in California – a massive, statewide winter storm. The last such storms occurred in the 19th century, outside the memory of current emergency managers, officials, and communities. However, massive storms are a recurring feature of the state, the source of rare but inevitable disasters. The USGS Multi Hazards Demonstration Project's (MHDP) developed a product called ARkStorm, which addressed massive U.S. West Coast storms analogous to those that devastated California in 1861-1862. Over the last decade, scientists have determined that the largest storms in California are the product of phenomena called Atmospheric Rivers (discussed above in Section 4.2.14 in the discussion of Pineapple Express), and so the MHDP storm scenario is called the ARkStorm, for Atmospheric River 1000 (a measure of the storm's size).

Scientific studies of offshore deposits in northern and southern California indicate that storms of this magnitude and larger have occurred about as often as large earthquakes on the southern San Andreas Fault. Such storms are projected to become more frequent and intense as a result of climate change. This scientific effort resulted in a plausible flood hazard scenario to be used as a planning and preparation tool by hazard mitigation and emergency response agencies.

For the ARkStorm Scenario, experts designed a large, scientifically realistic meteorological event followed by an examination of the secondary hazards (e.g., landslides and flooding), physical damages to the intense

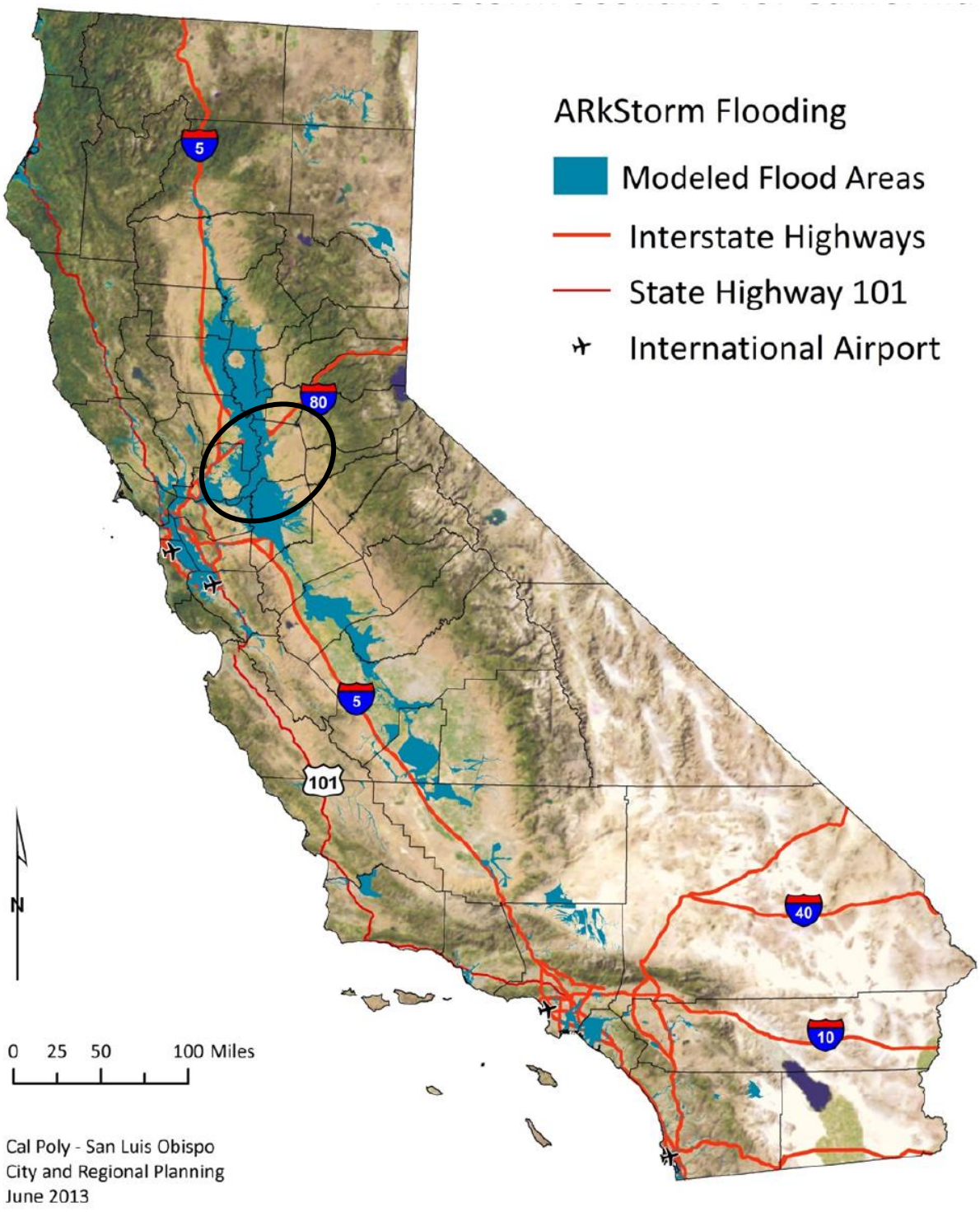
winter storms of 1861-62 that left California's Central Valley impassible. Storms far larger than the ARkStorm, dubbed megastorms, have also hit California at least six times in the last two millennia.

The ARkStorm produces precipitation in many places exceeding levels experienced on average every 500 to 1,000 years. Extensive flooding in many cases overwhelms the state's flood protection system, which is at best designed to resist 100- to 200-year runoffs (many flood protection systems in the state were designed for smaller runoff events). The Central Valley experiences widespread flooding. Serious flooding also occurs in Orange County, Los Angeles County, San Diego, the San Francisco Bay Area, and other coastal communities. In some places, winds reach hurricane speeds, as high as 125 miles per hour. Hundreds of landslides occur, damaging roads, highways, and homes. Property damage exceeds $300 billion, most of it from flooding. Agricultural losses and other costs to repair lifelines, dewater flooded islands, and repair damage from landslides brings the total direct property loss to nearly $400 billion, of which only $20 to $30 billion would be recoverable through public and commercial insurance. Power, water, sewer, and other lifelines experience damage that takes weeks or months to restore. Flooding evacuation could involve over one million residents in the inland region and Delta counties.

A storm of ARkStorm's magnitude has important implications: 1) it raises serious questions about the ability of existing national, state, and local disaster policy to handle an event of this magnitude; 2) it emphasizes the choice between paying now to mitigate, or paying a lot more later to recover; 3) innovative financing solutions are likely to be needed to avoid fiscal crisis and adequately fund response and recovery costs; 4) responders and government managers at all levels could be encouraged to conduct self-assessments and devise table-top exercises to exercise their ability to address a similar event; 5) the scenario can be a reference point for application of FEMA and Cal OES guidance connecting federal, state, and local natural hazards mapping and mitigation planning under the NFIP and Disaster Mitigation Act of 2000; and 6) common messages to educate the public about the risk of such an extreme event could be developed and consistently communicated to facilitate policy formulation and transformation.

Figure 4-87 depicts an ARkStorm modeled scenario showing the potential for flooding in the Central Valley as the result of a large storm. In Sacramento County, the modeled scenario suggests the westernmost portion of the County would face inundation.

Figure 4-87 Projected ARkStorm Flooding in California



Source: USGS ArkStorm

4.3.11. Flood: Localized Stormwater Flooding Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Medium

Historically, the planning area has been at risk to flooding primarily during the spring months when river systems in the County swell with heavy rainfall. Localized flooding also occurs throughout the planning area at various times throughout the year with several areas of primary concern unique to each City and the unincorporated County. Mapping of these areas is an ongoing effort by the County and Cities. However, affected localized flood areas and associated values identified by the County are summarized in Table 4-83.

Methodology

Areas in Sacramento County vulnerable to localized flooding were identified by the County and analysis was performed for the 2011 Plan Update. That analysis was updated here, using the 2010 DFIRM. Parcel and road segments vulnerable to these areas were tabulated by watershed, and are shown in Table 4-35 in Section 4.2.15. Road segments were initially selected if they were within 50 feet of an affected parcel. For the purposes of this analysis, parcels and road segments that overlapped watershed boundaries were counted for each of the watersheds. Parcels and road segments that intersect the 1% or.2% annual flood events (see DFIRM flood analysis, Section 4.3.10) were eliminated from these counts. It is important to note that localized flooding may also occur within those DFIRM zones, making this analysis a conservative approach.

There are 10,034 parcels affected by localized flooding (and outside of the DFIRM flood zones) in Sacramento County. Morrison Creek and Laguna Creek Watersheds have the highest counts of parcels affected, each with over 1,000. These are large watersheds that extend in a northeast-southwest orientation across the middle of the county and that cover unincorporated county and areas in Sacramento, Elk Grove and Rancho Cordova.

According to the County Assessor data, the mean (average) structure value of improved residential parcels county-wide is $295,000 (it was $158,665 in 2010). Assuming that the parcels listed in Table 4-35 are improved residential parcels, there is a total structure value of $2.9 billion at risk to localized flooding. Assuming contents value is 50% of residential structure value, there is a total value of $4.4 billion at risk. Applying the 20% loss due to flooding, the loss estimate for the planning area is $888 million. Total values at risk are shown in Table 4-83. Total population at risk to localized flooding is 27,192 (based on Census 2010 household factor of 2.71).

Table 4-83 Sacramento County Planning Area – Vulnerability to Localized Flooding

Parcel Count	Improved Value/Parcel*	Structure Value	Contents Value	Total Value	Loss Estimate
10,034	$295,000	$2,960,030,000	$1,480,015,000	$4,440,045,000	$888,009,000

*mean value of an improved residential structure

Future Development

Much of the growth in Sacramento County is occurring through expansion of the urban areas, causing a significant increase in peak flow and stormwater runoff. Such growth can consume previously undeveloped acres, and the impacts may overwhelm existing drainage and flood control facilities.

The potential for flooding may increase as stormwater is channeled due to land development. Such changes can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. Floodplain modeling and master planning should be based on build out property use to ensure that all new development remains safe from future flooding. While local floodplain management, stormwater management, and water quality regulations and policies address these changes on a site-by-site basis, their cumulative effects can have a negative impact on the floodplain.

The risk of stormwater/localized flooding to future development can be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater through compliance with stormwater management regulations or choosing not to develop in areas that often are subject to localized flooding will reduce future risks of losses due to stormwater/localized flooding.

4.3.12. Levee Failure Vulnerability Assessment

Likelihood of Future Occurrence—Occasional
Vulnerability—Medium

Levee failure flooding can occur as the result of partial or complete collapse of an impoundment, and often results from prolonged rainfall and flooding. The primary danger associated with dam or levee failure is the high velocity flooding of those properties downstream of the breach. Section 4.2.17 Levee Failure describes the levee inventory in the Sacramento County Planning Area.

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to levee failures is generally confined to the areas subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the facility and associated revenues that accompany those functions.

Approximately 150 years ago, the levees of the Sacramento-San Joaquin Delta were raised to prevent flooding on what remains some of the most fertile farmland in the nation. While the peat soils were excellent for agriculture, they were not the best choice to create strong foundations for levee barriers meant to contain a constant flow of river water. Nevertheless, it was these native soils that were primarily used to create the levee system.

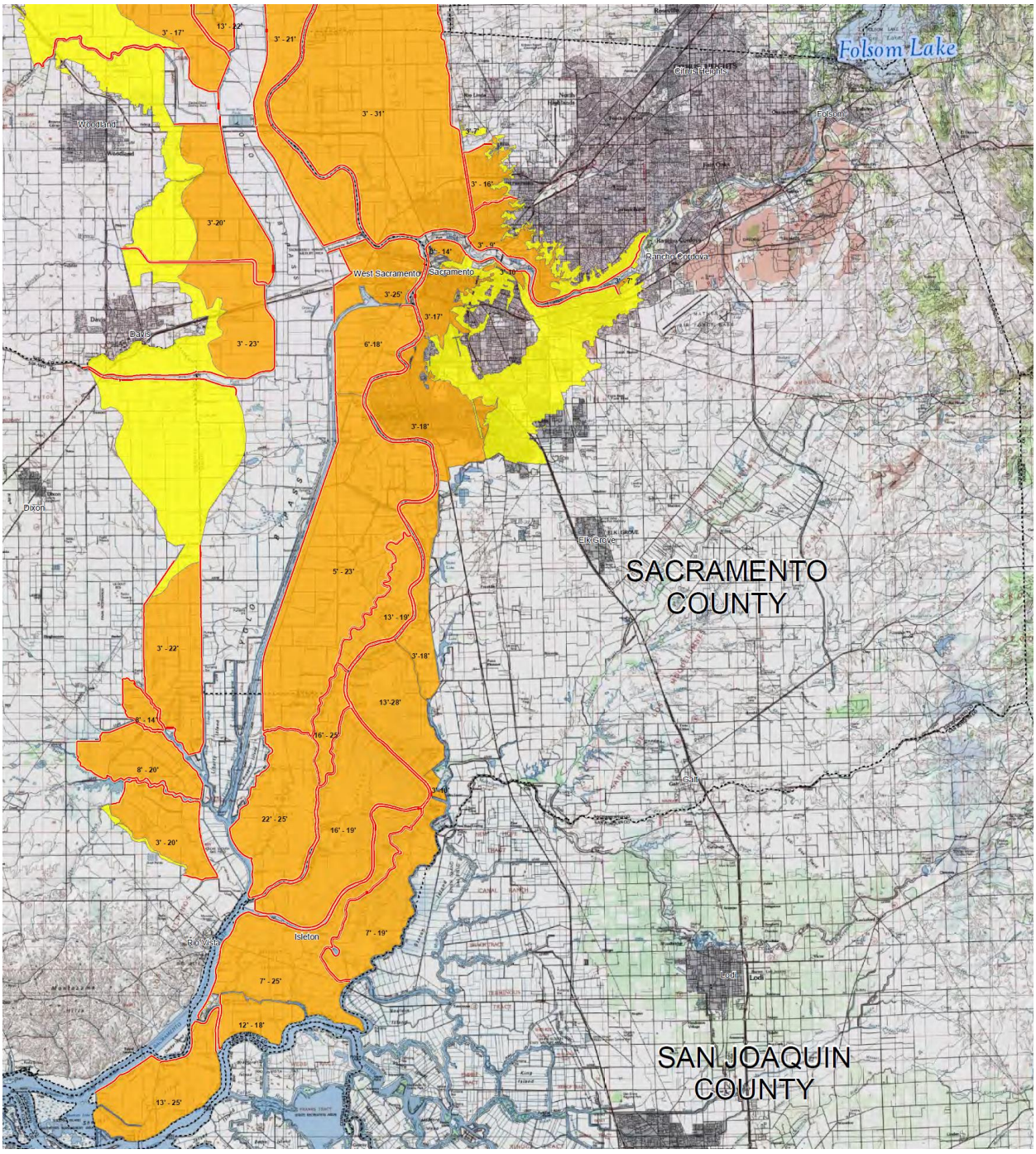
Levee failure flooding would vary in the County depending on which structure fails and the nature and extent of the failure and associated flooding. This flooding presents a threat to life and property, including buildings, their contents, and their use. Large flood events can affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, agricultural industry, and the local and regional economies.

Levee Flood Protection Zones

Levee Flood Protection Zones estimate the maximum area that may be inundated if a project levee fails when water surface elevation is at the top of a project levee. Zones depicted on Figure 4-88 do not necessarily depict areas likely to be protected from flow events for which project levees were designed. Figure 4-88 illustrates the depths of flooding should a levee that protects that area fail.

Lands within the Levee Flood Protection Zones and other leveed areas may be subject to flooding due to various factors, including the failure or overtopping of project or non-project levees, flows that exceed the design capacity of project or non-project levees, and flows from water sources not specifically protected against by project levees. Lands not mapped within a Levee Flood Protection Zone and within other areas protected by a levee are not invulnerable to flood risk, and some may also experience flooding from these or other related events.

Figure 4-88 Expected Flood Depths from Levee Failure



Levee Flood Protection Zones

- Estimated Depth Greater Than 3' (Numbers shown indicate approximate inundation depths)
- Depth Unknown
- Butte Basin: Not an LFPZ - area is designed to flood. Area shown is based on historical limits of flooding.
- State Federal Project Levee
- County Boundary

Source: DWR, USGS

Values at Risk

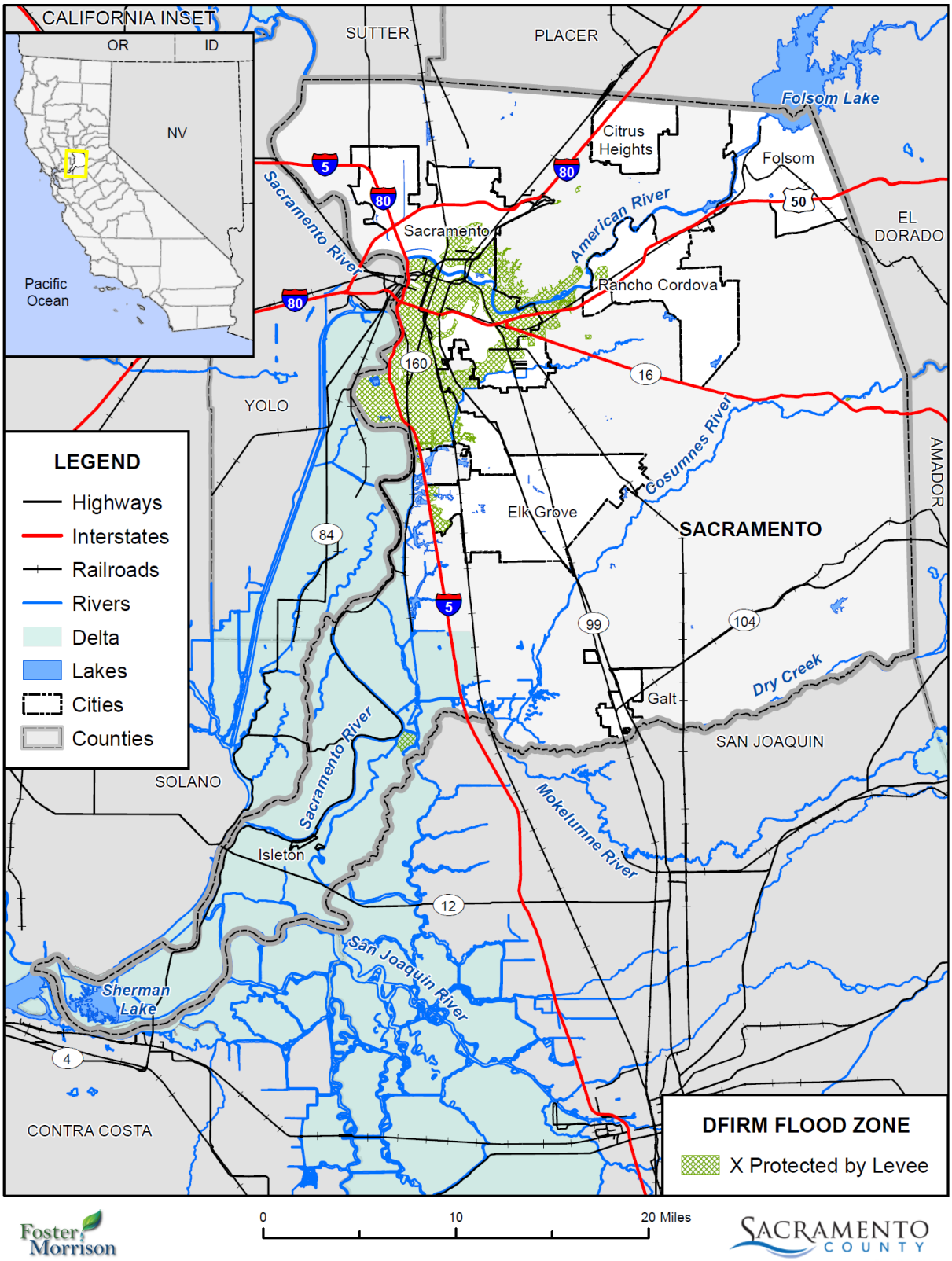
X Protected by Levee Analysis

Methodology

Unincorporated Sacramento County and its incorporated jurisdictions have mapped flood hazard areas. This includes areas protected by levees. GIS was used to determine the possible impacts of flooding in areas protected by levee within the County, and how the risk varies across the planning area. The following methodology was followed in determining improved parcel counts and values at risk to levee failure. Sacramento's parcel and associated secured roll assessor 2015 data was used as the basis for the countywide inventory of developed parcels, land value, and structure value. Sacramento County's current FEMA DFIRM, obtained from the FEMA National Flood Hazard Layer and dated April 16, 2016was utilized to perform this analysis of areas protected by levees. GIS was used to create a centroid, or point representing the center of the parcel polygon. DFIRM data was then overlaid on the parcel centroids. For the purposes of this analysis, the X-protected by levee flood zone that intersected a parcel centroid was assigned that zone for the entire parcel. The model assumes that every parcel with a structure value greater than zero is improved in some way. It is important to note that there could be more than one structure on an improved parcel (i.e. condo complex occupies one parcel but might have several structures).

Figure 4-89 contains flood analysis results for area protected by a levee (i.e. designation of X Protected by Levee) for the entire Sacramento County Planning Area. GIS was used to create a centroid, or point representing the center of the parcel polygon. The DFIRM data was then overlaid on the parcel centroids to determine how much value is at risk falls within the X-protected by levee flood zone. Based on FEMA guidance for levee failure, contents value is estimated at 50 percent of the improved structure value. This analysis includes unincorporated Sacramento County and the incorporated communities and shows the number of parcels and values at risk to potential levee failure events. There are 77,740 parcels with a structure value of $18,178,787,817 in the X Protected by Levee zone in Sacramento County, as shown on Table 4-84. Structures protected by levees that fail are often total losses (see Figure 4-41 in Section 4.2.17). According to the analysis, total loss for the County is estimated to be almost $27 billion. This assumes all levees in the County break at one time, which is unlikely. The extent and depth of actual flooding and associated damage will vary depending on the location, nature, depth, and extent of any levee break.

Figure 4-89 Sacramento County Planning Area - X Protected by Levee Zones



Data Source: Sacramento County GIS, Cal-Atlas, FEMA NFHL 04/16/2016; Map Date: 05/2016.

Table 4-84 Count and Structure Value of Improved Parcels by Land Use in X Protected by Levee Zone Sacramento County

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value	Contents Value	Total Loss Estimate
Citrus Heights	0	0	$0	$0	$0	$0	$0
Elk Grove	2,359	2,261	$261,870,363	$778,210,531	$1,040,080,894	$389,105,266	$1,167,315,797
Folsom	0	0	$0	$0	$0	$0	$0
Galt	0	0	$0	$0	$0	$0	$0
Isleton	0	0	$0	$0	$0	$0	$0
Rancho Cordova	826	796	$41,727,801	$113,935,128	$155,662,929	$56,967,564	$170,902,692
City of Sacramento	69,158	64,495	$6,259,968,574	$14,814,016,310	$21,073,984,884	$7,407,008,155	$22,221,024,465
Unincorporated Sacramento County	10,654	10,188	$1,077,093,916	$2,472,625,848	$3,549,719,764	$1,236,312,924	$3,708,938,772
Total	**82,997**	**77,740**	**$7,640,660,654**	**$18,178,787,817**	**$25,819,448,471**	**$9,089,393,909**	**$27,268,181,726**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data; Sacramento County DFIRM, April 2016

Other values at risk from levee failure include agricultural crop loss. High value crops are grown in the Delta and other agricultural areas would be at risk to levee failure. Specific dollar values of crops protected by levees was not available for this plan.

Population at Risk

A separate analysis was performed to determine population in the X Protected by Levee areas. Using GIS, the X Protected by Levee DFIRM Zone was overlaid on the improved residential parcel data. Those parcel centroids that intersect the levee protected area were counted and multiplied by the Census Bureau household factor for each jurisdiction; and results were tabulated in Table 4-85. According to this analysis, there is a population of 193,533 in the X Protected by Levee Zone for the Sacramento County Planning Area.

Table 4-85 Sacramento County Planning Area – X Protected by Levee – Improved Residential Parcels and Population

Jurisdiction	Improved Residential Parcels	Population*
Citrus Heights	0	0
Elk Grove	2,193	5,548
Folsom	0	0
Galt	0	0
Isleton	0	0
Rancho Cordova	792	2,178

Jurisdiction	Improved Residential Parcels	Population*
Sacramento	61,023	159,880
Unincorporated	9,567	25,927
Total	**73,575**	**193,533**

Source: Sacramento County 2016 Parcel/2015 Assessor's Data; Sacramento County DFIRM, June 2016; US Census Bureau
*Census Bureau 2010 average household sizes are: Citrus Heights – 2.53; Elk Grove – 3.18; Folsom – 2.61; Galt – 3.24; Isleton – 2.43; Rancho Cordova – 2.75; City of Sacramento – 2.62; Unincorporated County – 2.71

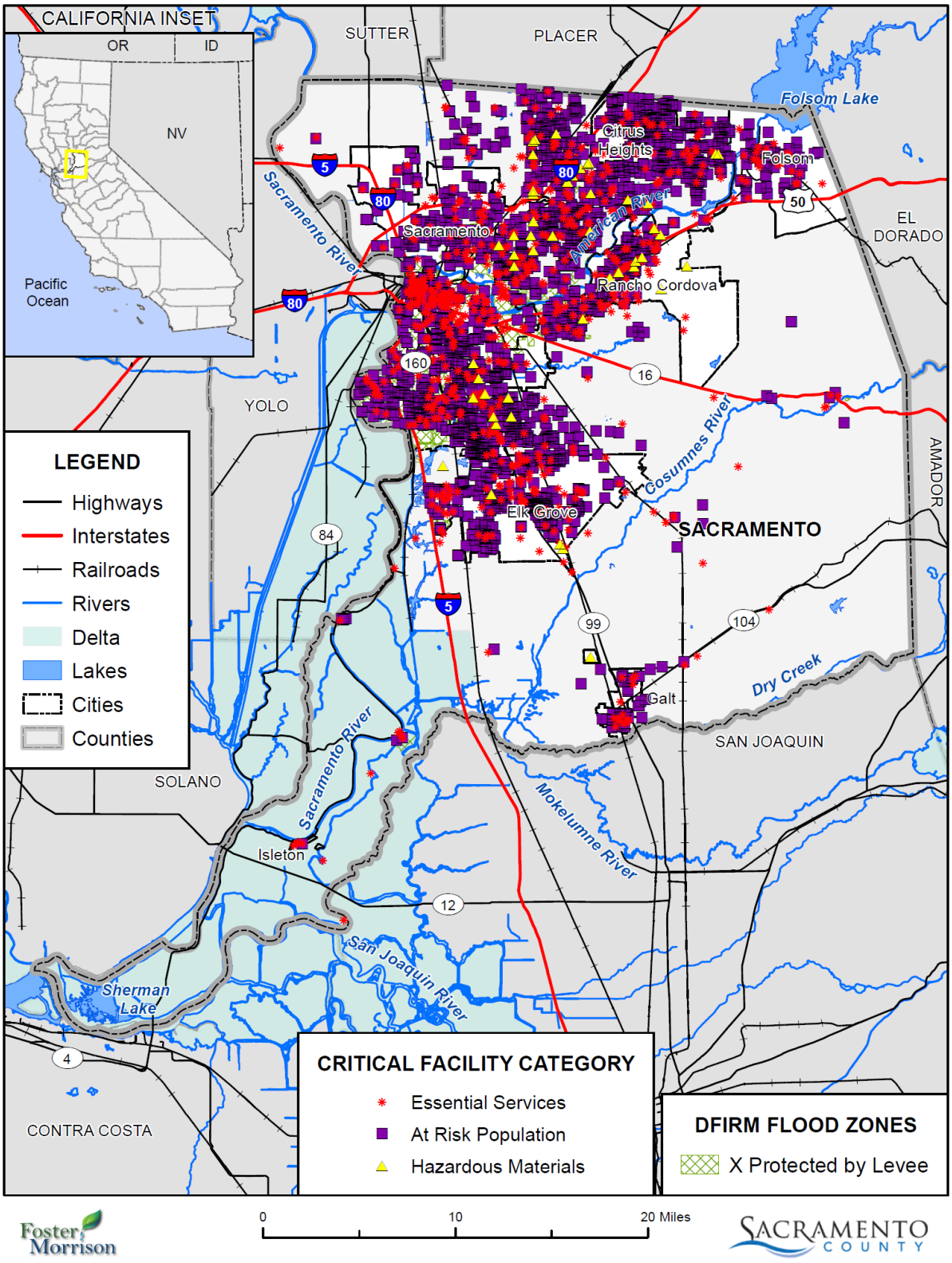
Cultural and Natural Resources at Risk

The Sacramento County Planning Area has significant cultural and natural resources located throughout the County as previously described. Vulnerability analysis of these resources was not possible due to data limitations.

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Sacramento County. GIS was used to determine whether the facility locations intersect the X Protected by Levee hazard areas. These are shown in Figure 4-90. Table 4-86 details critical facilities by facility type and count for the Planning Area, while Table 4-87 details the critical facilities for the unincorporated County. Details of critical facility definition, type, name and address and jurisdiction by flood zone are listed in Appendix E.

Figure 4-90 Sacramento County Planning Area – Critical Facilities in X Protected by Levee Zones



Data Source: Sacramento County GIS, Cal-Atlas, FEMA NFHL 04/16/2016; Map Date: 05/2016.

Table 4-86 Sacramento County Planning Area – Critical Facilities in DFIRM X Protected by Levee Flood Zones

Critical Facility Category	Facility Type	Facility Count
Essential Services Facilities	Airport	1
	Bus Terminal	4
	Convention Center	1
	Drainage	1
	Emergency Evacuation Shelter	59
	Fire Station	19
	General Acute Care Hospital	2
	Government Facilities	18
	Light Rail Stop	26
	Medical Health Facility	79
	Police	2
	Sand Bag	2
	Stadium	2
	Vehicle and Equipment Storage	1
	Water Treatment Plant	1
	Total	**218**
At Risk Population Facilities	Adult Day Care	11
	Adult Education School	4
	Adult Residential	61
	Assisted Living Centers	3
	Charter School	5
	College/University	2
	Community Day School	2
	Day Care Center	107
	Group Home	18
	Hotel	16
	Independent Study School	1
	Infant Center	11
	Private Elementary School	11
	Private High School	6
	Private K-12 School	4
	Public Elementary School	56
	Public High School	5
	Public Middle School	9
	Residential Care/Elderly	45

Critical Facility Category	Facility Type	Facility Count
	School	1
	School-Age Day Care Center	21
	Total	**399**
Hazardous Materials Facilities Total	Oil Collection Center	2
	Total	**2**
X Protected by Levee Total		**619**

Source: Sacramento County DFIRM, Sacramento County GIS

Table 4-87 Unincorporated Sacramento County – Critical Facilities in DFIRM X Protected by Levee Flood Zones

Critical Facility Category	Facility Type	Facility Count
Essential Services Facilities	Emergency Evacuation Shelter	11
	Fire Station	3
	Light Rail Stop	3
	Medical Health Facility	8
	Police	1
	Vehicle and Equipment Storage	1
	Total	**27**
At Risk Population Facilities	Adult Day Care	2
	Adult Residential	12
	Charter School	1
	Day Care Center	14
	Group Home	5
	Hotel	1
	Infant Center	2
	Private Elementary School	1
	Private High School	2
	Private K-12 School	1
	Public Elementary School	10
	Public High School	1
	Public Middle School	1
	Residential Care/Elderly	6
	School-Age Day Care Center	3
	Total	**62**
Hazardous Materials Facilities	Oil Collection Center	1
	Total	**1**
X Protected by Levee Total		**90**

Source: Sacramento County DFIRM, Sacramento County GIS

Overall Community Impact

Levee failures and their impacts vary by location and severity of any given flood event and will likely only affect certain areas of the County during specific times. Based on the risk assessment, it is evident that levee failures will continue to have potentially devastating economic impacts to certain areas of the County. Impacts that are not quantified, but can be anticipated in large future events, include:

- Commercial and residential structural and property damage;
- Costs incurred due to post-flood clean up and repair of buildings and infrastructure;
- Damage to roads/bridges resulting in loss of mobility;
- Decreased revenue due to loss of income, sales, tourism, and property taxes;
- Deterioration of homes and neighborhoods as floods recur;
- Disruption of and damage to public infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Impact on the overall mental health of the community;
- Injury and loss of life, including first responders rescuing those who did not evacuate or are stranded;
- Loss of historical or unique artifacts;
- Loss of jobs due to businesses closing or cutting back on operating hours;
- Loss of programs or services that are cut to pay for flood recovery;
- Mental health and family impacts, including increased occurrence of suicides and divorce
- Negative impact on commercial and residential property values;
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed; and
- Significant economic impact (jobs, sales, tax revenue) to the community.

Future Development

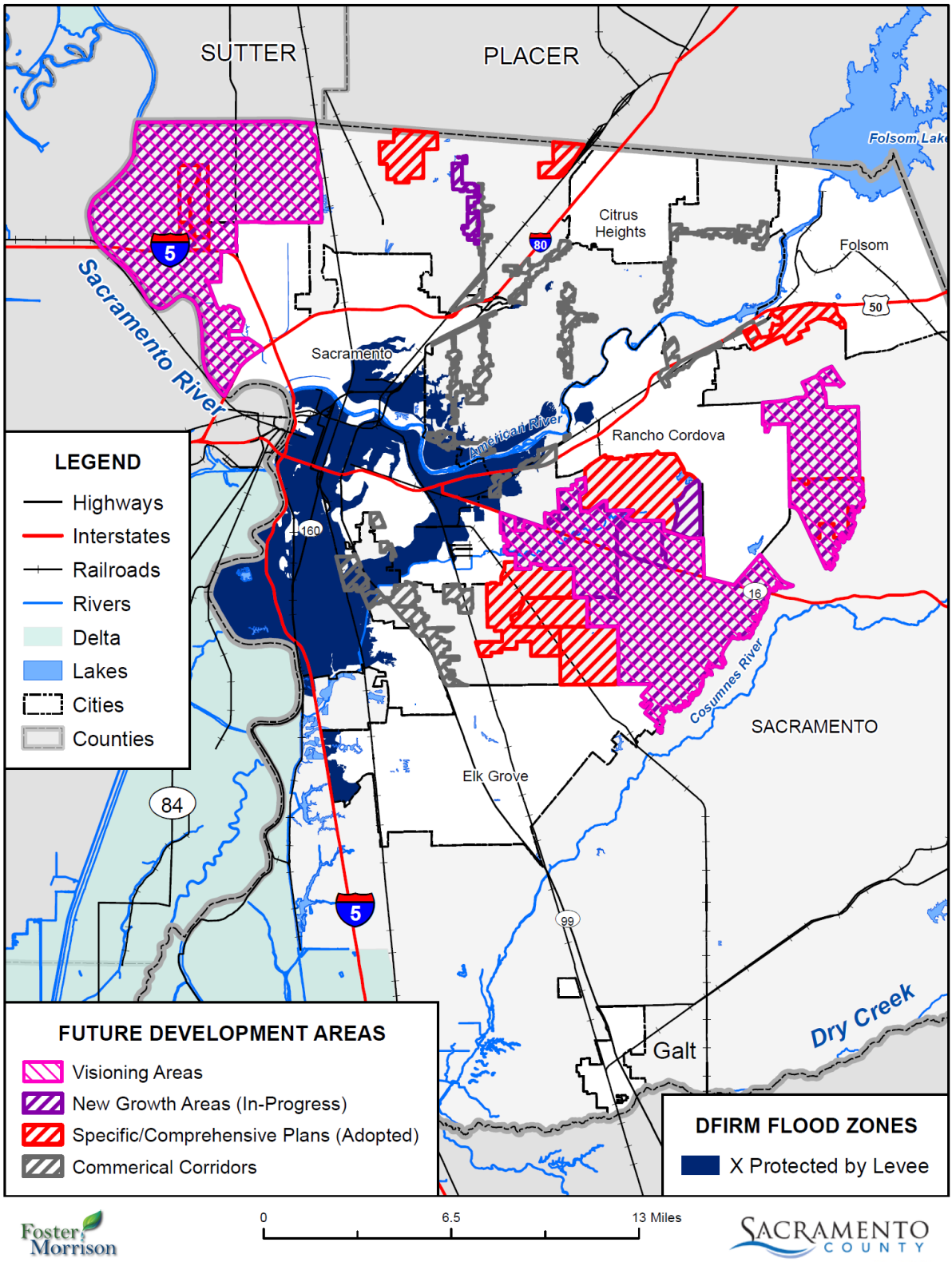
The HMPC detailed that SB 5 and levee improvements ULOP that will provide 200-year level of protection for urbanizing areas, as well as levee improvement projects to provide 100-year level in non urban areas. Both of these levee improvements will allow development in leveed areas to continue without being within a SFHA. For those areas where 100 and 200 cannot be met to accredit/certify these levees, then development standards associated with their FEMA floodzones would apply; most likely the SFHA

Future Development GIS Analysis

Visioning areas, new growth areas, specific plan areas, commercial corridors data is maintained by Sacramento County, and was made available for this plan. A simple analysis was performed to quantify parcels within these development areas that are also in flood hazard areas. Results can serve as confirmation for future development.

GIS was used to determine the number of parcels in the X Protected by Levee flood zones within visioning areas, specific plan areas, new growth areas, and commercial corridor areas. GIS was used to create a centroid, or point representing the center of the parcel polygon. Those parcels centroids that fall inside the future development areas and that were within the X Protected by Levee flood zone were selected and tabulated in Figure 4-91 and shown in Table 4-88.

Figure 4-91 Sacramento County Planning Area – Future Development in X Protected by Levee DFIRM Flood Zones



Data Source: Sacramento County GIS, Cal-Atlas, FEMA NFHL 04/16/2016; Map Date: 05/2016.

Table 4-88 Sacramento County Planning Area – Future Development in X Protected by Levee DFIRM Flood Zones

Area	Parcels	Acres	DFIRM Flood Zone
Visioning Area			
Jackson	1,099	21,670	A, AE, AO, 0.2% Annual Chance, X-Protected by Levee, X
Plan Areas			
West Jackson Highway Master Plan	455	6,181	A, AE, AO, 0.2% Annual Chance, X-Protected by Levee, X
Corridor Areas			
Corridor 9	946	290	AE, 0.2% Annual Chance, X-Protected by Levee, X
Corridor 11	266	76	X-Protected by Levee, X
Corridor 12	2,537	1,929	A, AE, AH, 0.2% Annual Chance, X-Protected by Levee, X
Corridor 17	203	254	A, 0.2% Annual Chance, X-Protected by Levee, X
Corridor 19	48	130	0.2% Annual Chance, X-Protected by Levee
New Growth Areas			
West Jackson Highway	455	6,181	A, AE, AO, 0.2% Annual Chance, X-Protected by Levee, X

Source: Sacramento County GIS, Sacramento County DFIRM June 16, 2015

4.3.13. River/Stream/Creek Bank Erosion Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Medium

Sacramento is traversed by many waterways, both large and small (see Figure 4-41 and Table 4-33). These locations are all subject to bank erosion. Certain developed areas that abut creeks and rivers in the County are at risk to continued bank erosion. The HMPC noted that areas of the American River near the Fair Oaks area were at risk to continued erosion, and possible landslide, of American River banks. Levees are at risk to erosion as well, due to the channelization due to narrow river channels, high water levels, and wave action from boating. The annual costs of repairs to the banks of rivers and levees can vary, but the average cost of erosion repairs done under the Sacramento Bank Protection program by the Corps of Engineers/Central Valley Flood Protection Board has averaged between $2 million to $3 million a year over the last several years within SAFCA's jurisdiction.

Future Development

Planned developments should take erosion risk areas into account during the construction of new homes and commercial properties. Enforcement of leveed setback areas may also prevent erosion due to encroachment activities. The County will continue to enforce the zoning, subdivision, and development ordinances that are discussed in Section 4.4.1.

4.3.14. Severe Weather: Extreme Temperatures – Heat Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Medium

Extreme heat happens in Sacramento County each year. Limited data on temperature extreme impacts per County was available during the development of this hazard's profile. Extreme heat normally does not impact structures as there may be a limited number of days where the temperatures stay high which gives the structure periodic relief between hot and cool temperature cycles. Areas prone to excessively high temperatures are identified normally on a nation-wide assessment scale, which doesn't allow detailed results on specific structures.

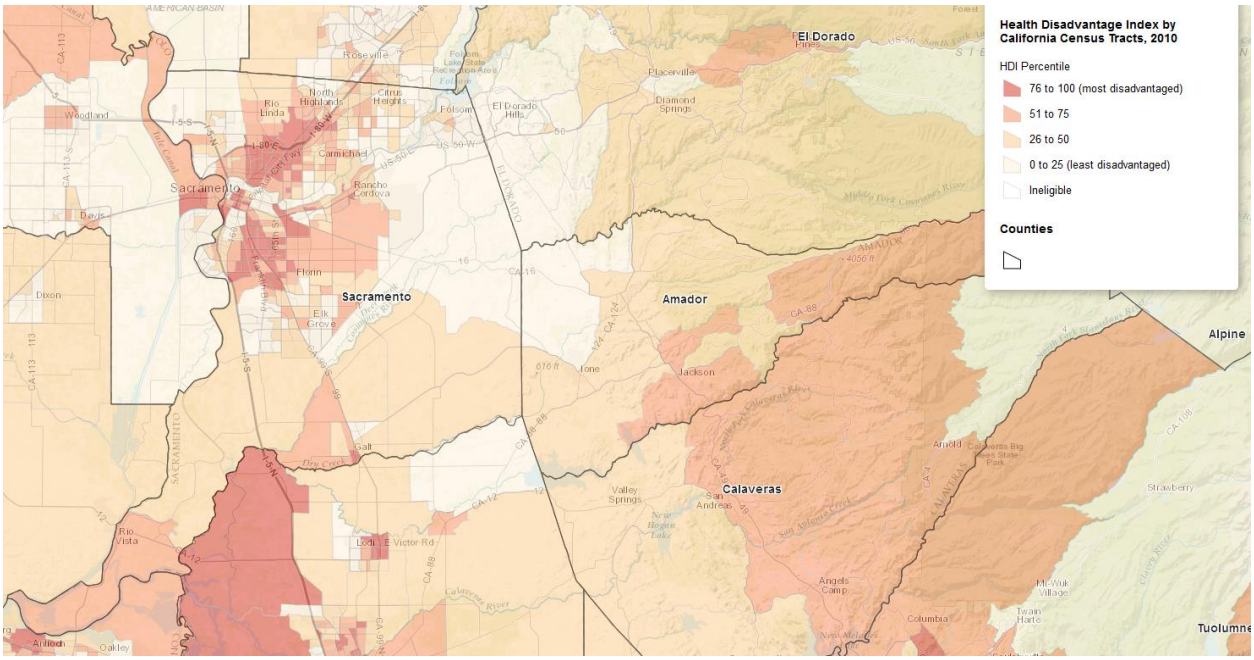
Recent research indicates that the impact of extreme temperatures, particularly on populations, has been historically under-represented. The risks of extreme temperatures are often profiled as part of larger hazards, such as severe winter storms or drought (see Section 4.3.7). However, as temperature variances may occur outside of larger hazards or outside of the expected seasons but still incur large costs, it is important to examine them as stand-alone hazards. Extreme heat may overload demands for electricity to run air conditioners in homes and businesses during prolonged periods of exposure and presents health concerns to individuals outside in the temperatures. Extreme heat may also be a secondary effect of droughts, or may cause drought-like conditions in a temporary setting. For example, several weeks of extreme heat increases evapotranspiration and reduces moisture content in vegetation, leading to higher wildfire vulnerability for that time period even if the rest of the season is relatively moist.

Vulnerable populations to extreme heat include:

- Homeless
- Infants and children under age five
- Elderly (65 and older)
- Individuals with disabilities
- Individuals dependent on medical equipment
- Individuals with impaired mobility

The Public Health Alliance has developed a composite index to identify cumulative health disadvantage in California. Factors such as those bulleted above were combined to show what areas are at greater risk to hazards like extreme heat. This is shown on Figure 4-92.

Figure 4-92 Health Disadvantage Index by California Census Tract



Source: Public Health Alliance of Southern California

In addition to vulnerable populations, pets and livestock are at risk to extreme heat.

Future Development

As the County shifts in demographics, more residents will become senior citizens. The residents of nursing homes and elder care facilities are especially vulnerable to extreme temperature events. It is encouraged that such facilities have emergency plans or backup power to address power failure during times of extreme heat. Low income residents and homeless populations are also vulnerable. Cooling centers for these populations are opened when necessary.

4.3.15. Severe Weather: Heavy Rains and Storms (Thunderstorms, Hail, and Lightning) Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—Medium

According to historical hazard data, severe weather is an annual occurrence in Sacramento County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the County. Wind and lightning often accompany these storms and have caused damage in the past. However, actual damage associated with the primary effects of severe weather has been limited. It is the secondary hazards caused by weather, such as floods, fire, and agricultural losses that have had the greatest impact on the County. The risk and vulnerability associated with these secondary hazards are discussed in other sections (Section 4.2.14 Flood: 100/200/500-year, Section 4.2.15 Flood: Localized, Section 4.2.16 Levee Failure).

Future Development

New critical facilities should be built to withstand heavy rains, hail damage, and lightning. While minimal damages have occurred to critical facilities in the past due to heavy rains, lightning, and hail, there still remains future risk. With development occurring in the region, future losses to new development may occur.

4.3.16. Wildfire Vulnerability Assessment

Likelihood of Future Occurrence—Highly Likely
Vulnerability—High

Risk and vulnerability to the Sacramento County Planning Area from wildfire is of significant concern, with some areas of the Planning Area being at greater risk than others as described further in this section. High fuel loads in the Planning Area, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. During the May to October fire season, the dry vegetation and hot and sometimes windy weather, combined with continued growth in the WUI areas, results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the Planning Area, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

Wildfires can cause short-term and long-term disruption to the County. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the County by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires may result in casualties and can destroy buildings and infrastructure.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In some cases, the economic impact of this loss of services may be comparable to the economic impact of physical damages or, in some cases, even greater. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Fires can also cause major damage to power plants and power lines needed to distribute electricity to operate facilities as well as impact the agricultural industry.

Sacramento County Communities at Risk to Wildfire

The National Fire Plan is a cooperative, long-term effort between various government agency partners with the intent of actively responding to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. For purposes of the National Fire Plan, CAL FIRE generated a list of California communities at risk for wildfire. The intent of this assessment was to evaluate the risk to a given area from fire escaping off federal lands. Three main factors were used to determine the wildfire

threat in the wildland-urban interface areas of California: fuel hazards, probability of fire, and areas of suitable housing density that could create wildland urban interface fire protection strategy situations. The preliminary criteria and methodology for evaluating wildfire risk to communities is published in the Federal Register, January 4, 2001. The National Fire Plan identifies 13 "Communities at Risk" in Sacramento County. These are shown in Table 4-89.

Table 4-89 Sacramento County Communities at Risk to Wildfire

Communities at Risk		
Fair Oaks	Mather Air Force Base	Rio Lindo
Folsom	North Highlands	Rosemont
Galt	Orangevale	Sacramento
Isleton	Rancho Cordova	
La Riviera	Rancho Murieta	

Source: CAL FIRE

Beetle Kill and Tree Mortality

Drought can weaken trees, making them less resistant to bark beetles. These beetles attack trees weakened trees and can kill them. These trees then become fuel for wildfires. This is discussed in greater detail in Section 4.3.7.

On October 30, 2015, Governor Brown proclaimed a State of Emergency and included provisions to expedite the removal and disposal of dead and dying hazardous trees. As a result, costs related to identification, removal, and disposal of dead and dying trees caused from drought conditions may be eligible for California Disaster Assistance Act (CDAA) reimbursement.

CAN THE HMPC DESCRIBE AREAS THAT ARE OF CONCERN AND WHY? PROVIDE DETAILS ON AREAS WITH HIGH TREE MORTALITY RATES AND THE CAUSES AND ANY IMPACTS FROM THIS

Wildfire and Air Quality

During many summer months in past years, Sacramento County residents have had to breathe wildfire smoke. Wildfire smoke is particularly dangerous because it contains a key air pollutant known as PM 2.5, or fine particulate matter less than 2.5 microns in diameter. These particulates are small enough to travel deep into the lungs causing short-term health impacts while aggravating long-term, existing respiratory and heart issues. For example, a report in *Climate Central* indicated that wildfire smoke can exacerbate chronic heart and lung disease, trigger asthma attacks and heart attacks, and increase visits to emergency rooms and hospitalizations. (l)

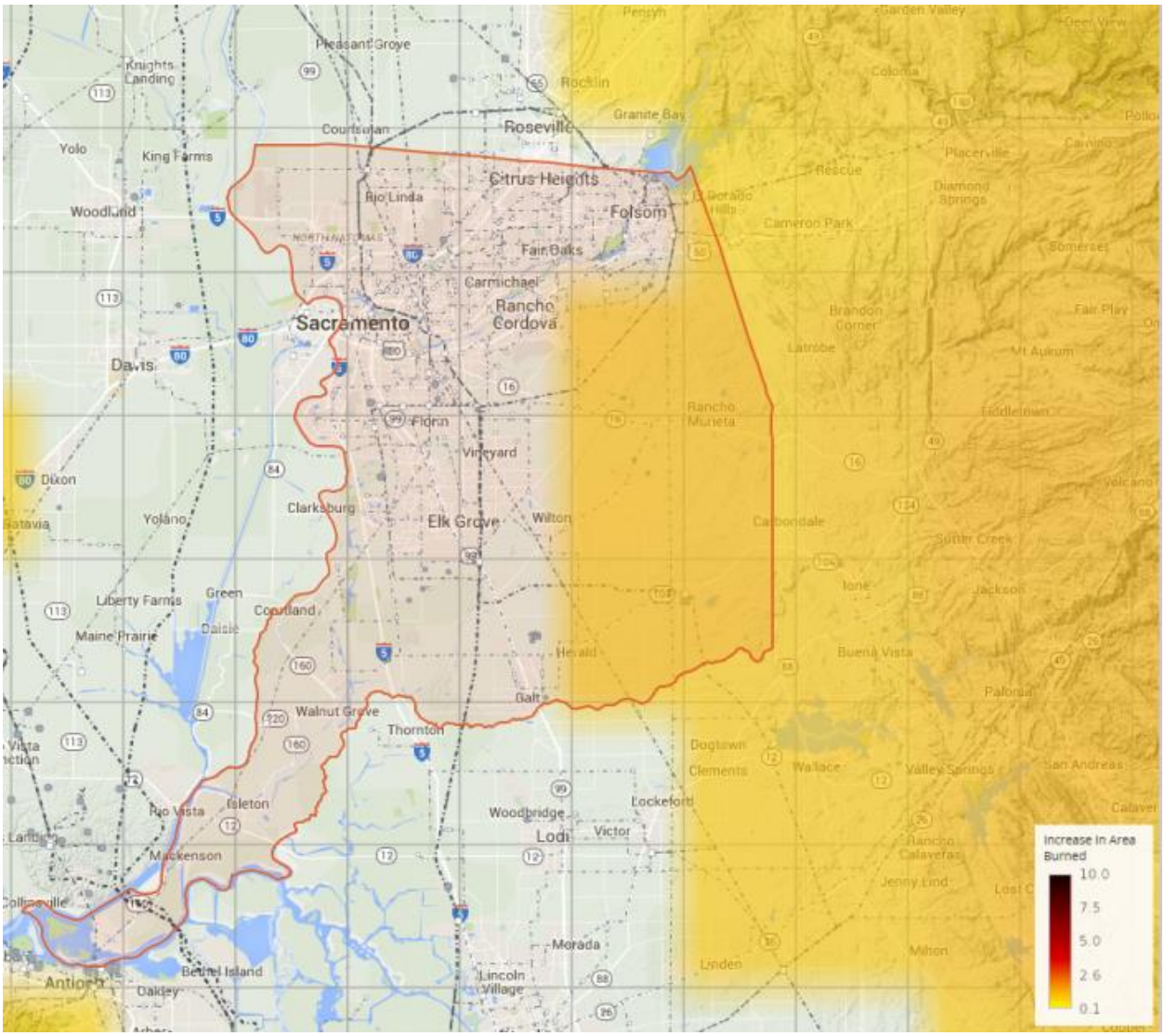
During the summers of 2013 through 2015, several wildfire incidents occurred in Northern California that increased PM2.5 concentration within Sacramento County. When Sacramento air quality is affected by wildfire smoke, whether from fires within the County or from throughout Northern California, the Sacramento County Air Pollution Control Officer will work with the County health department to issue

health advisories to residents. These advisories are sent to the media, including newspapers, TV, radio, the community, and posted on county websites and the regional Spare the Air website.

While Sacramento-specific projections on future wildfire risk are limited, overall wildfire risk in California is expected to increase as a result of reduced precipitation, rising temperatures, deteriorating forest health due to drought, heat, and tree disease and pests; and logging dead trees. According to a study by Climate Central, wildfires burning within 50-100 miles of a city generally caused air quality to be 5-15 times worse than normal. On average, in the U.S. West there are now twice as many fires burning each year as there were in the 1970s. A recent Yale University study published in *Climatic Change* predicts a significant increase in the number of days that people in the western U.S. will be exposed to wildfire smoke by 2050. The number of people exposed to "smoke waves," or consecutive days with poor air quality due to wildfires, will also increase from 57 million today to 82 million by 2050, the majority of whom will be in northern California, western Oregon, and the Great Plains.

Cal-Adapt is an online tool put together by the California Energy Commission that downscales global climate models to the California level with projections for sea-level rise, drought, temperature increase, heat, and wildfire, from 2020 out to 2085. Figure 4-93 shows the 2020 wildfire projection for Sacramento County. The lines represent transmission lines and the dots and squares power lines and transmission lines. Air quality in these areas of the County would be lower due to wildfire if the scenario projected is accurate.

Figure 4-93 2020 Wildfire Projections for Sacramento County



Source; Cal-Adapt

Assets at Risk

Unincorporated Sacramento County and the incorporated jurisdictions have mapped CAL FIRE fire threat areas. GIS was used to determine the possible impacts of wildfire within the County and how the wildfire risk varies across the Planning Area. The following methodology was followed in determining improved parcel counts and values by fire threat. Analysis on assets at risk to wildfire in the County is provided for two different areas in this base plan:

- Sacramento County Planning Area
- Unincorporated Sacramento County

The Sacramento County Planning Area includes both the unincorporated County and all of the incorporated jurisdictions, essentially the entire geographical area of Sacramento County. Summary tables for the

Planning Area are presented below. For the unincorporated County, both summary and detail tables are shown and discussed below. Detail tables for the participating jurisdictions are included in their respective annexes to this plan.

Methodology

Cal Fire develops and maintains datasets related to wildland fire threat and risk. The Fire Threat dataset, created in 2004, was used for analysis on unincorporated Sacramento County and for the county's seven incorporated areas including Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova and Sacramento. This fire threat layer was used for loss estimation purposes based on its comprehensive coverage of the planning area. Sacramento County's parcel and associated assessor data was used as the basis for the countywide inventory of developed parcels, or structures.

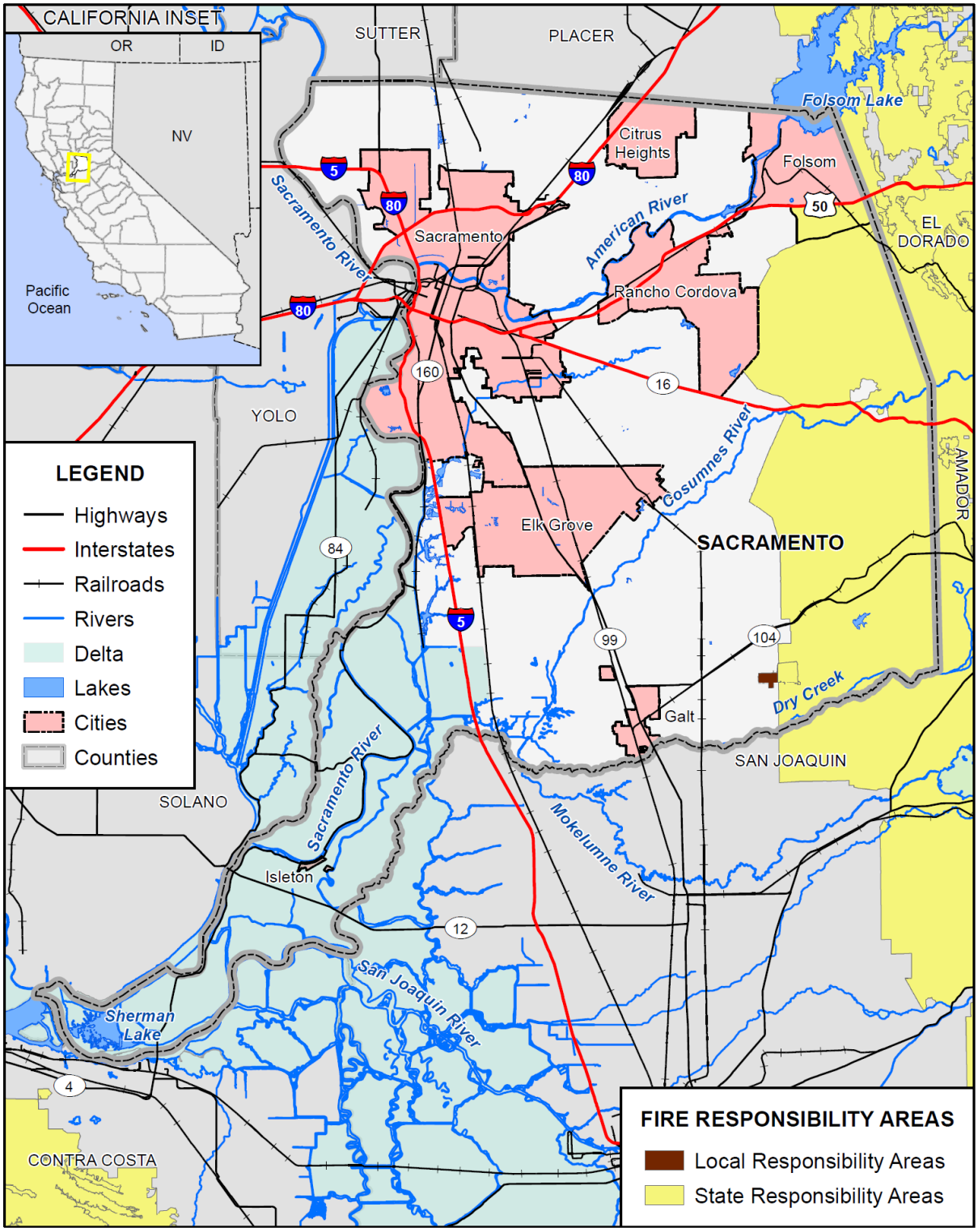
The Fire Threat dataset is a combination of fire frequency, or the likelihood of a given area to burn, and potential fire behavior. Fire rotation is calculated using fifty years of fire history, as well as climate, vegetation, and land ownership information. Fuel rank is calculated based on expected fire behavior for unique combinations of topography and vegetative fuels under given weather conditions (wind speed, humidity, temperature, and fuel moistures). Fuel rank and fire rotation are then combined to create the 5 threat classes in the Fire Threat dataset, ranging from Little or No Threat to Extreme Threat.

GIS was used to create a centroid, or point representing the center of the Sacramento County parcel polygon. Fire Threat was then be overlayed on the parcel centroids. For the purposes of this analysis, the wildfire threat zone (Little or No Threat | Moderate | High | Very High | Extreme) that intersected a parcel centroid was assigned as the threat zone for the entire parcel.

Responsibility Areas

CAL FIRE has a legal responsibility to provide fire protection on all SRA lands, which are defined based on land ownership, population density and property use. CAL FIRE is now also responsible for determining parcels subject to the SRA Fire Prevention Fee under AB X1 29. This dataset (SRA15_2) represents SRA status as of 7/1/2015 and was used for the final determination of which parcels were potentially eligible for the fee. CAL FIRE's State Responsibility Area layer was used in this analysis to show Sacramento County's values, inventory and population by Federal Responsibility Area (FRA), SRA, and LRA. The FRA in the County contains no improved properties. The largest number of improved properties is in the LRA. Locations of each responsibility area are shown in Figure 4-94.

Figure 4-94 Sacramento County FRA, SRA, LRA Wildfire Responsibility Areas



Data Source: Sacramento County GIS, Cal-Atlas, Cal-Fire FRAP Statewide LRA/SRA 11/2007; Map Date: 05/2016.

The FRA contains no improved parcels. The SRA contains 1,987 parcels, with about $811 million in total value, and the LRA has 442,068 parcels with nearly $129 billion in total value. It should be noted that fire does not just affect structural values, fire can also affect land values. As such the Assessor's land values and all parcels were accounted for in this analysis to represent total county assets at risk. However, it is highly unlikely the whole County will ever be on fire at once. The County parcel inventory and associated values by responsibility area are provided in Table 4-90.

Table 4-90 Sacramento County Planning Area – Assets in Local, State, and Federal Responsibility Areas by Property Use

Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value*
Federal Responsibility Area					
Agricultural	4	$0	0	$0	$0
Care / Health	0	$0	0	$0	$0
Church / Welfare	0	$0	0	$0	$0
Industrial	0	$0	0	$0	$0
Miscellaneous	0	$0	0	$0	$0
Office	0	$0	0	$0	$0
Public / Utilities	29	$0	0	$0	$0
Recreational	0	$0	0	$0	$0
Residential	1	$0	0	$0	$0
Retail / Commercial	0	$0	0	$0	$0
Vacant	0	$0	0	$0	$0
No Data	0	$0	0	$0	$0
Total	**34**	**$0**	**0**	**$0**	**$0**
State Responsibility Area					
Agricultural	450	$176,979,238	108	$84,873,195	$261,852,433
Care / Health	0	$0	0		$0
Church / Welfare	1	$286,472	1	$3,404,127	$3,690,599
Industrial	27	$23,699,591	6	$1,498,794	$25,198,385
Miscellaneous	39	$81,529	2	$5,379	$86,908
Office	2	$440,424	1	$677,579	$1,118,003
Public / Utilities	112	$0	0	$0	$0
Recreational	7	$3,867,428	3	$4,793,289	$8,660,717
Residential	1,090	$126,111,415	954	$224,865,488	$350,976,903
Retail / Commercial	3	$4,191,169	3	$4,493,161	$8,684,330
Vacant	255	$149,723,488	15	$918,274	$150,641,762
No Data	1	$0	0	$0	$0

Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value*
Total	**1,987**	**$485,380,754**	**1,093**	**$325,529,286**	**$810,910,040**
Local Responsibility Area					
Agricultural	2,157	$590,713,601	1,265	$398,101,195	$988,814,796
Care / Health	657	$285,193,234	578	$1,868,570,719	$2,153,763,953
Church / Welfare	1,151	$277,976,428	999	$1,285,532,595	$1,563,509,023
Industrial	4,296	$1,430,169,222	3,731	$3,695,929,958	$5,126,099,180
Miscellaneous	5,027	$10,078,985	21	$435,962	$10,514,947
Office	3,295	$1,811,845,814	2,981	$6,903,518,450	$8,715,364,264
Public / Utilities	8,007	$18,100,245	27	$17,165,874	$35,266,119
Recreational	332	$137,582,547	244	$297,824,035	$435,406,582
Residential	394,051	$28,618,208,743	388,309	$69,988,291,012	$98,606,499,755
Retail / Commercial	6,357	$3,185,018,016	5,728	$6,037,477,479	$9,222,495,495
Vacant	16,714	$1,968,565,618	622	$58,396,689	$2,026,962,307
No Data	24	$2,123,330	10	$2,342,809	$4,466,139
Total	**442,068**	**$38,335,575,783**	**404,515**	**$90,553,586,777**	**$128,889,162,560**

Source: CAL FIRE, Sacramento County 2016 Parcel/2015 Assessor's Data
*Land and structure values

Fire Threat Analysis

Cal Fire develops and maintains datasets related to wildland fire threat and risk. The Fire Threat dataset, created in 2004, was used for analysis on unincorporated Sacramento County and for the county's seven incorporated areas including Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova and Sacramento. This fire threat layer was used for loss estimation purposes based on its comprehensive coverage of the planning area. Sacramento County's parcel and associated assessor data was used as the basis for the countywide inventory of developed parcels, or structures.

The Fire Threat dataset is a combination of fire frequency, or the likelihood of a given area to burn, and potential fire behavior. Fire rotation is calculated using fifty years of fire history, as well as climate, vegetation, and land ownership information. Fuel rank is calculated based on expected fire behavior for unique combinations of topography and vegetative fuels under given weather conditions (wind speed, humidity, temperature, and fuel moistures). Fuel rank and fire rotation are then combined to create the 5 threat classes in the Fire Threat dataset, ranging from Little or No Threat to Extreme Threat. There is no area of Extreme Threat in Sacramento County.

GIS was used to create a centroid, or point representing the center of the Sacramento County parcel polygon. Fire Threat was then overlaid on the parcel centroids. For the purposes of this analysis, the wildfire threat zone (Little or No Threat | Moderate | High | Very High | Extreme) that intersected a parcel centroid was assigned as the threat zone for the entire parcel.

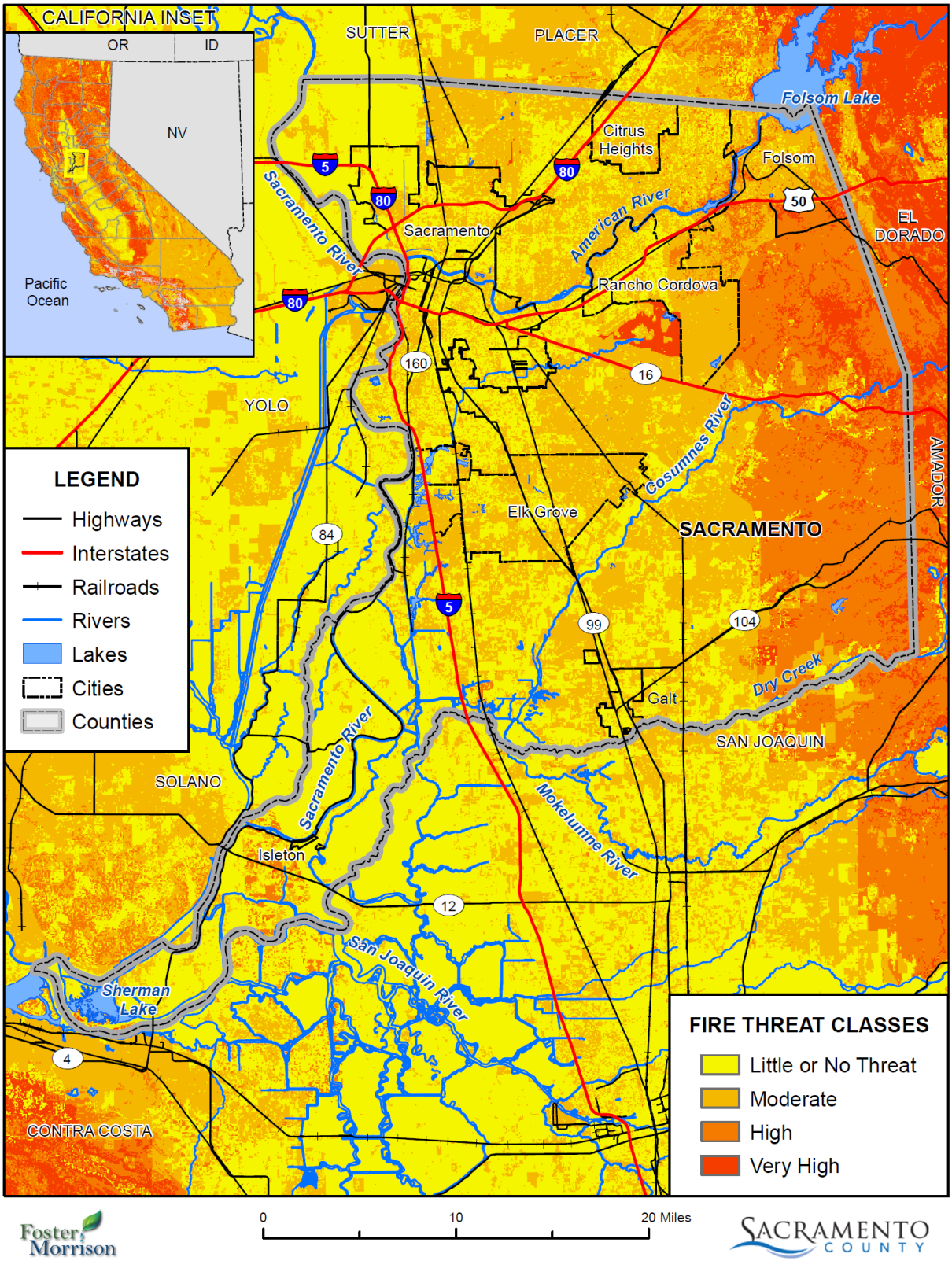
Assets at Risk

Results are presented by total Planning Area, unincorporated county, and for the participating jurisdictions (in their respective annexes to the plan), and detailed tables show improved parcel counts and their land and structure values by property use (residential, industrial, etc.) within each fire threat zone.

Sacramento County Planning Area

Analysis results for the entire Sacramento County Planning Area are summarized in Table 4-91, which summarizes total parcel counts, improved parcel counts, and their improved and land values by jurisdiction. Fire threat is shown in Figure 4-95.

Figure 4-95 Sacramento County Planning Area Fire Threat Zones



Data Source: Sacramento County GIS, Cal-Atlas, Cal-Fire 2004 Fire Threat Data; Map Date: 05/2016.

Table 4-91 Sacramento County Planning Area – Count and Value of Parcels by Jurisdiction and Fire Threat Zone

Jurisdiction	Little or No Threat		Moderate		High		Very High	
	Imp. Parcel Count	Improved Structure Value	Imp. Parcel Count	Improved Structure Value	Imp. Parcel Count	Improved Structure Value	Imp. Parcel Count	Improved Structure Value
Citrus Heights	9,027	$1,528,881,062	14,296	$2,480,158,745	19	$3,556,445	163	$35,932,376
Elk Grove	19,397	$4,501,259,568	27,947	$7,562,799,423	58	$19,703,611	0	$0
Folsom	3,041	$767,685,499	15,557	$5,940,882,470	1,648	$861,468,891	351	$113,606,213
Galt	4,869	$777,657,262	1,903	$429,612,755	3	$177,790	0	$0
Isleton	248	$22,266,676	86	$6,286,028	0	$0	0	$0
Rancho Cordova	9,593	$2,715,054,337	8,485	$1,945,831,870	13	$12,557,201	1	$5,297,123
City of Sacramento	87,831	$20,158,400,464	43,213	$8,958,468,787	38	$10,287,720	3	$1,475,434
Unincorporated County	76,521	$15,046,236,091	79,118	$16,390,513,662	1,612	$451,368,485	567	$131,690,075
Planning Area Total	**210,527**	**$45,517,440,959**	**190,605**	**$43,714,553,740**	**3,391**	**$1,359,120,143**	**1,085**	**$288,001,221**

Source: CAL FIRE 2004 Fire Threat Maps, Sacramento County 2016 Parcel/2015 Assessor's Data
*Land and structure values

Unincorporated Sacramento County

Table 4-92 breaks out the details of fire threat class and property use type for the unincorporated County.

Table 4-92 Unincorporated Sacramento County – Count and Value of Parcels by Property Use and Fire Threat Zone

Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value
Little or No Threat					
Agricultural	1,380	$375,260,590	861	$264,918,899	$640,179,489
Care / Health	164	$51,833,586	153	$347,569,562	$399,403,148
Church / Welfare	274	$66,085,343	242	$306,205,804	$372,291,147
Industrial	894	$349,488,969	768	$834,488,119	$1,183,977,088
Miscellaneous	649	$2,437,203	7	$43,176	$2,480,379
NO DATA	5	$1,379,765	3	$762,048	$2,141,813
Office	841	$315,184,580	777	$915,391,891	$1,230,576,471
Public / Utilities	1,442	$6,630,808	14	$13,264,491	$19,895,299
Recreational	126	$52,675,850	98	$84,850,716	$137,526,566
Residential	72,660	$4,459,923,163	71,768	$10,755,174,845	$15,215,098,008

Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value
Retail / Commercial	1,830	$866,774,980	1,704	$1,512,330,761	$2,379,105,741
Vacant	1,762	$263,501,839	126	$11,235,779	$274,737,618
Total	**82,027**	**$6,811,176,676**	**76,521**	**$15,046,236,091**	**$21,857,412,767**
Moderate					
Agricultural	747	$204,491,937	421	$180,465,853	$384,957,790
Care / Health	151	$70,995,676	140	$211,641,630	$282,637,306
Church / Welfare	176	$56,282,638	151	$242,735,799	$299,018,437
Industrial	512	$166,219,126	386	$464,696,414	$630,915,540
Miscellaneous	942	$1,458,357	3	$59,279	$1,517,636
NO DATA	6	$166,349	1	$45,082	$211,431
Office	268	$96,635,887	238	$287,852,802	$384,488,689
Public / Utilities	1,493	$3,744,898	5	$1,404,284	$5,149,182
Recreational	43	$10,991,764	31	$19,507,031	$30,498,795
Residential	78,275	$6,651,475,883	77,225	$14,540,264,093	$21,191,739,976
Retail / Commercial	353	$205,970,921	321	$427,344,776	$633,315,697
Vacant	3,532	$383,691,610	196	$14,496,619	$398,188,229
Total	**86,498**	**$7,852,125,046**	**79,118**	**$16,390,513,662**	**$24,242,638,708**
High					
Agricultural	339	$87,366,810	63	$32,559,555	$119,926,365
Care / Health	3	$487,080	2	$776,664	$1,263,744
Church / Welfare	3	$4,927,189	2	$23,181,514	$28,108,703
Industrial	21	$20,609,680	4	$1,047,452	$21,657,132
Miscellaneous	40	$116,663	3	$8,454	$125,117
NO DATA	1	$0	-	$0	$0
Office	3	$264,252	2	$518,911	$783,163
Public / Utilities	126	$56,917	-	$0	$56,917
Recreational	1	$13,278	-	$0	$13,278
Residential	1,575	$183,267,476	1,522	$391,815,820	$575,083,296
Retail / Commercial	1	$6,096	1	$531,121	$537,217
Vacant	259	$74,890,918	13	$928,994	$75,819,912
Total	**2,372**	**$372,006,359**	**1,612**	**$451,368,485**	**$823,374,844**
Very High					
Agricultural	64	$12,801,099	8	$2,977,224	$15,778,323
Care / Health	2	$422,451	2	$667,633	$1,090,084

Property Use	Total Parcel Count	Total Land Value	Improved Parcel Count	Improved Structure Value	Total Value
Church / Welfare	1	$289,627	1	$201,939	$491,566
Industrial	4	$1,416,312	-	$0	$1,416,312
Miscellaneous	17	$3,737	-	$0	$3,737
Office	2	$667,989	2	$490,028	$1,158,017
Public / Utilities	59	$0	-	$0	
Residential	560	$54,055,418	545	$124,816,685	$178,872,103
Retail / Commercial	5	$2,010,893	5	$2,264,309	$4,275,202
Vacant	39	$11,097,665	4	$272,257	$11,369,922
Total	**753**	**$82,765,191**	**567**	**$131,690,075**	**$214,455,266**
Grand Total	**171,650**	**$15,118,073,272**	**157,818**	**$32,019,808,313**	**$47,137,881,585**

Source: CAL FIRE, Sacramento County 2016 Parcel/2015 Assessor's Data

Population at Risk

A separate analysis was performed to determine population in fire threat zones. Using GIS, the CAL FIRE fire theat dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect a fire threat zone were counted and multiplied by the Census Bureau Sacramento County average household size (2.71 for the County); results were tabulated by jurisdiction and fire threat zone (see Table 4-93). Information on specific jurisdictions can be found in their respective annexes to this plan.

Table 4-93 Sacramento County Planning Area – Population at Risk by Fire Threat Zone

Fire Threat Zone	Improved Residential Parcels	Population*
Very High	1,051	2,848
High	3,237	8,772
Moderate	185,957	503,943
Little or No Threat	199,018	539,339

Source: CAL FIRE, US Census Bureau, Sacramento County 2016 Assessor/2015 Parcel Data

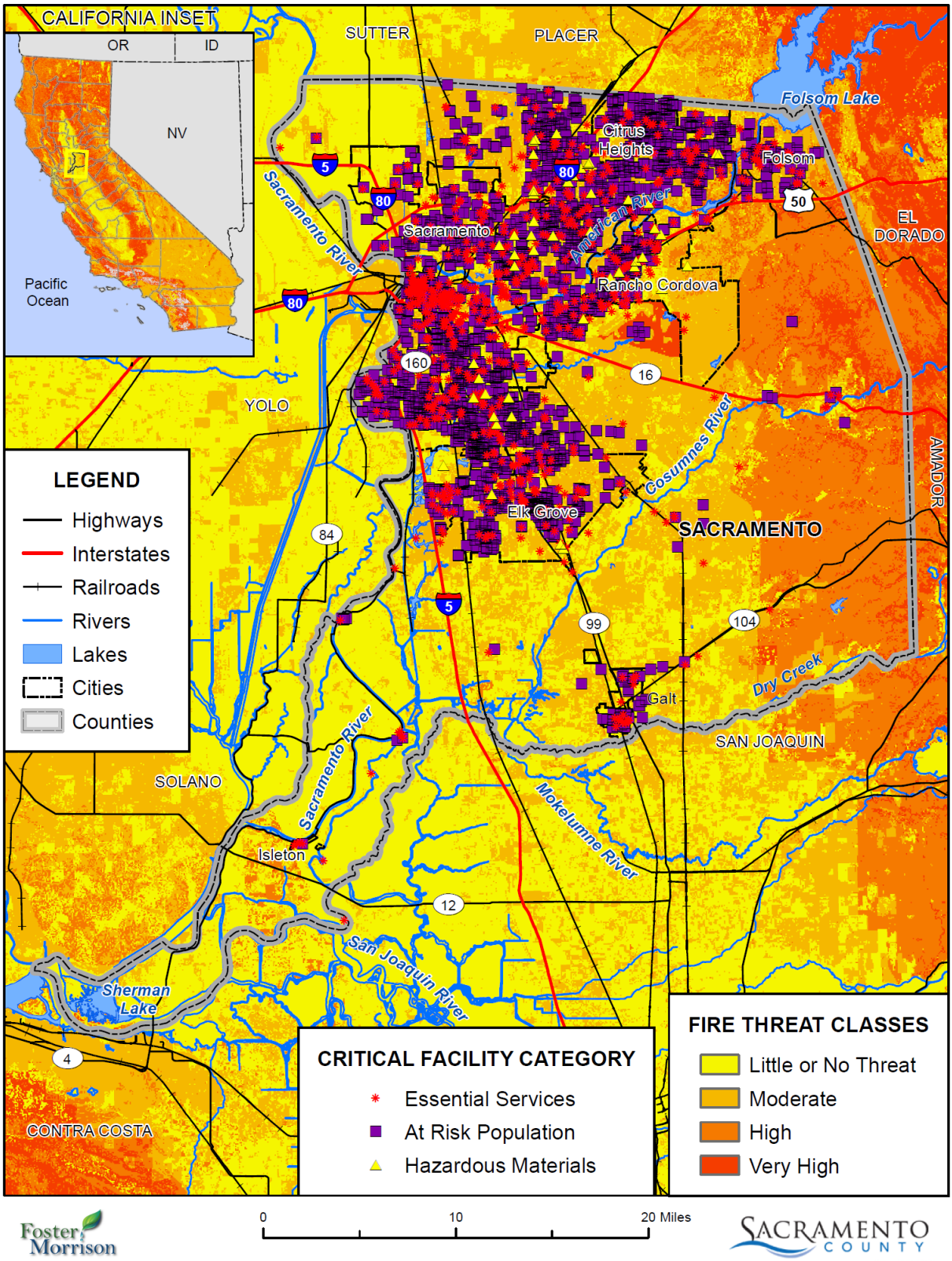
Cultural and Natural Resources at Risk

Sacramento County has substantial cultural and natural resources located throughout the County as previously described. In addition, there are other natural resources at risk when wildland-urban interface fires occur. One is the watershed and ecosystem losses that occur from wildland fires. This includes impacts to water supplies and water quality as well as air quality. Another is the aesthetic value of the area. Major fires that result in visible damage detract from that value. Other assets at risk include wildland recreation areas, wildlife and habitat areas, and rangeland resources. The loss to these natural resources can be significant.

Critical Facilities at Risk

Wildfire analysis was performed on the critical facility inventory in Sacramento County and all jurisdictions. GIS was used to determine whether the facility locations intersect a wildfire hazard areas provided by CAL FIRE, and if so, which zone it intersects. This is shown on Figure 4-96. Table 4-94 shows the breakdown of critical facilities by fire threat zone for the Planning Area, while Table 4-95 shows the breakdown of critical facilities by fire threat zone for the unincorporated County. Details of critical facility definition, type, name, address, and jurisdiction by fire threat zone are listed in Appendix E.

Figure 4-96 Sacramento County Planning Area – Critical Facilities in Fire Threat Zones



Data Source: Sacramento County GIS, Cal-Atlas, Cal-Fire 2004 Fire Threat Data; Map Date: 05/2016.

Table 4-94 Sacramento County Planning Area – Critical Facilities in Fire Threat Zones

Critical Facility Category	Facility Type	Facility Count
Little or No Threat		
Essential Services Facilities	Airport	5
	Arena	1
	Bus Terminal	6
	Convention Center	1
	Detention Basin	22
	Dispatch Center	
	Drainage	3
	Emergency Evacuation Shelter	113
	Emergency Rooms	1
	EOC	1
	Fire Station	56
	Gas Storage	1
	General Acute Care Hospital	7
	Government Facilities	49
	Hospitals	1
	Light Rail Stop	49
	Medical Health Facility	152
	Police	16
	Sand Bag	2
	Stadium	2
	Traffic Operations Center	1
	Train Station	1
	Vehicle and Equipment Storage	2
	Water Treatment Plant	2
	Total	**495**
At Risk Population Facilities	Adult Day Care	25
	Adult Education School	7
	Adult Residential	199
	Alternative Education School	5
	Assisted Living Centers	27
	Charter School	15
	Children's Home	2
	College/University	4
	Community Day School	5
	Day Care Center	228

Critical Facility Category	Facility Type	Facility Count
	Detention Center	2
	Group Home	49
	Hotel	40
	Independent Study School	1
	Infant Center	17
	JAIL	1
	Private Elementary School	36
	Private High School	19
	Private K-12 School	19
	Public Continuation High School	12
	Public Elementary School	110
	Public High School	15
	Public Middle School	20
	Residential Care/Elderly	209
	Residential Facility Chronically	1
	School	17
	School-Age Day Care Center	45
	Senior Center	1
	Social Rehabilitation Facility	2
	Special Education School	7
	Total	**1,140**
Hazardous Materials Facilities	Oil Collection Center	41
	OTHER	1
	Propane Storage	1
	Sewer Treatment Plant	2
	Total	**45**
Little or No Threat Total		**1,680**
Moderate		
Essential Services Facilities	Airport	4
	Bus Terminal	2
	Corporation Yard	1
	Detention Basin	23
	Dispatch Center	1
	Drainage	3
	Emergency Evacuation Shelter	118
	EOC	1
	Fire Station	37

Critical Facility Category	Facility Type	Facility Count
	General Acute Care Hospital	1
	Government Facilities	18
	Light Rail Stop	3
	Medical Health Facility	45
	Police	6
	Sand Bag	3
	Stadium	1
	State and Fed Facilities	1
	State Facility	1
	Urgent Care Facilities	2
	Water Treatment Plant	1
	Total	**272**
At Risk Population Facilities	Adult Day Care	1
	Adult Education School	5
	Adult Residential	109
	Alternative Education School	2
	Assisted Living Centers	31
	Charter School	10
	College/University	3
	Community Day School	4
	Day Care Center	185
	Detention Center	1
	Group Home	46
	Hotel	10
	Independent Study School	1
	Infant Center	16
	Prison	1
	Private Elementary School	29
	Private High School	11
	Private K-12 School	17
	Public Continuation High School	10
	Public Elementary School	119
	Public High School	19
	Public Middle School	23
	Residential Care/Elderly	202
	School	21
	School-Age Day Care Center	52

Critical Facility Category	Facility Type	Facility Count
	Social Rehabilitation Facility	2
	Special Education School	3
	Total	**933**
Hazardous Materials Facilities	Oil Collection Center	4
	Total	**4**
Moderate Total		**1,209**
High		
Essential Services Facilities	Airport	1
	Emergency Evacuation Shelter	1
	Fire Station	1
	General Acute Care Hospital	1
	Government Facilities	1
	Medical Health Facility	1
	Total	**6**
At Risk Population Facilities	Day Care Center	3
	Group Home	1
	Public Elementary School	1
	Public High School	1
	Residential Care/Elderly	1
	Total	**7**
High Total		**13**
Very High		
Essential Services Facilities	Emergency Evacuation Shelter	1
	Medical Health Facility	2
	Total	**3**
At Risk Population Facilities	Private K-12 School	1
	Residential Care/Elderly	2
	Total	**3**
Very High Total		**6**
Grand Total		**2,908**

Source: CAL FIRE, Sacramento County GIS

Table 4-95 Unincorporated Sacramento County – Critical Facilities in Fire Threat Zones

Critical Facility Category	Facility Type	Facility Count
Little or No Threat		
Essential Services Facilities	Airport	4
	Bus Terminal	1
	Detention Basin	2
	Emergency Evacuation Shelter	47
	Fire Station	29
	General Acute Care Hospital	1
	Government Facilities	13
	Light Rail Stop	5
	Medical Health Facility	54
	Police	9
	Traffic Operations Center	1
	Vehicle and Equipment Storage	2
	Total	**168**
At Risk Population Facilities	Adult Day Care	10
	Adult Education School	3
	Adult Residential	81
	Alternative Education School	4
	Charter School	4
	College/University	1
	Community Day School	4
	Day Care Center	88
	Detention Center	2
	Group Home	26
	Hotel	7
	Infant Center	7
	Private Elementary School	19
	Private High School	11
	Private K-12 School	10
	Public Continuation High School	7
	Public Elementary School	43
	Public High School	4
	Public Middle School	6
	Residential Care/Elderly	94
	Residential Facility Chronically	1
	School-Age Day Care Center	18

Critical Facility Category	Facility Type	Facility Count
	Social Rehabilitation Facility	1
	Special Education School	4
	Total	**455**
Hazardous Materials Facilities	Oil Collection Center	29
	OTHER	1
	Sewer Treatment Plant	1
	Total	**31**
Little or No Threat Total		**654**
Moderate		
Essential Services Facilities	Airport	4
	Detention Basin	2
	Emergency Evacuation Shelter	50
	Fire Station	20
	Government Facilities	5
	Light Rail Stop	1
	Medical Health Facility	14
	Police	3
	Stadium	1
	Total	**100**
At Risk Population Facilities	Adult Education School	2
	Adult Residential	53
	Alternative Education School	1
	Charter School	6
	Community Day School	1
	Day Care Center	63
	Detention Center	1
	Group Home	29
	Hotel	1
	Infant Center	7
	Private Elementary School	6
	Private High School	4
	Private K-12 School	10
	Public Continuation High School	6
	Public Elementary School	49
	Public High School	10
	Public Middle School	12
	Residential Care/Elderly	106

Critical Facility Category	Facility Type	Facility Count
	School-Age Day Care Center	15
	Social Rehabilitation Facility	1
	Special Education School	2
	Total	**385**
Hazardous Materials Facilities	Oil Collection Center	3
	Total	**3**
Moderate Total		**488**
High		
Essential Services Facilities	Airport	1
	Emergency Evacuation Shelter	1
	Fire Station	1
	Government Facilities	1
	Total	**4**
At Risk Population Facilities	Day Care Center	3
	Group Home	1
	Public Elementary School	1
	Residential Care/Elderly	1
	Total	**6**
High Total		**10**
Very High		
Essential Services Facilities	Medical Health Facility	2
	Total	**2**
At Risk Population Facilities	Private K-12 School	1
	Residential Care/Elderly	1
	Total	**2**
Very High Total		**4**
Grand Total		**1,156**

Source: CAL FIRE, Sacramento County GIS

Overall Community Impact

The overall impact to the community from a severe wildfire includes:

- Injury and loss of life;
- Commercial and residential structural and property damage;
- Decreased water quality in area watersheds;
- Increase in post-fire hazards such as flooding, sedimentation, and mudslides;
- Damage to natural resource habitats and other resources, such as timber and rangeland;

- Loss of water, power, roads, phones, and transportation, which could impact, strand, and/or impair mobility for emergency responders and/or area residents;
- Economic losses (jobs, sales, tax revenue) associated with loss of commercial structures;
- Negative impact on commercial and residential property values;
- Loss of churches, which could severely impact the social fabric of the community;
- Loss of schools, which could severely impact the entire school system and disrupt families and teachers, as temporary facilities and relocations would likely be needed; and
- Impact on the overall mental health of the community.

Future Development

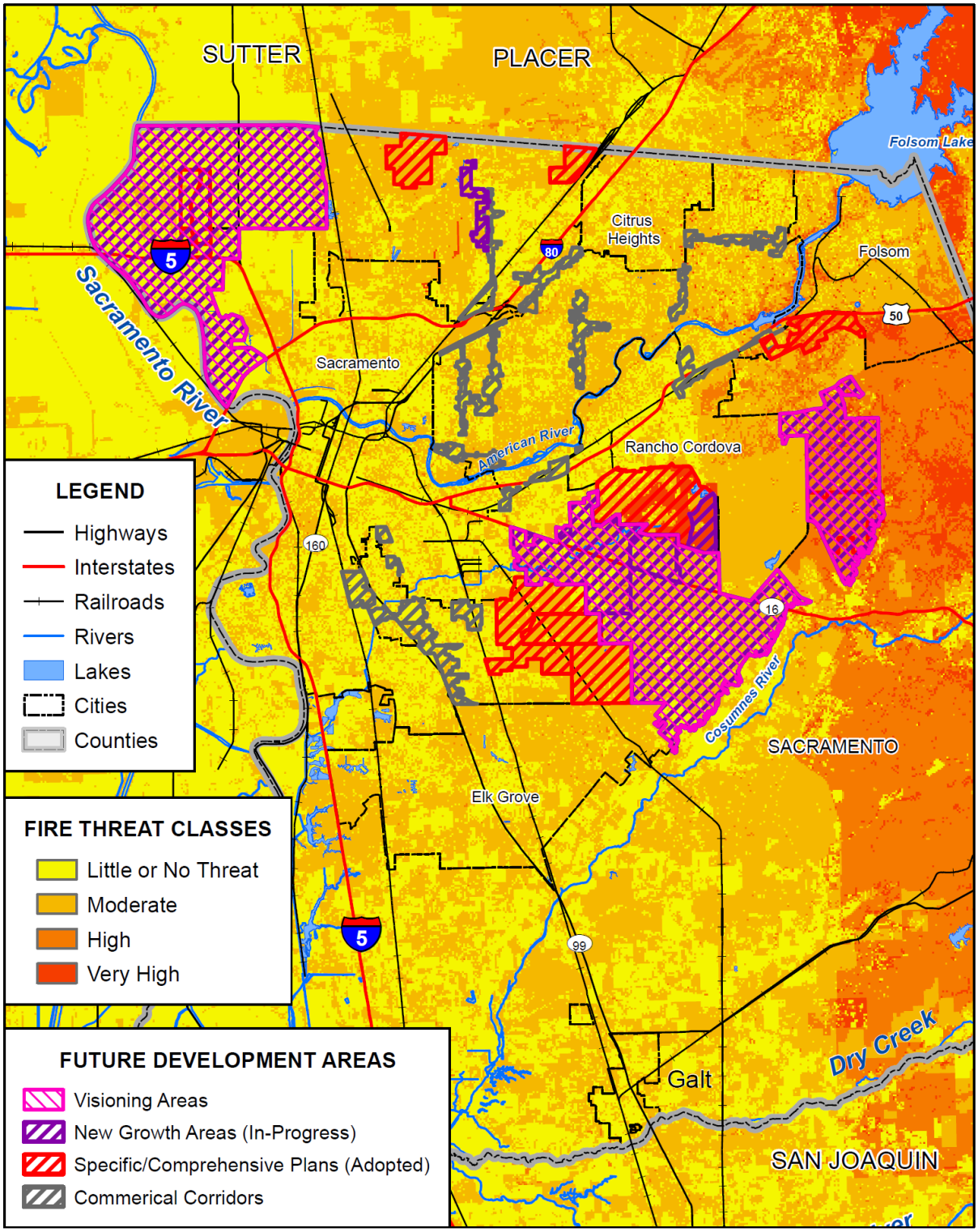
Population growth and development in Sacramento County is on the rise. Additional growth and development within the WUI areas of the County would place additional assets at risk to wildfire.

Future Development GIS Analysis

Visioning areas, new growth areas, specific plan areas, commercial corridors data is maintained by Sacramento County, and was made available for this plan. A simple analysis was performed to quantify parcels within these development areas that are also in flood hazard areas. Results can serve as confirmation for future development.

GIS was used to determine the number of parcels in the CAL FIRE threat zones within visioning areas, specific plan areas, new growth areas, and commercial corridor areas. GIS was used to create a centroid, or point representing the center of the parcel polygon. Those parcels centroids that fall inside the future development areas and that were within the fire threat zones were selected and shown on Figure 4-97 and tabulated in Table 4-96.

Figure 4-97 Sacramento County Planning Area – Future Development in Fire Threat Zones



Foster Morrison

SACRAMENTO COUNTY

Data Source: Sacramento County GIS, Cal-Atlas, Cal-Fire 2004 Fire Threat Data; Map Date: 05/2016.

Table 4-96 Sacramento County Planning Area – Future Development in Fire Threat Zones

Area	Parcels	Acres	Fire Threat Zones
Visioning Area			
Jackson	1,099	21,670	Little or No Hazard, Moderate, High, Very High
Natomas	907	24,504	Little or No Hazard, Moderate, High
Grantline East	48	8,198	Little or No Hazard, Moderate, High, Very High
Plan Areas			
Cordova Hills Master Plan	26	2,436	Moderate, High, Very High
East Antelope Specific Plan	1,425	601	Little or No Hazard, Moderate, High
Easton Project	19	1,409	Little or No Hazard, Moderate, High, Very High
Elverta Specific Plan	158	1,581	Little or No Hazard, Moderate, High
Florin-Vineyard Gap Community Plan	827	3,875	Little or No Hazard, Moderate, High
Jackson Township Master Plan	61	1,909	Little or No Hazard, Moderate, High, Very High
Mather Field	1,421	5,493	Little or No Hazard, Moderate, High, Very High
Mather South Master Plan	12	1,299	Little or No Hazard, Moderate, Very High
Metro Airpark	78	1,810	Little or No Hazard, Moderate
New Bridge Master Plan	27	1,339	Little or No Hazard, Moderate, Very High
North Vineyard Station Specific Plan	1,320	1,553	Little or No Hazard, Moderate
Vineyard Springs Comprehensive Plan	2,732	2,344	Little or No Hazard, Moderate, High
West Jackson Highway Master Plan	455	6,181	Little or No Hazard, Moderate, High, Very High
West of Watt	383	609	Little or No Hazard, Moderate, High
Corridor Areas			
Corridor 1	1,277	554	Little or No Hazard, Moderate, High, Very High
Corridor 2	533	226	Little or No Hazard, Moderate
Corridor 3	1,033	625	Little or No Hazard, Moderate
Corridor 4	626	532	Little or No Hazard, Moderate
Corridor 5	516	621	Little or No Hazard, Moderate
Corridor 6	579	311	Little or No Hazard, Moderate
Corridor 7	722	460	Little or No Hazard, Moderate
Corridor 8	126	136	Little or No Hazard, Moderate
Corridor 9	946	290	Little or No Hazard, Moderate
Corridor 10	593	101	Little or No Hazard, Moderate
Corridor 11	266	76	Little or No Hazard, Moderate
Corridor 12	2,537	1,929	Little or No Hazard, Moderate
Corridor 13	325	402	Little or No Hazard, Moderate, High
Corridor 14	30	155	Little or No Hazard, Moderate, High, Very High
Corridor 15	224	465	Little or No Hazard, Moderate, High

Area	Parcels	Acres	Fire Threat Zones
Corridor 16	31	11	Little or No Hazard, Moderate
Corridor 17	203	254	Little or No Hazard, Moderate
Corridor 18	3	1	Little or No Hazard, Moderate
Corridor 19	48	130	Little or No Hazard, Moderate
New Growth Areas			
Mather South Master Plan	12	1,299	Little or No Hazard, Moderate, Very High
Natomas North	907	24,504	Little or No Hazard, Moderate, High
Jackson Township	61	1,909	Little or No Hazard, Moderate, High, Very High
West Jackson Highway	455	6,181	Little or No Hazard, Moderate, Very High
New Bridge	27	1,339	Little or No Hazard, Moderate, High, Very High
West of Watt	383	609	Little or No Hazard, Moderate, High

Source: Sacramento County GIS, CAL FIRE

4.4 Capability Assessment

Thus far, the planning process has identified the natural hazards posing a threat to the Planning Area and described, in general, the vulnerability of the County to these risks. The next step is to assess what loss prevention mechanisms are already in place. This part of the planning process is the mitigation capability assessment. Combining the risk assessment with the mitigation capability assessment results in the County's net vulnerability to disasters, and more accurately focuses the goals, objectives, and proposed actions of this plan.

The HMPC used a two-step approach to conduct this assessment for the County. First, an inventory of common mitigation activities was made through the use of a matrix. The purpose of this effort was to identify policies and programs that were either in place, needed improvement, or could be undertaken if deemed appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, and programs to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses.

This section presents the County's mitigation capabilities and discusses select state and federal mitigation capabilities that are applicable to the County.

Similar to the HMPC's effort to describe hazards, risks, and vulnerability of the County, this mitigation capability assessment describes the County's existing capabilities, programs, and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This assessment is divided into four sections: regulatory mitigation capabilities are discussed in Section 4.4.1; administrative and technical mitigation capabilities are discussed in Section 4.4.2; fiscal mitigation capabilities are discussed in Section 4.4.3; and mitigation education, outreach, and partnerships are discussed in Section 4.4.4. A discussion of other mitigation efforts follows in Section 4.4.5.

4.4.1. Sacramento County's Regulatory Mitigation Capabilities

Table 4-97 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities, and indicates those that are in place in the County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Table 4-97 Sacramento County Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Y 2011	
Capital Improvements Plan	Y	The County has a Five-Year Capital Improvement Plan (CIP) that is prepared by the County Executive Office. The projects contained within the CIP are dependent upon the individual departments. Water Resources has a storm drain system capital improvement plan
Economic Development Plan	Y	The Planning and Environmental Review Division maintains the General Plan which has an Economic Development Element, but many of the items identified within the Element are the responsibility of the Office of Economic Development & Marketing. The Element does not address hazards.
Local Emergency Operations Plan	Y 2012	County Emergency Operations
Continuity of Operations Plan		
Transportation Plan	Y	The Planning and Environmental Review Division maintains the General Plan which has Circulation Element (including a Transportation Plan), but many of the items identified within the Element are the responsibility of SACDOT. The Element does not address hazards, but does include a policy to reduce the heat island effect.
Stormwater Management Plan/Program	Y	Hydrology Standards 1996 Stormwater Guidance Manual
Engineering Studies for Streams	Y	
Community Wildfire Protection Plan	Y 2014	Sacramento Metropolitan Fire District Community Wildfire Protection Plan
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y 2011	The Climate Action Plan Strategy and Framework Document was adopted with the General Plan update in 2011. Chapter 2 discusses the County's vulnerability to climate change and identified potential impacts to human, natural and built systems. It also proposed actions to address climate change. Preparation of a Communitywide Climate Action Plan has begun and is expected to be completed in Fall 2017.
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	Y	Version/Year: 2013 CBC
Building Code Effectiveness Grading Schedule (BCEGS) Score	Y	Score: 3/3

Fire department ISO rating:	Y	Rating: 2/9 Class 2 applies to all risks that are both: I) within 5 road miles of a recognized fire station AND II) within 1000 feet of a recognized fire hydrant. Class 9 would apply to those risks that are: I) within 5 road miles of a recognized fire station, but without a fire hydrant within 1000 feet.
Site plan review requirements	Y	The County operates a public counter for review of all development applications. DWR drainage division staff evaluates new development proposals for compliance with County standards, drainage ordinances, and floodplain development policies and provide flood zone information.
Property Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts?** **Is the ordinance adequately administered and enforced?**
Zoning ordinance	Y	Generally, the zoning ordinance separates hazardous land uses from sensitive land uses and addresses risks e.g. flood, erosion and traffic. The zoning ordinance contains a Flood (F) Combining Zoning District and Tributary Standards, and Natural Streams (NS) Combining Zoning District to reduce the impacts of flood hazards. Additionally, the ordinance contains a Parkway Corridor (PC) Combining Zoning District to ensure that bluff development does not create erosion or geologic instability.
Subdivision ordinance	Y	County Code Title 22 Land Development is the County's subdivision ordinance. The ordinance does not address hazards.
Floodplain ordinance	Y	Minor revisions in 2010 and 2014, major in 2007 reviewed by FEMA Region 9. Additional revisions are forthcoming to comply with Senate Bill (SB) 5 regarding floodplain management.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Improvement Standards
Flood insurance rate maps	Y	County maintains a library of past and current FIRMS.
Elevation Certificates	Y	Comprehensive record of elevation certificates
Acquisition of land for open space and public recreation uses	Y	Land acquisition is on-gong for purposes of flood control, species conservation, open space preservation and recreation.
Erosion or sediment control program	Y	County Improvement Standards, 2010
Other	Y Y	Evacuation Plan, The South Sacramento Habitat Conservation Plan is a regional approach to addressing issues related to urban development, habitat conservation and agricultural protection. The Plan is still in process and is estimated to be approved in Summer 2017.
How can these capabilities be expanded and improved to reduce risk?		

As indicated in the tables above, Sacramento County has several plans and programs that guide the County's mitigation of development of hazard-prone areas. Starting with the Sacramento County General Plan,

which is the most comprehensive of the County's plans when it comes to mitigation, some of these are described in more detail below.

Sacramento County Plans/Studies

Sacramento County General Plan

The Sacramento County General Plan is a comprehensive, long-term framework for the protection of the County's agricultural, natural, and cultural resources and for development in the County. Designed to meet state general plan requirements, it outlines policies, standards, and programs and sets out plan proposals to guide day-to-day decisions concerning Sacramento County's future. It is a legal document that serves as the County's blueprint for land use and development. It is broken into the following sections:

- Agriculture Element
- Air Quality Element
- Circulation Element
- Conservation Element
- Economic Development
- Energy Element
- Hazardous Materials Element
- Human Services Element
- Land Use Element
- Noise Element
- Open Space Element
- Public Facilities Element
- Safety Element

Goals and policies related to mitigation of natural hazards can be found in the discussion below.

Agriculture Element

The Sacramento County (County) General Plan provides for growth and development in the unincorporated area through the year 2030. Portions of the Plan contain policies for urban development including urban communities and the infrastructure necessary to serve them. Other sections of the Plan describe strategies to recognize and preserve areas of open space and natural resources. As a whole, the Plan reflects a balance between the amount and location of land uses in urban areas and those to remain in a rural or natural setting.

GOAL:	**Protect important farmlands from conversion and encroachment and conserve agricultural resources.**
Objective:	Reduce or eliminate groundwater cones of depression in farming areas by encouraging water conservation.
Objective:	Reduced soil erosion.
Objective:	No increase in the level or intensity of flooding of intensively farmed land.
Objective:	Reduced crop and livestock productivity losses resulting from noxious weed infestations and wildfires.
Objective:	Reduced cost and difficulty of obtaining permits for construction of accessory farm buildings in floodway fringe areas.

Conservation Element

The County recognizes the need for effective conservation practices which allow for the maintenance and preservation of its natural environment and efficient use of its resources. The State mandates that the County's General Plan include a Conservation Element which will enable the County to analyze its resources and determine policies for their use and conservation. State law requires that the element address the management and protection of specific resources:

- The Water Resources section addresses the County's objectives with respect to the use of ground, surface, and recycled water for residential, commercial, industrial, agricultural, and recreational purposes. The section assesses how and from where the County intends to secure its future water supply and provides guidelines for the County's policies on water quality, ground and surface water use, and water conservation.
- The Mineral Resources section delineates the County's policies on the protection of mineral resources for economic extraction while providing guidelines on how, when, and where mineral resources can be extracted to avert adverse impacts on the environment.
- The Materials Recycling section specifies the County's plan of reducing the amount of solid waste that is produced. It includes policies and programs which will encourage participation in the recycling of materials and supports a sustainable market for recycled materials.
- The Soil Resources section discusses the management and protection of county soils for purposes of maintaining its resource value and agricultural potential. The section deliberates on the County's future plans in dealing with the loss of agriculturally productive soils and discusses policies and programs which will encourage the utilization of effective soil conservation practices.
- The Vegetation and Wildlife section consist of four main subsections, each of which discusses the preservation and management of biotic resources. The Habitat Protection and Management subsection includes many overarching policies that address habitat mitigation; habitat preserves and management; and habitat protection and project review. The Special Status Species and their Respective Habitats subsection includes policies and measures to protect and manage habitats for the protection of special status species. Aquatic Resources, the third subsection, covers the protection of vernal pools, rivers and streams and fisheries. Lastly, the Terrestrial Resources subsection addresses the protection and preservation of native vegetation, landmark and heritage trees and the urban forest while also promoting new trees in the urban landscape.
- The Cultural Resources section discusses County objectives with respect to the protection and preservation of important cultural resources and plans for increasing public awareness and appreciation of them.

Soil Resources

GOAL:	Preserve and protect long-term health and resource value of agricultural soils.
Objective:	Agriculturally productive Delta soils protected from the effects of oxidation, shrinkage, and erosion.
Objective:	Mining of top soil to have minimal effect on soil productivity.

Water Resources

GOAL:	Preserve and manage natural habitats and their ecological functions throughout Sacramento County.
Objective:	Mitigate and restore for natural habitat and special status species loss.
Objective:	Establish and manage a preserve system with large core and landscape level preserves connected by wildlife corridors throughout Sacramento County to protect ecological functions and species populations.
Objective:	Review development plans and projects to ensure a balance between essential growth needs and the protection and preservation of natural habitats and special status species.

GOAL:	Preserve, enhance and restore special status species habitat in Sacramento County to aid in the recovery of these species.
Objective:	Protect and maintain habitat for special status species.
Objective:	Manage and maintain special status species and their respective habitat in a manner that resolves conflicts with adjacent privately owned-land and agricultural operations.

GOAL:	Preserve, protect, and manage the health and integrity of aquatic resources in Sacramento County.
Objective:	Preserve and enhance self-sustaining vernal pool habitats.
Objective:	Establish vernal pool preserves that enhance and protect the ecological integrity of vernal pool resources.

GOAL:	Preserve, protect, and enhance natural open space functions of riparian, stream and river corridors.
Objective:	Manage riparian corridors to protect natural, recreational, economic, agricultural and cultural resources as well as water quality, supply and conveyance.
Objective:	Maintain the natural character of the 100-year floodplain by limiting fill and excavation.
Objective	Maintain levee protection, riparian vegetation, function and topographic diversity by stream channel and bank stabilization projects.
Objective	Stabilize riverbanks to protect levees, water conveyance and riparian functions.
Objective	Conserve and protect the Sacramento, Cosumnes, Mokelumne and American Rivers to preserve natural habitat and recreational opportunities.
Objective	Protect and restore natural stream functions.
Objective	Land uses within and development adjacent to stream corridors are to be consistent with natural values.
Objective	Properly manage and fund the maintenance of rivers and streams to protect and enhance natural functions.
Objective	Restore concrete sections of rivers and streams to increase natural functions.

GOAL:	Preserve and protect fisheries in County waterways and water bodies.
Objective:	Provide and protect high quality in-stream habitat, water quality and water flows to support fisheries propagation, development, and migration.

GOAL:	Sacramento County vegetative habitats preserved, protected, and enhanced.
Objective:	Tree and native vegetation management practices to promote regeneration in designated resource conservation areas.
Objective:	Heritage and landmark tree resources preserved and protected for their historic, economic, and environmental functions.
Objective:	A coordinated, funded Urban Tree Management Plan and program sufficient to achieve a doubling of the County's tree canopy by 2050 and promote trees as economic and environmental resources for the use, education, and enjoyment of current and future generations.
Objective:	One million new trees planted within the urban area between now and 2030.

Cultural Resources

The foundation of a cultural community rests upon the attributes and artifacts of its predecessors. Preserving and understanding these cultural resources needs to be an element of consideration when planning for future growth.

GOAL:	Promote the inventory, protection and interpretation of the cultural heritage of Sacramento County, including historical and archaeological settings, sites, buildings, features, artifacts and/or areas of ethnic historical, religious or socioeconomical importance.
Objective:	Comprehensive knowledge of archeological and historic site locations.
Objective:	Attention and care during project review and construction to ensure that cultural resource sites, either previously known or discovered on the project site, are properly protected with sensitivity to cultural and ethnic values of all affected.
Objective	Preserve structures such as buildings, bridges, or other permanent structures with architectural or historical importance to maintain contributing design elements.
Objective	Protect any known cultural resources from vandalism, unauthorized excavation, or accidental destruction.
Objective	Properly stored and classified artifacts for ongoing study.
Objective	Increase public education, awareness and appreciation of both visible and intangible cultural resources.

Delta Protection Element

Recognizing the threats to the Primary Zone of the Delta from potential urban and suburban encroachment and the need to protect the area for agriculture, wildlife habitat, and recreation uses, the California Legislature passed and the Governor signed into law on September 23, 1992, the Delta Protection Act of 1992 (SB 1866). The Act directs the Delta Protection Commission to prepare a comprehensive resource management plan for land uses within the Primary Zone of the Delta (Plan).

The planning conducted by the Delta Protection Commission involved preparation and public review of nine background reports: Environment; Utilities and Infrastructure; Land Use and Development; Water; Levees; Agriculture; Recreation and Access; Marine Patrol, Boater Education, and Safety Programs; and Implementation. These reports provided the information base for the Plan findings and policies, as well as

allowing opportunities for public review and comment through circulation and public hearings before the Commission.

Environment

- Goal: Preserve and protect the natural resources of the Delta, including soils. Promote protection of remnants of riparian habitat. Promote seasonal flooding and agriculture practices on agricultural lands to maximize wildlife use of the hundreds of thousands of acres of lands in the Delta. Promote levee maintenance and rehabilitation to preserve the land areas and channel configurations in the Delta.

Utilities and Infrastructure

- Goal: Protect the Delta from excessive construction of utilities and infrastructure facilities, including those that support uses and development outside the Delta. Where construction of new utility and infrastructure facilities is appropriate, ensure the impacts of such new construction on the integrity of levees, wildlife, and agriculture are minimized.

Land Use

- Goal: Protect the unique character and qualities of the Primary Zone by preserving the cultural heritage and strong agricultural base of the Primary Zone. Direct new residential, commercial, and industrial development within the existing communities as currently designated and where appropriate services are available.

Agriculture

- Goal: To support long-term viability of commercial agriculture and to discourage inappropriate development of agricultural lands.

Water

- Goal: Protect long-term water quality in the Delta for agriculture, municipal, industrial, water-contact recreation, and fish and wildlife habitat uses, as well as all other designated beneficial uses.

Recreation and Access

- Goal: To promote continued recreational use of the land and waters of the Delta; to ensure that needed facilities that allow such uses are constructed, maintained, and supervised; to protect landowners from unauthorized recreational uses on private lands; and to maximize dwindling public funds for recreation by promoting public-private partnerships and multiple use of Delta lands.

Levees

- Goal: Support the improvement and long-term maintenance of Delta levees by coordinating permit reviews and guidelines for levee maintenance. Develop a long-term funding program for levee maintenance. Protect levees in emergency situations. Give levee rehabilitation and maintenance the priority over other uses of levee areas.

Land Use Element

The Land Use Element is the central focus of the General Plan. This Element sets policy for land uses in the unincorporated county for the next 25 years, establishing the foundation for future land use and development. The Land Use Element designates the distribution of land uses, such as residential, commercial, industrial, agricultural, open space, recreation and public uses. It also addresses the permitted density and intensity of the various land use designations as reflected on the County's General Plan Land Use Diagram. The overall goal of the land use element is:

- An orderly pattern of land use that concentrates urban development, enhances community character and identity through the creation and maintenance of neighborhoods, is functionally linked with transit, promotes public health and protects the County's natural, environmental and agricultural resources.

The County's land use strategy is illustrated in four sections. Each section contains objectives and policies that are intended to guide the County toward a more compact urban character by concentrating growth within existing urbanized areas and strategically-located new growth areas, thereby utilizing land resources as efficiently as possible.

Section 1: Logical Progression of Urban Development

GOAL:	**Direct new growth to previously urbanized areas, planned growth areas and strategically located new growth areas to promote efficient use of land, to reduce urban sprawl and its impacts, to preserve valuable environmental resources, and to protect agricultural and rangeland operations.**
Objective:	Reserve the land supply to amounts that can be systematically provided with urban services and confines the ultimate urban area within limits established by natural resources.
Objective:	Coordinated near- and long-term planning efforts for the development of the greater Jackson Highway area that creates cohesive and complete communities while protecting environmental resources.

Section 2: Growth Accommodation

GOAL:	**Accommodate projected population and employment growth in areas where the appropriate level of public infrastructure and services are or will be available during the planning period.**
Objective:	On average, achieve buildout of vacant and underutilized infill parcels at existing zoned densities, while recognizing that individual projects may be approved or denied at higher or lower densities based on their community and site suitability.
Objective:	Buildout of planned communities consistent with their approved plans.
Objective:	New retail and employment opportunities in targeted corridors to support community economic health and vitality, and additional residential dwelling units to support these stores and jobs.
Objective:	New communities that feature a mix of housing, jobs and retail development configured in a compact and transit supportive manner, that incorporate mixed use development (both vertical and horizontal), and that protect environmental resources and preserve open space.
Objective:	Historical rate of Agricultural-Residential development accommodated through build-out and limited expansion of existing Agricultural-Residential communities.

Section 3: Growth Management and Design

GOAL:	Land use patterns that maximize the benefits of new and existing development while maintaining the quality, character, and identity of neighborhood and community areas.
Objective:	Urban design that is functional, aesthetically pleasing, and distinctive.
Objective:	New development that maintains and/or enhances community identity while remaining compatible with existing neighborhoods.
Objective:	Neighborhoods with a mix of employment opportunities, commercial amenities, neighborhood services, and a variety of housing types and sizes.
Objective:	Compact, mixed use developments concentrated in nodes around transit stops, in community centers, and along commercial and transportation corridors.
Objective:	New development in existing communities, in new growth areas and improvements to existing buildings and housing stock that are designed and constructed to be energy efficient and incorporate renewable energy technologies where cost-effective and feasible.
Objective:	Reduced levels of light pollution in both new and existing communities.
Objective:	A community wide pattern of development with the most intensive land uses in close proximity to transit stops.
Objective:	High intensity, mixed use neighborhoods that provide a pedestrian environment and are closely linked to transit.
Objective:	Communities, neighborhoods, and single projects that promote pedestrian circulation and safety through amenities, good design, and a mix of different land uses in close proximity.
Objective:	A sufficient, yet efficient supply of parking.
Objective:	Improved housing affordability for residents earning below median incomes, and a continued supply of affordable housing units.
Objective:	Viable commercial services and a diversity of employment opportunities located in proximity to residents.
Objective:	Efficient build-out of existing Agricultural-Residential areas within the USB to meet rural residential demand without contaminating or overdrafting groundwater aquifers.
Objective:	Coordinate private development with the provision of adequate public facilities and services.
Objective:	Limited urban growth in rural towns consistent with infrastructure capacity, natural constraints, and the economic base.
Objective:	Limited agricultural-residential land use expansion outside the USB that does not compromise objectives for protecting prime agricultural lands and open space, and avoids groundwater overdraft and contamination.
Objective:	Important farmlands protected to ensure the continuation of agricultural production and to preserve open space.

Section 4: Built Environment Preservation and Enhancement

Sacramento County is unique in being a county that has a large percentage of urbanized and built out land under its jurisdiction, along with vast areas of open space, agriculture and rural development. Urban areas, ranging from new peripheral development to older existing communities, serve as the County's economic and employment backbone and are home to the majority of residents living in the unincorporated areas.

GOAL:	Reinvestment in and revitalization of existing communities through comprehensive and coordinated planning strategies and public participation that addresses housing, economic development, commercial development, employment opportunities, public facilities and infrastructure improvements.
Objective:	Revitalized commercial corridors that will enhance community image and stimulate private reinvestment, that support provision of enhanced public transit, and that will encourage new economic and commercial development and improvements to housing and infrastructure.
Objective:	Targeted planning efforts that focus on distinct districts within existing communities.
Objective:	Maximize compact, mixed use development opportunities along transportation corridors.
Objective:	Preserve and enhance the quality and character of the County's unique communities.
Objective:	Decentralized municipal services that will improve services, enhance and localize service delivery, and increase public involvement and authority in the planning process.
Objective:	Create and maintain a diversity of housing within existing communities, varying in terms of type, cost, design, size and tenure.
Objective:	Promote development in established communities that integrates well into the community and minimizes impacts to surrounding neighborhoods.
Objective:	Create and enhance dynamic, identifiable places unique to each community.
Objective:	Enhance the quality of life and economic vitality of each community area through strategic redevelopment, infill development and revitalization.
Objective:	Habitat enhancement, open space protection, and cohesive urban design accomplished by local, state, and federal agency coordination.
Objective:	Zoning consistent with the adopted General Plan Land Use Diagram.
Objective:	Accommodate land use proposals which are in the interest of the public health, safety, and welfare of the residents of Sacramento County.

Open Space Element

The Open Space Element is in many ways a plan for implementing other Elements of the General Plan. For example, maintaining intact habitat, productive soils, and mineral resource availability as open space is essential to resource conservation. Keeping floodplains undeveloped is likewise an important way to implement flood protection goals in the Safety Element. And, preserving open space areas within the fabric of urban development can address Land Use Element policies relating to neighborhood identity and land use conflicts. Indeed, the key role that open space plays in synthesizing land use objectives lends it the distinction as the only Element where an action plan is specifically required by state law.

GOAL:	Open space lands in Sacramento permanently protected through coordinated use of regulation, education, acquisition, density transfer and incentive programs.
Objective:	Effective open space preservation strategy that supports the Open Space Vision Diagram.
Objective:	Establishment of trails and greenbelts to provide for recreational opportunities and community separators.
Objective:	Appropriate urban and rural development clustered to provide open space resource protection.

Public Facilities Element

The Water Facilities Section addresses how future water supply facilities might be financed and provided for in an equitable fashion, while minimizing impacts on ground and surface water resources, as well as riverine and wetland environments. These facilities are a vital part of ensuring that enough public water is available to serve both existing residents as well as anticipated growth through 2030. This section describes policies and programs under two objectives:

- Environmentally sensitive and cost efficient placement of water treatment and distribution facilities.
- Timely and equitable financing of new water facilities

GOAL:	Efficient and effective fire protection and emergency response serving existing and new development.
Objective:	Fire and emergency safety measures integrated into all neighborhood and building design.
Objective:	Equitable and adequate funding for new fire protection facilities, equipment and personnel to serve growth.
Objective:	Encourage the service utility to develop cogeneration facilities in compliance with land use plans, ordinances, regulations, standards, and zoning restrictions without degrading natural and cultural resources.
Objective:	Plan and design electrical transmission facilities to minimize visual impacts, preserve existing land uses, and avoid biological and cultural resources.
Objective:	Develop new land uses adjacent to transmission facilities without compromising the safety and health of residents.

Safety Element

The purpose of the Safety Element is to identify and assess the potential for hazards to occur in Sacramento County and to formulate measures that provide adequate public protection. Sacramento County's physical setting and the projected rate of urban expansion create a potential for the residents of the County to be greatly affected by several hazards. Hazards can result from the action of nature, as in the case of earthquakes and floods; they can be man-made, as in the case of fires caused by arson or through carelessness. They can also originate from a combination of both natural and man-made causes, such as dam failure that results from an earthquake. This element examines both natural and man-made hazards, including seismic events, flooding, and fires. Minimizing and preventing these hazards are the focus of this Element.

Seismic and Geologic Hazards

- Goal: Minimize the loss of life, injury, and property damage due to seismic and geological hazards.

Flooding

- Goal: Minimize the loss of life, injury, and property damage due to flood hazards.

Fire Hazards

- Goal: Minimize the loss of life, injury, and property damage due to fire hazards.

Emergency Response

- Goal: An Emergency Preparedness System that can effectively respond in the event of a natural or manmade disaster.

Repetitive Loss Area Analysis Report (July 2015)

The purpose of this Report is to assist home owners in reducing their flood risk by providing a broader understanding of the potential and existing flooding problems and identifying potential solutions. This is one component of Sacramento County's overall floodplain management program. Due to the number of properties in Sacramento County that meet the National Flood Insurance Program's (NFIP's) definition of Repetitive Loss properties, a Repetitive Loss Area Analysis (RLAA) is required for Sacramento County as a part of its participation in the Community Rating System (CRS) program. This Report contains all twenty-eight (28) designated Repetitive Loss Areas (RLAs) within Sacramento County.

The County followed a process prescribed by the CRS program. An area analyses must have been prepared and adopted for each repetitive loss area in the community. The analyses must meet the following criteria:

- The repetitive loss areas must be mapped.
- A five-step process must be followed. Although all five steps must be completed, steps 2–4 do not have to be done in the order listed. For example, staff may want to contact agencies and organizations to see if they have useful data (Step 2) after the site visit is conducted (Step 3).
- The repetitive loss area analysis report(s) must be submitted to the community's governing body and made available to the media and the public. If private or sensitive information is included in the report, then a summary report may be prepared for the media and the public. The complete repetitive loss area analysis report(s) must be adopted by the community's governing body or by an office that has been delegated approval authority by the community's governing body.
- An annual evaluation report must be done.
- The analysis must be updated in time for each CRS cycle verification visit.

Properties in the RLAs were notified of the analysis and data was collected from various sources to identify the hazard and capabilities to mitigate them.

Sacramento Metropolitan Fire Protection District Community Wildfire Protection Plan (June 2014)

In 2008, a wildfire that injured Sacramento Metropolitan Fire District firefighters in a burnover, a fire in which personnel were overrun by a wildland fire, highlighted the need for Metro Fire to implement additional strategies to prevent and combat wildfire within Metro Fire's jurisdictional boundaries (District). In response to this fire, Metro Fire applied for and successfully obtained a grant from the Assistance to Firefighters Grants Program of the Federal Emergency Management Agency (FEMA) to develop this

community wildfire protection plans (CWPP) and to launch an integrated wildfire prevention program that would reduce wildfire risk and increase community resiliency within district boundaries.

Program for Public Involvement (September 2015)

Communities that participate in the Community Rating System (CRS) of the National Flood Insurance Program (NFIP) receive credit points for developing and implementing a Program for Public Information (PPI.) The PPI is a new approach to identify, prepare, implement, and monitor a range of public information activities tailored to meet community's unique needs for flood preparedness and response. The Sacramento County PPI committee reviewed the history of the Sacramento region's flood risk and defined target areas (specific risk and demographic, that would benefit from outreach projects.

- Target Areas (Specific Risk)
  - ✓ Residents living in Special Flood Hazard Areas (SFHA)s
  - ✓ Residents living in areas that have a non-mapped flood risk
  - ✓ Repetitive Loss Areas
  - ✓ Areas Protected by Levees
  - ✓ Areas Protected by Dams

- Target Audience (Demographics)
  - ✓ All County residents (will benefit from general flood message outreach)
  - ✓ Residents affected by NFIP map/policy change
  - ✓ School aged children
  - ✓ Relators, agents, lenders
  - ✓ Individuals that primarily use social media

There are six mandatory flood awareness and preparedness topics that must be included in the PPI. A community can include up to four additional topics based on the community's public information needs as identified by the PPI Committee. The Committee also determines the goal or desired outcome for each outreach topic. The Sacramento County PPI includes a total of ten outreach topics:

- Mandatory Topics
  - ✓ Know your flood hazard
  - ✓ Insure your property for your hazard
  - ✓ Protect people from the hazard
  - ✓ Protect your property from the flood hazard
  - ✓ Build responsibly
  - ✓ Protect natural floodplain functions

- Community Specific Topics
  - ✓ Check out a low cost Preferred Risk Policy
  - ✓ Call 875-RAIN for flood-related topics
  - ✓ Keep streams and ditches clean
  - ✓ Only rain down the drain (scoop the poop)

Table 4-98 contains initiatives that are in place that support the goal and CRS messages that are conducted by organizations other than Sacramento County. The list was composed by County staff research and PPI Committee members' feedback.

Table 4-98 PPI Outreach Initiatives

OP#	Organization/Stakeholder	Project	Subject Matter	Frequency	Outreach Classification	Target Audience
16	Homeowner's Association	Association meeting	Message: 1-10	Once a year	General Outreach	All County Residents
17	SAFCA	website	Message: 1, 2, 4, 6	Year-round	Informational Material	All County Residents
18	Sacramento Stormwater Quality Partnership	website	Message: 6, 9, 10	Year-round	Informational Material	All County Residents
		Events	Message: 6, 9, 10	Year-round	General Outreach	All County Residents
19	Department of Water Resources' (DWR) FloodSAFE California Initiative	Levee Mailer	Message: 1, 2, 3, 5	Fall	Targeted Outreach	Areas Protected by Levees
20	Sacramento Association of Realtors	member newsletter	Message: 1,2,7	Year-round	Informational Material	All County Residents
21	Sacramento Area Creeks Council	Creek Week	Message: 9	April	General Outreach	All County Residents
		Tours	Message: 6	multiple	General Outreach	School-Aged Children
		Website	Message: 9	Year-round	Informational Material	All County Residents
22	U.S. Fish & Wildlife Service (Stone Lakes National Wildlife Refuge)	Website	Message: 6	Year-round	Informational Material	All County Residents
		Tours		All County Residents	Tours	General Outreach
23	Sacramento County Parks and Recreation District	Scoop the Poop	Message: 10	Year-round	General Outreach	All County Residents
24	Sacramento Valley Conservancy (Deer Creek Hills)	Website	Message: 6	Year-round	Informational Material	All County Residents
		tours			General Outreach	All County Residents
25	Cosumnes River Preserve	Website	Message: 6	Year-round	Informational Material	All County Residents
		Tours			General Outreach	All County Residents
26	Sacramento Splash	Website	Message: 6	Year-round	Informational Material	All County Residents
		tours			General Outreach	School-Aged Children

OP#	Organization/Stakeholder	Project	Subject Matter	Frequency	Outreach Classification	Target Audience
27	American River Flood Control District	levee maintenance	Message: 1, 2, 4, 6	Year-round	Informational Material	SFHA residents along American River
28	Water Education Foundation	tours, lectures	Message: 1, 4, 5, 6	Year-round	Informational Material	School-Aged Children
29	Sacramento Regional County Sanitation District	Environmental Protection	Message: 6, 9, 10	Year-round	General Outreach	All County Residents
		Walk on the Wild Side	Message: 6	May	General Outreach	All County Residents
30	American Red Cross Sierra-Delta Chapter	trainings, community events, social media messaging, website, telephone/tablet applications	Message: 1,2, 3	Year-round	General Outreach	All County Residents

Sacramento County Stormwater Management Program

The County of Sacramento, along with the cities of Sacramento, Citrus Heights, Galt, Elk Grove, Folsom and Rancho Cordova (collectively known as the Sacramento Stormwater Quality Partnership), is subject to Waste Discharge Requirements Order No. R5-2008-0142 (National Pollutant Discharge Elimination System (NPDES) Permit No. CAS082597) (Municipal Stormwater Permit) issued by the Central Valley Regional Water Quality Control Board (Regional Water Board). This comprehensive plan is designed to ultimately reduce pollution in stormwater runoff in compliance with the County's National Pollutant Discharge Elimination System (NPDES) stormwater permit within Sacramento County. The plan includes processes for accomplishing the goals of minimizing construction site runoff as well as post-construction stormwater management in newly developed and redeveloped areas.

Sacramento County Watershed Management Plan (2009)

A watershed management plan is a document that guides efforts to control pollution, manage stormwater, and protect and improve local streams and the uplands that surround them. These plans also provide collaborative agreement among government, other local stakeholders, and citizens during the planning process. Sacramento County has been involved in the development of a comprehensive watershed management plan. This watershed plan guides the County and other stakeholders in protecting, managing, and improving environmental resources and habitat.

Sacramento and San Joaquin River Basins Comprehensive Study (2002)

This study was a joint effort by the State of California Reclamation Board and the U.S. Army Corps of Engineers (USACE) in coordination with Federal, State and local agencies. It provides a Comprehensive

Plan for Flood Damage Reduction and Ecosystem Restoration within the two river basins, and a strategy for implementation. Numerous technical analyses were performed for this study using computer modeling tools developed by the USACE and DWR to simulate the hydrology, hydraulics, ecosystem function, flood risk and associated economic damages in the Sacramento and San Joaquin river systems. DWR, USACE, and others will use these models in developing future flood management and environmental improvement projects in the Sacramento and San Joaquin river basins.

Community Plans

Sacramento County includes 25 mapped communities, some of which are incorporated cities that are not within County jurisdiction. In some cases, the communities within the unincorporated County have adopted Community or Specific Plans. Community Plans and Specific Plans provide direction for entire communities or other defined new geographic areas. These plans will take different forms depending on the specific needs of our communities. They typically set forth policy and implementation strategies for such items as land use, transportation, urban design, parks, school facilities and public services. A Community Plan for a developed, mature area would focus on neighborhood enhancement and commercial revitalization goals and action items; whereas a Specific Plan or Community Plan for an area that is newly developing would focus more on new development needs, location of new public facilities and infrastructure financing. These plans help implement the County General Plan on area-specific basis. In addition, the County has initiated and implemented special planning programs for projects that are unique and controversial in nature.

A Community Plan includes goals and policies specific to each individual community, and is accompanied by a Community Land Use Plan map. Status of these plans can be found in Table 4-99.

Table 4-99 Community Plans in Sacramento County

Community Plan	Last Adopted
Antelope	1985
Arden Arcade	1980 (currently being updated)
Carmichael	1975 (update process will begin soon)
Citrus Heights	1978
Cordova	1978 (currently being updated)
Delta	1983
Elk Grove	1978*
Fair Oaks	1975
Florin-Vineyard	1985
Laguna	1978*
North Highlands/Foothill Farms	1974
Orangevale	1976
Rio Linda/Elverta	1998
Southeast	1976 (map only)

Community Plan	Last Adopted
South Sacramento	1978

*These plans are no longer relevant as a result of the incorporation of the City of Elk Grove.

There are five specific plans adopted within Sacramento County. The plans are:

- Easton Project
- East Antelope
- Elverta
- Mather Field
- North Vineyard Station

Sacramento County Emergency Operations Plan (2012, 2016 in-process)

The Sacramento County Office of Emergency Services coordinates planning, preparedness, response, and recovery efforts for disasters in unincorporated Sacramento County. The Sacramento County Emergency Operations Plan addresses the County's planned response to emergency situations associated with natural disasters, technological incidents and national security emergencies in or affecting Sacramento County. Response issues and responsibilities contained in an EOP include:

- Emergency public information and warning
- Situation survey and analysis
- Allocation and mobilization of response resources
- Implementation of health and safety measures
- Enforcement of police powers
- Access control and movement
- Evacuation and rescue
- Care and treatment of casualties
- Control and allocation of vital resources and supplies
- Protection and restoration of facilities and systems
- Mass care for displaced individuals and families
- Collection, identification and disposal of the deceased

Sacramento County Warning and Evacuation Procedures

Sacramento County and its incorporated communities have a variety of systems and procedures established to protect its residents and visitors to plan for, avoid, and respond to a hazard event including those associated with floods and other natural disasters. This includes Pre-Disaster Public Awareness and Education information which is major component in successfully reducing loss of life and property in a community when faced with a potentially catastrophic incident. Much of this information is not specific to a given hazard event and is always accessible to the public on local County and City websites, while other information is incident-specific. A general overview of specific warning and evacuation systems and procedures are summarized further below.

Monitoring for Alerts, Watches and Warnings

Emergency officials constantly monitor events and the environment to identify specific threats that may affect their jurisdiction and increase awareness levels of emergency personnel and the community when a threat is approaching or imminent.

The National Weather Service (NWS), a part of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), is the prime agency for detecting meteorological threats, such as floods and severe weather. Severe weather warnings are transmitted through NOAA's Weather Radio System, considered by the federal government as the official source for weather information. Federal agencies can only look at the large scale, (e.g., whether conditions are appropriate for the formation of a thunderstorm.) Local emergency managers can provide more site-specific and timely recognition by sending out NWS trained spotters to watch the skies when the Weather Service issues a watch or a warning. The NWS page for Sacramento County is accessible through the Sacramento County website and at the following: http://forecast.weather.gov/MapClick.php?zoneid=CAZ017

A flood threat recognition system predicts the time and height of a flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On larger rivers, this measuring and calculating is performed by the NWS. Support for NOAA's efforts is provided by cooperating partners from state and local agencies. Forecasts of expected river stages are made through the Advanced Hydrologic Prediction Service (AHPS) of the NWS. Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio.

On smaller rivers, locally established rainfall and river gauges are needed to establish a flood threat recognition system. The NWS may issue a "flash flood watch." This is issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain nor imminent. These events are so localized and so rapid that a "flash flood warning" may not be issued, especially if no remote threat recognition equipment is available. In the absence of a gauging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding.

The County and City EOPs include procedures for threat identification. The City and County work closely with the NWS for issuing an Emergency Alert System (EAS). Additional Sacramento County's threat identification mechanisms include:

California Data Exchange Center (CDEC). The CDEC provides information for flood forecasting information at http://cdec.water.ca.gov/. The CDEC installs, maintains, and operates an extensive hydrologic data collection network including automatic snow reporting gages for the Cooperative Snow Surveys Program and precipitation and river stage sensors for flood forecasting.

Automated Local Evaluation in Real Time (ALERT) System. ALERT was created by the NWS to provide continuous and automatic reports from river levels and rainfall gauges detect impending high water levels. ALERT information includes:

- Rainfall Summary
- Stage Summary
- Storm Ready
- Sandbag Information
- Detailed Forecast
- Quantitative Precipitation Forecasts (QPF)
- NWS River Forecasts

The Sacramento County's ALERT system consists of 2 base stations, and 50 gaging stations. The purpose of the County's ALERT website is to provide real time monitoring information to stage and rainfall information during storm events, which assist in informing the activation of additional warning and potential evacuation of affected areas. This information which can be accessed through the Sacramento County website includes information for: Stream Level Summaries and Maps; and Rainfall Summaries and Maps. See https://www.sacflood.org/home.php.

Dam Protocols. Should an event trigger the activation of an Emergency Action Plan (EAP) for a potential dam failure, County OES receives this information via direct phone calls from the originating source/agency or from Sacramento County Dispatch and/or Cal OES. County OES then follows the notification and evacuation procedures called for in the EOP.

Notifications and Warning Systems

Once a disaster is imminent, action is taken to control the situation, save lives, protect property, and minimize the effects of the disaster. During this phase, warning systems are activated; resources and first responders notified and mobilized; and evacuations begin.

After a threat recognition system tells the emergency services office that a flood, severe weather or other hazard is coming, the next step is to notify the public and staff of other agencies and critical facilities. Providing adequate and timely notification to the public is the greatest challenge, especially with sudden or no-notice events. The earlier and more specific the warning, the greater the number of people that can implement protection measures.

As previously described, the NWS issues notices to the public using two levels of notification:

- **Watch.** Conditions are right for flooding, thunderstorms, or other hazard event.
- **Warning**. A flood or other event has started or been observed.

In coordination with established public safety warning protocols, the activated EOC will manage the dissemination of timely and adequate warnings to threatened populations in the most direct and effective means possible. Depending upon the threat and time availability, the County and City EOCs will initiate alerts and warnings utilizing any of the following methods:

- Activation of the Emergency Alert System (EAS)
- Activation of the Telephonic Alert and Warning System (Everbridge and Reverse 911)
- Activation of the Emergency Digital Information System (EDIS)
- Activation of the California Law Enforcement Mutual Aid Radio System (CLEMARS)
- Media broadcast alerts.
- Commercial or public radio or TV stations

- ✓ Radio: KFBK 1530 am, KSTE 650, KGBY, 92.5 FM
- ✓ TV: KCRA Channel 3, www.KCRA.com; KXTV Channel 10; KOVR Channel 13; KTXL Channel 40

- NOAA Weather Radio
- www.saccounty.net; SacramentoReady.org websites
- 211/311 Sacramento
- CalTrans 511
- Telephone trees/mass telephone notifications
- Tone activated receivers in key facilities
- Fire and Law enforcement loudspeakers
- Outdoor warning sirens
- Mobile public address sirens/systems
- Door-to-door contact
- Vulnerable population databases
- Email notifications

Multiple or redundant systems are most effective – if people do not hear one warning, they may still get the message from another part of the system. Just as important as issuing a warning is telling people what to do in case of an emergency. A warning program should have a public information aspect that details appropriate warnings and responses.

Sacramento ALERT

The Sacramento County OES, in partnership with Yolo and Placer emergency agencies, use a state-of-the-art emergency alert system known as Sacramento Alert. The system provides information to residents about emergency events quickly and through a variety of communication methods.

The alert system currently includes all listed and unlisted landline telephone numbers in Yolo, Placer, and Sacramento counties that are serviced by AT&T and Verizon.

To ensure emergency notices are received quickly both at work and home, residents are encouraged to log onto the Sacramento Alert Self- Registration Portal and provide phone numbers for both home and work, including land and cell phone numbers, email addresses, TTY device information and instant messaging information.

Residents will only receive alerts that are critical and time-sensitive, including: flooding, levee failures, severe weather, disaster events, unexpected road closures, missing persons, and evacuations of buildings or neighborhoods in specific geographic locations.

The system, which uses Everbridge Alert and Notifications System, was made possible for all three counties by a grant from CAL OES and supported by CA Department of Water Resources, Flood Operations Center through the Sacramento County OES.

StormReady

The NWS established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather related warnings for the public. Both Sacramento County and the City of Sacramento are StormReady certified. StormReady communities are better prepared to save live from the onslaught of severe weather through advanced planning, education, and awareness. Being designated a StormReady community by the NWS is a good measure of a community's emergency warning program for weather hazards.

Evacuation and Shelter-in-Place

The principle of evacuation is to move citizens from a place of relative danger to a place of relative safety, via a route that does not pose significant danger. There are six key components to a successful evacuation:

- Adequate warning
- Adequate routes
- Proper timing to ensure the routes are clear
- Traffic control
- Knowledgeable travelers
- Care for special populations (e.g., disabled, hospital patients, school children)

Evacuation planning also considers sheltering options for those that cannot get out of harm's way. Shelters can also serve as a temporary place after the storm for those who have lost their homes.

The County and City both maintain Evacuation Plans that outline strategies and protocols for medium to high-level (catastrophic) evacuation events in the County. These plans also include procedures for sheltering to provide people affected by a disaster with a safe, temporary place to be housed during or immediately after a disaster until they can either return to their homes or be relocated to other housing facilities. Highlights of these County/City plans are detailed below.

Sacramento County Evacuation Plan (2008 Annex to EOP)

Sacramento County's Evacuation Plan, 2008, is an annex to the County EOP. An update to the 2008 Evacuation Plan is scheduled for 2016. The purpose of the Evacuation Plan is to document agreed upon strategy for the County's response to emergencies that involve the evacuation of persons from an impacted area to a safe area. This involves coordination and support for the safe and effective evacuation of the general population and for those who need additional support to evacuate, such as health care facilities and schools. This plan also includes considerations for shelter-in-place options, in circumstances where evacuation may be a higher risk option. All evacuation and sheltering-in-place for medium and high level catastrophic incidents will be coordinated through Sacramento County EOC. Low level incidents will be handled at a more local level, such as through local fire departments. Care and sheltering of evacuees will be handled through Sacramento County's Department of Human Assistance (DHA), with support from Red Cross. The County's Evacuation Plan identifies criteria and triggers for determining what level of evacuation is warranted; information on transportation and evacuation movement control; and roles and responsibilities of agencies/organizations supporting the evacuation.

Information about flood depth maps and evacuation plan maps can be found online by accessing http://www.msa.saccounty.net/waterresources/stormready/default.asp?page=maps.

The Evacuation Plan is broken down in to the following sections:

- Section 1—Introduction
- Section 2—Concept of Operations
- Section 3—Levels of Activation and Evacuation Triggers
- Section 4 Emergency Communication—Public Warning and Alerts
- Section 5—Transportation and Evacuation Movement Control
- Section 6—Care and Shelter
- Section 7—Roles and Responsibilities

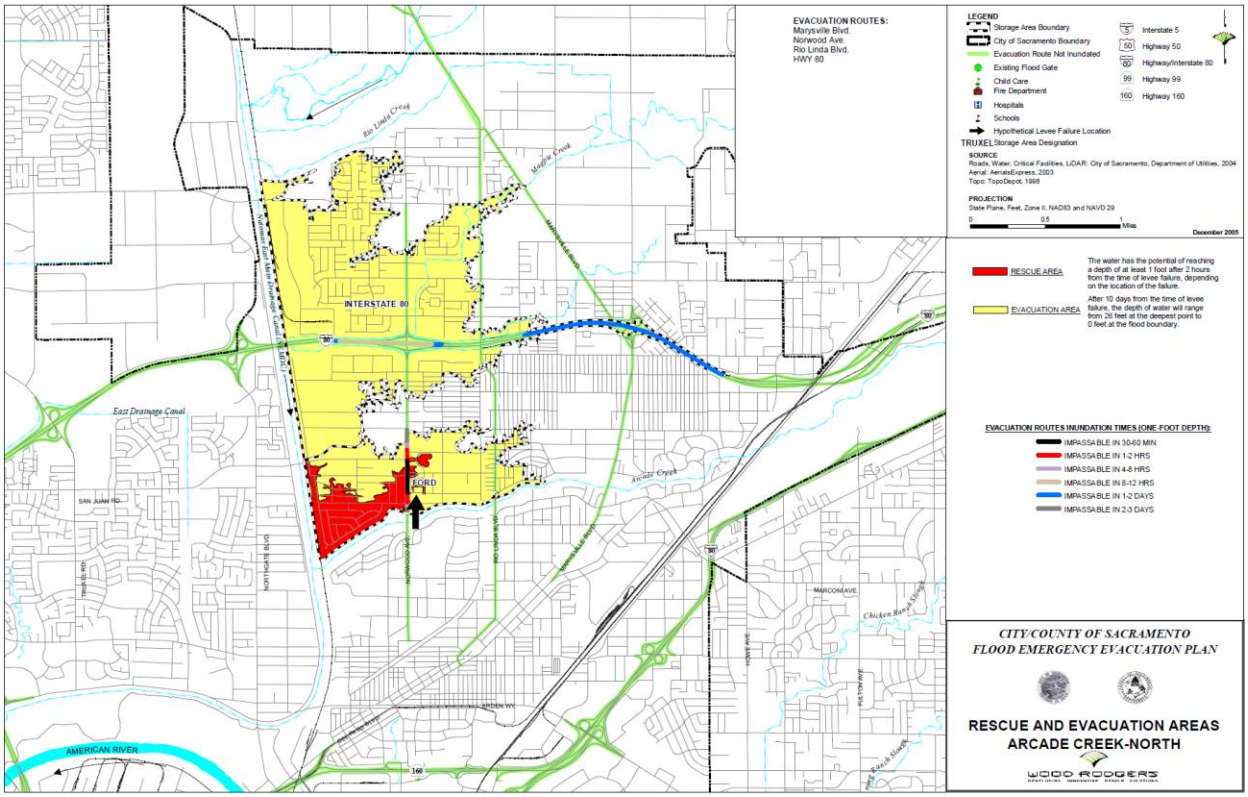
The overall objectives of emergency evacuation actions include:

- Alert and warning of the public to the threat and need to evacuate, and the establishment of the Joint Information Center (JIC) for information coordination.
- Movement and control of the general population out of the threatened area, including traffic control and directions.
- Transportation support of vulnerable populations (people with disabilities, elderly, persons without vehicles, et al.) out of the threatened area.
- Establishment of Evacuation Transfer Points.
- Provision of shelters for care of the county's population and animals.
- Access control into the hazard area.
- Assure safe and orderly re-entry to evacuated persons, with clear instructions.

A key evacuation and safety concern is when roads and bridges go under water. Generally, the larger the road, the less likely it is to flood, but this is not always the case. In addition, a bridge does not have to be under water to be damaged or to cut off an evacuation route. In some cases the bridge is high, but the access road may be flooded. In other cases, the bridge or culvert can be washed out. This is especially dangerous if a person drives on a flooded road and assumes that the bridge is still there.

Residents and visitors within Sacramento County should be made aware of evacuation routes. It is important that the County work with both public and private entities to ensure that everyone knows which roads and thoroughfares are designated for evacuation. Figure 4-98 is an example map that indicates the designated evacuation routes for a portion of Sacramento County.

Figure 4-98 Arcade Creek Area Evacuation Plan Map



Source: Sacramento County Evacuation Plan

More information on the importance of including evacuation procedures and maps as part of a sound mitigation strategy can be found in Appendix C to this plan. In addition, Appendix C contains information on post mitigation policies and procedures. More information specific to the County can be found in their various response and recovery plans.

Sacramento County Post Disaster Mitigation Policies and Procedure

The Sacramento County EOP, and its annexes, is intended to facilitate multi-agency and multi-jurisdictional coordination during emergencies including hazard events. Through it policies and procedures it seeks to mitigate the effects of hazards, prepare for measures to be taken which will preserve life and minimize damage, enhance response during emergencies and provide necessary assistance, and establish a recovery system in order to return the community to their normal state of affairs.

The goal of the recovery phase of an emergency incident or natural disaster is to return the residents, public services and private sector in an impacted area to their pre-disaster state, and through implementation of hazard mitigation measures, seek to prevent, as much as possible, similar damage, destruction or chaos after incidents and disasters in the future. Sacramento policies include objectives, responsibilities and procedures for restoration of services and returning of the affected area to its pre-emergency condition. Mitigation is emphasized as a major component of recovery efforts.

Post-disaster recovery activities are designed to protect public health and safety and facilitate recovery. Appropriate measures include:

- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Monitoring for diseases
- Vaccinating residents for tetanus and other diseases
- Clearing streets
- Cleaning up debris and garbage

As the initial and sustained operational priorities are met, emergency management officials consider the recovery phase needs. Short-term and long-term recovery is covered in the EOP. Short-term recovery operations begin during the response phase and include rapid debris removal and cleanup and restoration of essential services to minimum operating standards. Long-term recovery operations work to restore the community to pre-disaster conditions and include hazard mitigation activities, restoration and reconstruction of public facilities, and disaster response cost recovery. Local Assistance Centers and/or Disaster Recovery Centers are opened and damages assessed. Elements of recovery include:

- Windshield survey and documentation of flood impacts
- Safety assessment
- Damage assessments
- Engineering assessments
- Post-flood building entry
- High water marks (also risk communication)
- Code enforcement/triage process
- Permitting process
- Temporary housing
- After action reporting

Regulating Reconstruction

Requiring permits for building repairs and conducting inspections are vital activities to ensure that damaged structures are safe for people to reenter and repair. The NFIP requires that local officials enforce the substantial damage regulations. These rules require that if the cost to repair a building in the mapped floodplain equals or exceeds 50% of the building's market value, the building must be retrofitted to meet the standards of a new building in the floodplain. In most cases, this means that a substantially damaged building must be elevated above the base flood elevation.

Mitigation

Mitigation measures to reduce the risk and vulnerability of a community to future disaster losses can be implemented in advance of a disaster event and also as part of post-disaster recovery efforts. Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Effective mitigation can break the cycle of disaster damage, reconstruction, and repeated damage. Categories of mitigation measures include prevention, emergency services, property protection, natural resource protection, structural, and public information, many of which are discussed throughout this document.

Additional mitigation elements specific to the Sacramento area are discussed further below.

LHMP

The Federal Disaster Mitigation Act (DMA) of 2000 requires communities to develop an approved Local Hazard Mitigation Plan (LHMP) to remain eligible to apply for certain FEMA Hazard Mitigation Assistance (HMA) grants. Applications submitted for funding from the FEMA HMA grant programs must "be consistent with" the mitigation strategy outlined in the LHMP. Sacramento County and the City of Sacramento are in process with the update of their 2016 LHMP Update. Once complete and adopted, this LHMP update will provide continued eligibility for all participating jurisdictions for FEMA pre- and post-disaster mitigation funding.

Grant Funding

An understanding of the various funding streams and opportunities will enable the communities to match up identified flood mitigation projects with the grant programs that are most likely to fund them. Additionally, some of the funding opportunities can be utilized together. Mitigation grant funding opportunities available pre- and post- disaster include the following:

- FEMA Hazard Mitigation Assistance (HMA) Grants (Pre-disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Hazard Mitigation Grant Program (HMGP))
- FEMA Public Assistance Section 406 Mitigation
- Community Development Block Grants
- Small Business Loans
- Increased Cost of Compliance

Other Key Sacramento Area Emergency Plans

- ✓ Mass Care and Sheltering Plan, 2012 Annex to the EOP
- ✓ People with Access and Functional Needs, 2012 Annex to the Mass Care and Sheltering Plan
- ✓ Sheltering the Medically Fragile, 2012 Annex to the Mass Care and Sheltering Plan
- ✓ Severe Weather Guidance, 2012 Annex to the EOP
- ✓ Animal Care and Shelter, 2012 Annex to the EOP
- ✓ Continuity of Governmental Operations Functional Annex and departmental COOP plans, 2011
- ✓ Local Hazard Mitigation Plan, Update 2011; 2016 Update in process

South Sacramento Habitat Conservation Plan

The South Sacramento Habitat Conservation Plan (SSHCP) is a regional approach to addressing issues related to urban development, habitat conservation and agricultural protection. As of the writing of this plan, the SSHCP was undergoing environmental review. The SSHCP will consolidate environmental efforts to protect and enhance wetlands (primarily vernal pools) and upland habitats to provide ecologically viable conservation areas. It will also minimize regulatory hurdles and streamline the permitting process for development projects. The SSHCP will cover 40 different species of plants and wildlife including 10

that are state or federally listed as threatened or endangered. The SSHCP will be an agreement between state/federal wildlife and wetland regulators and local jurisdictions, which will allow land owners to engage in the "incidental take" of listed species (i.e., to destroy or degrade habitat) in return for conservation commitments from local jurisdictions.

The options for securing these commitments are currently being developed and will be identified prior to the adoption of the SSHCP. The geographic scope of the SSHCP includes U.S. Highway 50 to the north, Interstate 5 to the west, the Sacramento County line with El Dorado and Amador Counties to the east, and San Joaquin County to the south. The Study Area excludes the City of Sacramento, the City of Folsom and Folsom's Sphere of Influence, the Sacramento-San Joaquin Delta, and the Sacramento County community of Rancho Murieta. Sacramento County is partnering with the incorporated cities of Rancho Cordova, Galt, and Elk Grove as well as the Sacramento Regional County Sanitation District and Sacramento County Water Agency to further advance the regional planning goals of the SSHCP.

SSHCP Goals and Objectives

Key Principles - Develop a Habitat Conservation Plan through a process that:

- Involves all stakeholders in the study area including developers, environmentalists, agriculturists and government agencies.
- Educates stakeholders regarding the importance of the plan, its components and its significance to them.
- Progresses in an efficient and expeditious manner through consensus building.

Stakeholder Goals - Create a Habitat Conservation Plan that:

- Ensures long-term viability to aid and enhance recovery of sensitive species in the study area by protecting an adequate quality and quantity of habitat in an integrated manner.
- Accommodates development in appropriate sites with fair and reasonable mitigation cost structure.
- Protects agricultural lands and operations from constraints associated with the plan's implementation.
- Gains the trust of all stakeholders in the permitting process by providing certainty that their interests will be considered in a fair and predictable process.
- Relies on voluntary participation through incentives that make the HCP process preferable to the existing process.
- Provides a streamlined permitting process that reduces permitting cost to developers and taxpayers.
- Provides a comprehensive framework for use in linking plant and animal conservation with local land use programs, consistent with Sacramento County General Plan goals and policies.

Sacramento County Ordinances

The Sacramento County General Plan provides policy direction for land use, development, open space protection, and environmental quality; however, this policy direction must be carried out through numerous ordinances, programs, and agreements. The following ordinances are among the most important tools for implementing the General Plan and/or are critical to the mitigation of hazards identified in this plan.

Emergency Organization (Sacramento County Code Title 2, Chapter 2.46)

The purposes of this chapter are to provide for the preparation, unification and carrying out of plans for the protection of persons and property within the incorporated and unincorporated areas of the County in the event of an emergency; to provide for the direction of the emergency management organization and the coordination of the emergency functions of the County with all other political subdivisions, emergency services agencies both public and private, corporations, organizations and affected persons within the County.

Mosquito Ordinance (Sacramento County Code Title 6, Chapter 24)

The purpose of this ordinance is to control the mosquito population and breeding grounds in the County. The natural presence of mosquito larvae in any such water shall be deemed conclusive evidence of mosquito breeding and of the existence of a public nuisance, provided such water, receptacle, container or mosquito breeding occurs within two thousand (2000) feet of any occupied dwelling house. The health officer of the County is tasked with the eradication of the mosquito population.

Sacramento County Building Code (Sacramento County Code Title 16, Chapter 4)

The purpose of this Code is to provide minimum standards to safeguard life, limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, use, occupancy, location and of all buildings and structures within this jurisdiction, and certain equipment specifically regulated herein.

The 2013 California Building Code, Title 24, Part 2 of the California Code of Regulations, a portion of the California Building Standards Code as defined in the California State Health and Safety Code Sections 17922 and 18901 et seq., (hereinafter referred to as the "Building Code") and Building Code Appendix C (Group U Agricultural Buildings) and any rules and regulations promulgated pursuant thereto are hereby adopted and incorporated by reference herein. Except as otherwise provided by this chapter, Chapters 16.02 and 16.10 of the Sacramento County Code, all construction, alteration, moving, demolition, repair and use of any building or structure within this jurisdiction shall be made in conformance with the Building Code and any rules and regulations promulgated pursuant thereto.

Sacramento County Land Grading and Erosion Control Ordinance (Sacramento County Code Title 16, Chapter 44).

The ordinance was established to minimize damage to surrounding properties and public rights-of-way; limit degradation to the water quality of watercourses; and curb the disruption of drainage system flow caused by the activities of clearing, grubbing, grading, filling, and excavating land. The ordinance establishes administrative procedures, minimum standards of review, and implementation and enforcement procedures for the control of erosion and sedimentation that are directly related to land grading activities.

Sacramento County Fire Code (Sacramento County Code Title 17, Chapter 4)

There is hereby adopted by the Board of Supervisors of the County of Sacramento for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion, that

certain code known as the California Fire Code, Title 24, California Code of Regulations, Part 9, incorporating the International Fire Code published by the International Code Council, being particularly the 2012 Edition, including the appendices thereof, and the International Fire Code Standards published by the International Code Council, being particularly the 2012 Edition, and the wholes thereof, save and except such portions as hereinafter deleted, modified or amended herein. Not less than one copy of such code has been and now is filed with the Clerk of the Board of Supervisors. From the effective date of the ordinance codified in this chapter, the provisions thereof shall be controlling within the limits of Sacramento County except that any inconsistent regulations and ordinances adopted pursuant to applicable law by a fire protection district or a community service district having a fire department within the County shall be controlling within that district's jurisdictional areas.

Sacramento County Weed Control Ordinance (Sacramento County Code Title 17, Chapter 12)

This ordinance establishes that the uncontrolled growth or accumulation of grass, weeds or other materials or obstructions on sidewalks, streets, and on lands or lots is dangerous or injurious to neighboring property and the health or welfare of residents of the vicinity and is a public nuisance in that it creates a condition that reduces the value of private property, promotes blight and deterioration, invites plundering, creates fire hazards, constitutes an attractive nuisance creating a hazard to the health and safety of minors, creates a harbor for rodents and insects and is injurious to the health, safety and general welfare. This ordinance tasks the Chief of any County Fire Department with the authority to enforce the ordinance.

Zoning and Subdivision Ordinance (Sacramento County Code Title 22)

The Sacramento County Zoning Code has been adopted by the Board of Supervisors and is used to encourage the most appropriate use of land; to conserve, protect and stabilize the value of property; to provide adequate open space for light and air; to prevent undue concentration of population; to lessen congestion on the streets; to facilitate adequate provisions for community utilities such as transportation, water, sewerage, schools, parks and other publicly owned facilities; and to promote the public health, safety and general welfare.

Sacramento County's subdivision ordinance regulates the design and improvement of land divisions and the dedication of public improvements needed in connection with land divisions.

Floodplain Management Ordinance (Ordinance No. SZC-2014-0007)

The special flood hazard areas and local flood hazard areas of the County are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental service, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety, and general welfare. Flood losses may be avoided by development standards described in this Ordinance including elevating new construction safely above the recognized flood hazard and minimizing cumulative effect of encroachments in special and local flood hazard areas, which may increase flood heights and velocities.

It is the purpose of this ordinance to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities located in special flood hazard areas and local flood hazard areas;
- Ensure that current flood hazard data is available for property owners, prospective buyers, insurance agents, real estate agents, and other interested parties;
- Ensure that those who develop in special flood hazard areas or local flood hazard areas do so pursuant to this ordinance; and
- Ensure that those who develop special flood hazard areas or local flood hazard areas assume responsibility for their actions.

In order to accomplish its purposes, this ordinance includes methods and provisions to:

- Restrict or prohibit development which is dangerous to health, safety, and property due to flood hazards, or which result in damaging increases in flood heights or velocities;
- Require that development vulnerable to floods, including facilities which serve such development, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
- Control filling, grading, dredging, and other development which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwater or which may increase flood hazards in other areas.

This ordinance shall apply to all areas of special flood hazards and local flood hazards within the jurisdiction of the County of Sacramento. The areas of special flood hazard identified by the Federal Insurance Administration (FIA) of the Federal Emergency Management Agency (FEMA) in the most recent effective Flood Insurance Study (FIS) for the County of Sacramento and accompanying Flood Insurance Rate Maps and their subsequent amendments and/or revisions, are hereby adopted by reference and declared a part of this ordinance. This FIS and FIRM are the minimum area of applicability of this ordinance, and are on file in the office of the Sacramento County Floodplain Administrator, 827 7th Street, Room 430, Sacramento, CA 95814.

The area of applicability of this ordinance may be supplemented by the Floodplain Administrator declaring Local Flood Hazard Areas. A map of Local Flood Hazard Areas is on file in the Office of the Floodplain Administrator. Floodplain maps are a general graphic representation of a flood insurance study. If the FIRM and the ground data disagree, the Floodplain Administrator will determine the base flood elevation for flood protection purposes. The Flood Insurance Rate Map, effective August 16, 2012, shows the area known as east Walnut Grove (RD554) as (provisionally) protected by levees.

A Floodplain Management Permit shall be obtained before any new construction, substantial improvements or other development, including alteration of land, begins within any special flood hazard area or local flood hazard area established in Section 903-02. Permits for work in the floodplain requiring approval by the Floodplain Administrator are either in the form of a permit or formal improvement plan. The application

for a Floodplain Management Permit shall be filed on a form and submitted with such information as is prescribed by the Floodplain Administrator including, but not limited to the following:

- Plans in duplicate drawn to scale showing the nature, location, dimensions, and elevation of the property, existing or proposed structures, fill, storage of materials, and drainage facilities;
- Proposed elevation in relation to currently adopted Vertical Datum of the lowest floor of all buildings - in Zone AO, elevation of highest adjacent preconstruction natural grade and proposed elevation of lowest floor of all buildings;
- Proposed elevation in relation to currently adopted Vertical Datum to which any structure will be flood-proofed, if required in Chapter 6;
- All appropriate certifications listed in Section 904-02(D);
- Location and elevation of the base flood and the floodway, both before and after proposed development;
- Location, volume and depth of proposed fill and excavation within the 100-year floodplain and the floodway; and
- Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.

All new construction or substantial improvements within special flood hazard areas and local flood hazard areas shall comply with the standards set forth in this ordinance.

New residential structures, or the entire structure being substantially improved/repaired, shall be constructed such that the lowest finished floor is at or above elevations as follows:

- In Zone AO with numbered depth, elevate at least 1.5 feet above that depth given on the FIRM as measured from the highest adjacent grade. When no depth is provided on the FIRM, elevate to at least three feet above the highest adjacent preconstruction natural grade. In either case, the Floodplain Administrator may justify and require a higher elevation.
- In Zone A where there is no base flood elevation or depth on the FIRM, elevate at least 1.5 feet above the highest value determined by using the methods below:
  - ✓ The elevation taken from historic high water data interpreted by the Floodplain Administrator;
  - ✓ The elevation shown on a County study;
  - ✓ The elevation as the floodplain is plotted on the topography map; or
  - ✓ The elevation determined using the detailed method from the FEMA publication, FEMA 265, "Managing Floodplain Development in Approximate Zone A Areas – A Guide for Obtaining and Developing Base (100-year) Flood Elevations" dated July 1995.
- In areas affected by dual zones, such as AE or local flood hazard, the above A-99 regulations or the base flood elevation for the underlying zone, whichever is higher, shall apply.
- In Zone AE, Zone AH, and in local flood hazard areas, at least 1.5 feet above the base flood elevation. Building pads for slab-on-grade construction shall be at least one-foot above the base flood elevation and the lowest floor must be at least 1.5 feet above the base flood elevation.
- In Zone AR as established on the effective Flood Insurance Rate Map, the standards in this chapter shall apply to the construction of new buildings, including elevating floors 1.5 ft above the base flood elevation. The base flood elevation will be determined as follows:
  - ✓ The base flood elevation for developed areas shall be the elevation shown on the FIRM or 3 feet above the highest adjacent grade (before grading occurred), whichever is lower.
  - ✓ In areas that are not designated as developed areas:

- where the AR flood depth is equal to or less than 5 feet above the highest adjacent grade, use the lower of either the AR base flood elevation or the elevation that is 3 feet above the highest adjacent grade; or
- where the AR flood depth is greater than 5 feet above the highest adjacent grade, use the AR base flood elevation

✓ In areas affected by dual zones, such as AE or local flood hazard, the above AR regulations or the base flood elevation for the underlying zone, whichever is higher, shall apply.

New nonresidential structures or the entire structure being substantially improved shall either be elevated to conform to Section 906-02 or together with attendant utility and sanitary facilities be dry flood-proofed in accordance with FEMA technical bulletin(s) and the following:

- Watertight below 1.5 ft above the base flood elevation so that the building walls are substantially impermeable to the passage of water;
- Have structural components capable of resisting hydrostatic and hydrodynamic loads including the effects of buoyancy; and
- Be certified by a registered professional engineer or architect that the standards of this section are satisfied. Such certification shall be provided to the Floodplain Administrator.

Attached garages for residential buildings shall be constructed at least one foot above the base flood elevation and all building materials below the minimum floor elevation shall be flood resistant. Garage space under a house must be elevated at least 1' above the base flood elevation except as allowed in other portion of this ordinance.

Detached garages, barns, and storage buildings shall be constructed per Section 906-02. At the discretion of the Floodplain Administrator, minor detached structures not meeting these requirements, may be allowed with proper venting and an executed and recorded declaration of land use restriction in a form deemed acceptable to County Counsel, provided they are constructed at or above the base flood elevation.

Applicable only in the Delta Area, the floodplain of the Beach Stone Lakes Area, areas protected by RD1000 levees (Natomas), and areas protected by Reclamation District 800 levees of the Cosumnes River, where building in accordance with this ordinance is impractical and such structures are functionally dependent to the land use, barns and garages may be constructed or substantially improved at grade in accordance with FEMA Technical Bulletin 'Wet Flood-proofing Requirements' (Technical Bulletin TB7-93, as amended), provided:

- The building is constructed of flood resistant material, fully vented, with at least one opening at least 10 feet wide on at least one side (may be a barn or garage door provided the building is fully vented without including the door opening), and anchored to resist the potential flooding;
- All mechanical, plumbing and electrical equipment in the building, including utilities and sanitary facilities, shall be 1.5 feet above the base flood elevation or flood-proofed below that elevation;
- Compliance with these criteria, particularly in deep special or local flood hazard areas may require consultation with a qualified registered professional engineer or architect;
- The structure should not be used as collateral for a federally backed lender and shall not be considered an insurable structure under the National Flood Insurance Program, nor shall it be eligible for relief funds in the case of flood damage.

- The property owner executes and records a declaration of land use restriction with the County indicating the use of the building and assuring that all of the above requirements are met and will be maintained for the useful life of the building and that the building will not be converted to habitable, public, or commercial use.

Non-enclosed parking areas for apartments shall be constructed no lower than 0.50 foot below the base flood elevation and commercial parking lots no more than 1.0 foot below the BFE with signs posting the flood hazard.

Any new built-in swimming pool deck, filter and pump equipment must be elevated at least 1-foot above the base flood elevation unless the property owners execute and record a declaration of land use restriction in a form acceptable to County Counsel.

For new or substantially improved structures, heating, plumbing fixtures, air conditioning equipment, furnaces, ductwork, electrical panels, solar panels, outlets, switches and fixtures serving new or substantially improved structures shall be at least 1.5 feet above the base flood elevation or the finished floor whichever is lower or may be flood-proofed to 1.5 feet above the base flood elevation.

New solar panels and appurtenances, except as described above, should be elevated or flood-proofed safely above the base flood elevation. In the latter case, the property owner must execute and record a declaration of land use restriction with the County, in a form acceptable to County Counsel.

Addition of enclosed area attached to an existing pre-FIRM structure, but not substantial improvement, shall be elevated 1.5 feet above the base flood elevation unless determined by the Floodplain Administrator to be a minor addition in which adding steps would be impractical (e.g. expanding a dining room). In levee-protected areas shown as Zone AE, room additions are allowed with detailed documentation proving the addition is not a substantial improvement.

Lateral additions to post-FIRM buildings (residential or nonresidential) must comply with this ordinance including elevation. Lateral additions must not alter any aspect of the building that had to be met when the building was constructed in compliance with the NFIP and the effective ordinance at the time of original construction. A non-substantial improvement lateral addition may be allowed in special or local flood hazard areas under the following conditions:

- If the base flood elevation is unchanged since original building construction, the addition must be elevated in compliance with this ordinance. An exception may be granted (above the base flood elevation but lacking 1.5 feet vertical freeboard) for very small dependent expansions such as expanding an existing room or adding a bathroom.
- If a revised higher base flood elevation is in effect, a lateral addition may be allowed if the addition is elevated at least as high as the existing floor. This includes areas that were mapped Zone X and are now AE due to levee de-accreditation.

Special Construction Standards

- Anchoring. All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the building resulting from hydrodynamic and hydrostatic loads

including the effects of buoyancy. All manufactured homes shall also meet the standards of Section 906-07.

- Construction materials and methods. Unless specifically described in 906-04, all new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage and using methods and practices that minimize flood damage. Electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during flooding.
- Compacted Fill. If a site is filled above the base flood elevation, then buildings constructed within special or local flood hazard areas must be constructed on compacted fill in accordance with the Construction Specifications or at least 90% density per ASTM-D1557 (known as Modified Proctor), and extending at least five feet beyond the building foundation walls before dropping below the base flood elevation and shall include appropriate protection from erosion and scour. The design of the fill must be approved by a registered professional engineer.
- Drainage Paths - Zones AO and AH. Within zones AO and AH, drainage paths around buildings on slopes are required to guide floodwater around and away from proposed buildings.
- Underground and above-ground tanks shall be designed, constructed, installed and anchored to prevent flotation, collapse and lateral movement resulting from floodwater loads, including the effects of buoyancy, hydrostatic pressure, and velocity. Tank inlets, fill openings, outlets, and vents shall be installed 1-foot above the base flood elevation or fitted with covers designed to prevent the inflow of floodwater and outflow of the contents of the tank during the base flood. Water tanks for agricultural operations may be exempted from this elevated venting requirement.
- Foundations. Foundations and walls constructed below the base flood elevation shall be vented to equalize hydrostatic pressures. Vent openings shall be permanent openings in the walls that allow for the free passage of water automatically in both directions without human intervention. Such venting shall be on at least two sides of the structure, or enclosure, have a bottom at no more than one-foot above the ground elevation. The total area of such venting shall be at least one square inch per square foot of enclosed footprint. Openings may be equipped with screens, louvers, or automated float control in accordance with FEMA Technical Bulletin TB #1-08 Foundations and walls below the base flood elevation shall be constructed of flood resistant materials in accordance with FEMA Technical Bulletin TB #2-08. Alternatively, the project proponent may submit a design that will allow for automatic equalization of hydrostatic flood forces on exterior walls, signed and stamped by a registered civil engineer and approved by the Floodplain Administrator. A window, a door, or a garage door is not considered a vent opening. If there are multiple enclosed areas within the foundation, each area must be vented as herewith described.
- Non-Conversion. To put current and future tenants and owners on notice that the area below the base flood elevation may not be architecturally finished and converted to living space and that the space may only be used as incidental material storage, building access and vehicle parking [also see 906-04], a declaration of land use restriction shall be executed and recorded whenever there is a height of more than five feet to assure that foundation area is never converted to living space. The declaration of land use restriction shall be in a form acceptable to the Floodplain Administrator and County Counsel. The Floodplain Administrator shall have the right to inspect for conversion with 72- hour notice.
- Basements. No basements are allowed where deep prolonged flooding may occur (e.g. Sacramento River, Delta Area, Beach Stone Lake, and Natomas). However, basements may be constructed with a floor elevation below the base flood elevation (BFE) in the following situation:
  - ✓ In areas where flooding due to the base flood is less than 24 hour duration;

- ✓ There is a minimum of 30 feet of horizontal separation between the foundation wall and the base flood water surface and the distance is increased by 3 feet per foot of depth below the BFE (example: 4 feet below BFE requires minimum 42 feet of separation);
- ✓ A report prepared by a registered civil engineer or geotechnical engineer accompanies the design, for basements deeper than 5 feet below the BFE, indicating that the design is adequate to prohibit seepage;
- ✓ The soil separating the base flood water from the structure provides at least 1.0 foot of freeboard for a minimum width of 15 feet;
- ✓ The soil has low permeability in its existing condition or is re-compacted to a depth adequate to minimize seepage; and
- ✓ The lowest opening shall have at least 1.5 feet of freeboard above the BFE.
- ✓ Or, an alternate solution may be designed, certified by a professional civil engineer and submitted for review and approval by the Floodplain Administrator.

- ➢ Electrical panels for uses other than new or substantially improved residential, commercial, or industrial structures (such as agricultural wells and barns) in areas protected by RD1000 levees (Natomas area), and in the Delta Area may be installed below the base flood elevation. In this case, marine grade (or otherwise flood resistant) equipment is recommended.
- ➢ Commercial solar power plants are treated as development (Section 906-06), and any structures or electrical panels for such facilities shall be elevated or flood-proofed at least 1.5' above the base flood elevation, and designed and anchored in accordance with this section. A declaration of land use restriction in a format approved by County Counsel must be recorded if any part of the commercial solar development will be lower than 1.5' above the base flood elevation.
- ➢ Any structure with increased cost of compliance flood insurance coverage that sustains flood damage on two or more occasions exceeding 25 percent of the 23 market value (measured before the recent damage occurred) but less than 50 percent in any one event should, as such insurance allows, elevate or otherwise mitigate the flood risk.

Standards for New Development

All development plans and grading plans shall:

- ➢ Identify special or local flood hazard areas and the elevation of the base flood.
- ➢ Provide the elevation of proposed buildings and pads, and assure the proposed pads will be at least one foot above the base flood elevation and meet minimum floor requirements per section 906-02. If the site is filled above the base flood elevation, the constructed pad elevations shall be as-built surveyed by a registered professional engineer or surveyor, compacted in accordance with 906-05 (C), and certified results shall be provided to the Floodplain Administrator for review and submittal to FEMA for map revision.
- ➢ Be designed in accordance with this Code and the County Improvement Standards to minimize flood damage.
- ➢ In addition to elevation and flood-proofing requirements for structures described herein, all floodplain management permits for new public utilities (such as pump stations, power plants, and communications) should assure that the flood damageable facility is elevated 1.5 feet above the base flood elevation or certified flood-proof. Utilities deemed critical to emergency management (including sewer, gas, electrical, and water systems) should be protected from damage in the 1/200 year flood

event (in accordance with the Central Valley Flood Protection Board Urban Level of Flood Protection requirements).

- Provide a drainage system report in accordance with the County Improvement Standards with a narrative describing the existing and proposed stormwater management system, including all discharge points, collection, conveyance, and stormwater storage facilities.
- Provide a drainage system map including, but not limited to, sub-watershed boundaries and the property's location within the larger watershed, predevelopment and post- development terrain at 1-foot contour intervals and the location of all existing and proposed drainage features. Include a plan of the parcel showing applicable proposed revisions to pre-development and postdevelopment surface drainage flows.
- Before any proposed filling in a floodplain is permitted and when a detailed hydraulic model is not available, the volume which will be occupied by the permitted fill below the base flood elevation shall be compensated for and balanced by a hydraulically equivalent volume of excavation taken from below the base flood elevation. This is a general rule on creeks and channels in riverine flow, thus is not necessary on land within the island side of levees in the Delta Area, Beach Stone Lake, and very wide levee breach floodplains of the Cosumnes River floodplain.
- No new construction or substantial improvements or development may occur without the approval of the Floodplain Administrator and without demonstrating that the cumulative effect of the proposed development when combined with all other existing and anticipated development will not have adverse impacts to downstream, upstream, or adjacent properties, and the FEMA mapping requirements of section 905-08 are met.
- In floodplains of natural streams and natural stream tributaries, and other streams subject to review and approval by the Floodplain Administrator, grading causing an adverse impact, as measured at the property lines of the parcel(s) being developed, must be approved by the Floodplain Administrator..
- Stormwater calculations by a professional civil engineer shall be submitted to the Floodplain Administrator, including but not limited to, detention basin sizing, storm drain pipe sizing and overland flow path design.
- The majority of stormwater management features in the urban services area of the County are maintained in a routine manner funded by the Storm Water Utility; however, on occasion an operation and maintenance procedure for peculiar features will require a supplemental funding agreement.
- The applicant shall obtain all required state and federal permits.
- All new development within Zone A that creates more than 4 lots or involves more than 5 acres of land shall provide base flood elevation data to the Floodplain Administrator and meet FEMA mapping requirements per section 905-08. The base flood elevation shall be determined to the satisfaction of the Floodplain Administrator.
- Development master plan floodplain models for specific plan areas must establish the existing condition base flood elevation and assure no adverse impact in accordance with this ordinance. The project proponent shall submit the existing condition model to the Floodplain Administrator prior to publishing the environmental impact report for that development proposal. When the watershed area is greater than one square mile, the existing condition floodplain model must be submitted to FEMA for approval before improvement plans are approved for the development. The project proponent must obtain a CLOMR (Conditional Letter of Map Revision) from FEMA for any actions affecting the floodplain before those actions are constructed.

Standards for Manufactured Homes

- All new or substantially improved manufactured homes that are placed on a foundation at a site located outside of a manufactured home park and within a special flood hazard area or local flood hazard area shall be constructed per Section 906-02, and be anchored in accordance with Section 906-05(A).
- All new manufactured home parks or subdivisions or expansion of existing parks or subdivisions shall be constructed such that the concrete home pads are at least one foot above the base flood elevation.
- All manufactured homes to be placed or substantially improved on sites in an existing manufactured home park or subdivision within a special flood hazard area or local flood hazard area except as otherwise provided in this section or by other standards required by the State regulators of manufactured home parks will be securely fastened to an adequately anchored foundation system to resist flotation, collapse, and lateral movement, and be elevated so that either:
  - ✓ (1) The lowest floor of the manufactured home is 1.5 feet above the base flood elevation; or
  - ✓ (2) The manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade.
- On a pad or space in a manufactured home park at which a manufactured home has incurred substantial damage caused by floodwater, the repaired home and all subsequently placed homes must be elevated at least 1.5 feet above the base flood elevation on a secure and anchored foundation.
- Upon the completion of an installation described above, the elevation of the lowest floor shall be certified by a registered professional engineer or surveyor, and verified by the community building-inspector to be properly elevated. Such certification and verification shall be provided to the Floodplain Administrator.

Standards for Recreational Vehicles

All new recreational vehicle parks or additions to parks in a special or local flood hazard area shall clearly post the hazard and methods of flood warning. All recreational vehicles placed on sites within special flood hazard areas or local flood hazard areas shall:

- Be on wheels, mobile, fully licensed, attached to the site only by quick disconnect type utilities and security devices; and
- Have no attached additions on adjoining foundation.

Floodways

- New construction, substantial improvements, and other development within a floodway is prohibited unless certification by a registered professional engineer is provided which demonstrates to the satisfaction of the Floodplain Administrator that such development will not result in any increase in the base flood elevation.
- All new construction, substantial improvements, and other development within floodways which satisfies the requirements of this section shall also comply with all other applicable provisions of this ordinance.
- All new construction, substantial improvements, and other development within floodways which will cause increases in the base flood elevation shall only be permitted if the County has applied to the Federal Emergency Management Agency for modification of the flood insurance rate maps and has received conditional approval of such modifications, and all other applicable provisions of this ordinance are satisfied.

Senate Bill 5 Changes to Plans and Ordinances

The Urban Level of Flood Protection Criteria was developed in response to requirements from the Central Valley Flood Protection Act of 2008—enacted by Senate Bill 5 (SB 5) (2007)—to strengthen the link between flood management and land use; specifically, California Government Code Section 65007(n):

> *"Urban level of flood protection" means the level of protection that is necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources. "Urban level of flood protection" shall not mean shallow flooding or flooding from local drainage that meets the criteria of the national Federal Emergency Management Agency standard of flood protection.*

SB 5 (2007) as amended does not specify any enforcement authority for the urban level of flood protection, but instead relies on the due diligence of cities and counties to incorporate flood risk considerations into floodplain management and planning. However, the law tasked the California Department of Water Resources (DWR) with developing criteria that cities and counties could use to make findings related to an urban level of flood protection. The law also provides that cities and counties may develop their own criteria as long as it is consistent with the criteria developed by DWR. In this context, DWR developed the Criteria to satisfy the legislative requirements without interfering with local land use authority, while providing reasonable details and flexibility, and promoting prudent floodplain management in concert with other State law provisions related to smart growth and climate change adaptation strategies.

Key General Plan and Zoning Code Compliance Amendments are included below.

Safety Element

SA-5. A comprehensive drainage plan for major planning efforts shall be prepared for streams and their tributaries prior to any development within the 100-year floodplain and/or the 200-year floodplain in areas subject to the Urban Level of Flood Protection, defined by full watershed development without channel modifications. The plan shall:

- a. Determine the elevation of the future 100-year flood and/ or the 200-year flood in areas subject to the Urban Level of Flood Protection, associated with planned and full development of the watershed;
- b. Determine the boundaries of the future 100-year floodplain and/or the 200-year floodplain in areas subject to the Urban Level of Flood Protection, for both flood elevations (planned and full development) based on minimum 2-foot contour intervals;

SA-6a. The County will continue to coordinate with parties responsible for flood management facilities and structures (e.g., pump stations, levees, canals, channels, and dams) to provide proper maintenance and/or improvements. (Added 2016)

SA-6b. The County will continue to coordinate with relevant organizations and agencies (e.g., Federal Emergency Management Agency (FEMA) and State of California Department of Water Resources (CADWR) when updating floodplain mapping, flood management plans, local hazard mitigation plans, and other emergency response plans to consider the impacts of urbanization and climate change on long-term flood safety and flood event probabilities. (Added 2016)

SA-6c. The County will continue to coordinate with local, regional, state, and federal agencies to maintain an adequate flood management information base, prepare risk assessments, and identify strategies to mitigate flooding impacts. (Added 2016)

SA-9. New and modified bridge structures should minimize any increase in water surface elevations of the 100-year floodplain, or the 200-year floodplain in areas subject to the Urban Level of Flood Protection. (Modified 2016)

SA-16. Deny creation of parcels that do not have buildable areas outside the 100-year floodplain, or the 200-year floodplain in areas subject to the Urban Level of Flood Protection, unless otherwise allowed in the Floodplain Management Ordinance. (Modified 2016)

SA-17. For residential zoning, the area outside the 100-year floodplain, or the 200-year floodplain in areas subject to the Urban Level of Flood Protection, must be contiguous or reasonably situated to provide buildable area for a residence and associated structures. Examples of structures include swimming pools, sheds, barns, detached garages, and other outbuildings that are normally associated with residential development. There may be exceptions (such as the Delta area) as allowed in the Floodplain Management Ordinance. (Modified 2016)

SA-18a. Provide unobstructed to levees on county-owned lands, whenever practicable, for maintenance and emergencies. Require setbacks and easements to provide access to levees from private property. (Added 2016)

SA-18 b. Urban flood control levees should have adequate setbacks consistent with local, regional, State, and federal design and management standards. (Added 2016)

SA-22. Areas within a 100-year floodplain, or within the 200-year floodplain in areas subject to the Urban Level of Flood Protection, shall not be upzoned to a more intensive use unless and until a Master Drainage Plan is prepared that identifies areas of the floodplain that may be developed. (Modified 2016)

SA-22a. Sacramento County will evaluate development projects and all new construction located within a defined Flood Hazard Zone (FHZ) to determine whether the 200-year ULOP or 100-year FEMA flood protection applies and whether the proposed development or new construction is consistent with that standard. Prior to approval of development projects or new construction subject to either standard, the appropriate authority must make specific finding(s) related to the following:

Urban Level of Flood Protection (ULOP) standard (200-year) applies to projects in a Flood Hazard Zone that meet certain criteria, developed by the State of California Department of Water Resources, related to urbanization, watershed size and potential flood depth.

Federal Emergency Management Agency (FEMA) standard of protection (100-year) applies to projects in a Special Flood Hazard Area that are not subject to ULOP. (Added 2016)

SA-22b. New development shall be elevated as required by the applicable flood standards (100-year, or 200-year in areas subject to the Urban Level of Flood Protection applies) and should be constructed to be resistant to flood damage consistent with the Floodplain Management Ordinance. (Added 2016)

SA-37. The County shall continue to maintain its response to flood emergencies by maintaining and updating:

- a. Flood Emergency Action Plan to address potential flooding in levee and dam inundation areas, consistent with the California Water Code, and;
- b. Community flood evacuation and rescue maps, making them available to the public, as appropriate. (Added 2016)

Conservation Element

CO-30. Require development projects to comply with the County's stormwater development/design standards, including hydromodification management and low impact development standards, established pursuant to the NPDES Municipal Permit. Low impact development design and associated landscaping may serve multiple purposes including reduction of water demand, retention of runoff, reduced flooding and enhanced groundwater recharge. (Modified 2016)

CO-105a. Encourage flood management designs that respect the natural topography and vegetation of waterways while retaining flow and functional integrity. (Added 2016)

Zoning Code

CHAPTER 3: USE REGULATIONS; 3.10. Temporary Use Standards

3.10.2. General Requirements for all Temporary Uses and Structures

All temporary uses or structures shall meet the following general requirements, unless otherwise specified in this Code:

3.10.2.K. Applications for temporary structures to be located in the 100-year floodplain, or in the 200-year floodplain in areas subject to the Urban Level of Flood Protection, shall be required to submit a plan to the Building Department for the removal of such structure(s) in the event of notification by the Sacramento County Department of Water Resources. The plan shall include the following information:

CHAPTER 4: SPECIAL AND COMBINING ZONING DISTRICTS; 4.2. Flood (F) Combining Zone district and Tributary

4.2.3. Definitions

4.2.3.E. 200-Year Floodplain

The area adjoining a river, stream, or watercourse which is subject to inundation by the 200-year flood.

4.2.5. Development Standards for Property Adjacent to Designated Tributaries

No building or structure shall be erected or maintained within the 100-year floodplain, or within the 200-year floodplain in areas subject to the Urban Level of Flood Protection, of designated tributaries, as defined

in Section 4.2.3, and no lot shall be created unless the standards and requirements set forth in this Section are complied with and maintained.

4.2. Flood (F) Combining Zone district and Tributary

4.2.5.A. Development Standards

The following development standards shall apply to the placement of structures within floodplains of designated tributaries.

2. All construction shall maintain a habitable finished floor elevation at least one and one-half (1.5) feet above the water surface elevation of the 100-year floodplain, or at or above the 200-year floodplain in areas subject to the Urban Level of Flood Protection.

7. Any new lot which is proposed to be created adjacent to a designated tributary, as defined in Section 4.2.3, must provide either:

- a. A buildable area outside the 100-year floodplain of that tributary, or
- b. A buildable area which is located at least 25 feet from the center line of the tributary and which provides for construction with a minimum habitable floor elevation that is at least one (1) foot above the water surface elevation of the 100-year floodplain, or at or above the 200-year floodplain in areas subject to the Urban Level of Flood Protection, and is outside the floodway.

4.5.3. Development Standards

4.5.3.A. General Standards

2. Every property, structure, or use in the NS zoning district that is located within a Special Flood Hazard Area shall comply with the Floodplain Management Ordinance, and applicable provisions of all other Water Agency regulations.

4.5.3.B. Placement of Structures in Floodplain Areas

1. All new construction or substantial improvements shall have the lowest habitable floor including basements floodproofed or elevated at least one and one-half (1.5) foot feet above the water surface elevation of the 100-year floodplain, or at or above the 200-year floodplain in areas subject to the Urban Level of Flood Protection.

2. No encroachment, fill, alteration, or use shall result in diminution of the freeboard of an existing dwelling's lowest habitable floor below one (1) foot above the water surface elevation of the 100-year floodplain.

3. Single-family and duplex garages, swimming pools, and other similar structures shall be constructed at an elevation equal to or greater than the water surface elevation of the 100-year floodplain, or the 200-year floodplain in areas subject to the Urban Level of Flood Protection.

4.7. Parkway Corridor (PC) Combining Zoning District:

4.7.2. Erosion Zones

C. Resolution of Disputes

The Planning Director shall resolve disputes with regard to a determination made establishing a bluff or terrace, the edge of a bluff or terrace, toe of a bluff or terrace, 100-year floodplain, 200-year floodplain, designated floodway, or other significant topographic or geologic feature. Any person dissatisfied with the determination made by the Planning Director may appeal such determination, pursuant to Section 6.1.3, "Appeal."

CHAPTER 5: DEVELOPMENT STANDARDS

5.11 Findings for Projects in Flood Hazard Zones

Prior to approval of a development agreement; a discretionary permit or other discretionary entitlement, or a ministerial permit (e.g., grading or building permit) that would result in the construction of a new residence; a tentative map, or a parcel map for which a tentative map was not required for a subdivision; on property within the Flood Hazard Zone (FHZ) the appropriate authority must find, based on substantial evidence in the record, one of the following:

1. The facilities of the State Plan of Flood Control or other flood management facilities protect the property to the Urban Level of Flood Protection (ULOP) in urban and urbanizing areas or the Federal Emergency Management Agency (FEMA) standard of flood protection in nonurbanized areas.

2. The County has imposed conditions on the entitlement or permit that will protect the property to the ULOP in urban and urbanizing areas or the FEMA standard of flood protection in nonurbanized areas.

3. The local flood management agency has made adequate progress on the construction of a flood protection system that will result in flood protection equal to or greater than the ULOP in urban or urbanizing areas by 2025.

4. The property in an undetermined risk area has met the ULOP.

7.3 Code Terms and Use Definitions

Areas of Moderate Flood Hazard. Moderate risk flood hazard zones are shown by the letter "X" on the Flood Insurance Rate Maps. (Older maps use the letters "B" or "C".)

Federal Emergency Management Agency (FEMA) standard of protection (100-year). A 100-year standard of flood protection that applies to areas that are shown on the current FEMA Flood Insurance Study and Flood Insurance Rate Map as Zone A, AO, A1-A30, AE, AH or AR., but are not subject to ULOP.

Flood Hazard Zone. An area subject to flooding that is delineated as either a Special Flood Hazard Area or an area of moderate hazard on an official Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency (FEMA). The identification of flood hazard zones does not imply that

areas outside the flood hazard zones, or uses permitted within flood hazard zones, will be free from flooding or flood damage.

Special Flood Hazard Area (SFHA). An area shown on the FEMA Flood Insurance Study and the FIRM as Zone A, AO, A1-30, AE, A99, AH or AR. These zones are lands covered by the floodwaters of the base flood (100-year) where the National Flood Insurance Program's floodplain management regulations apply.

Urban Level of Flood Protection (ULOP). The level of flood protection that is necessary for new development to withstand a 200-year event in accordance with Urban Level of Flood Protection criteria developed by the State of California Department of Water Resources. The ULOP is required for a development project and/or new construction located within an "applicability area" as shown in Appendix D of the Floodplain Management Ordinance: "ULOP Applicability in Unincorporated Areas of Sacramento County", indicating locations where all the following criteria apply:

1. The project site is in a Flood Hazard Zone.

2. The project site is in an urban area with 10,000 or more residents, or is in an urbanizing area in which 10,000 or more residents are anticipated within 10 years; and

3. The project site is in a watershed with a contributing area greater than 10 square miles; and

4. The project site is potential flood depths greater than 3' in the 200-year flood.

County Departments/Agencies

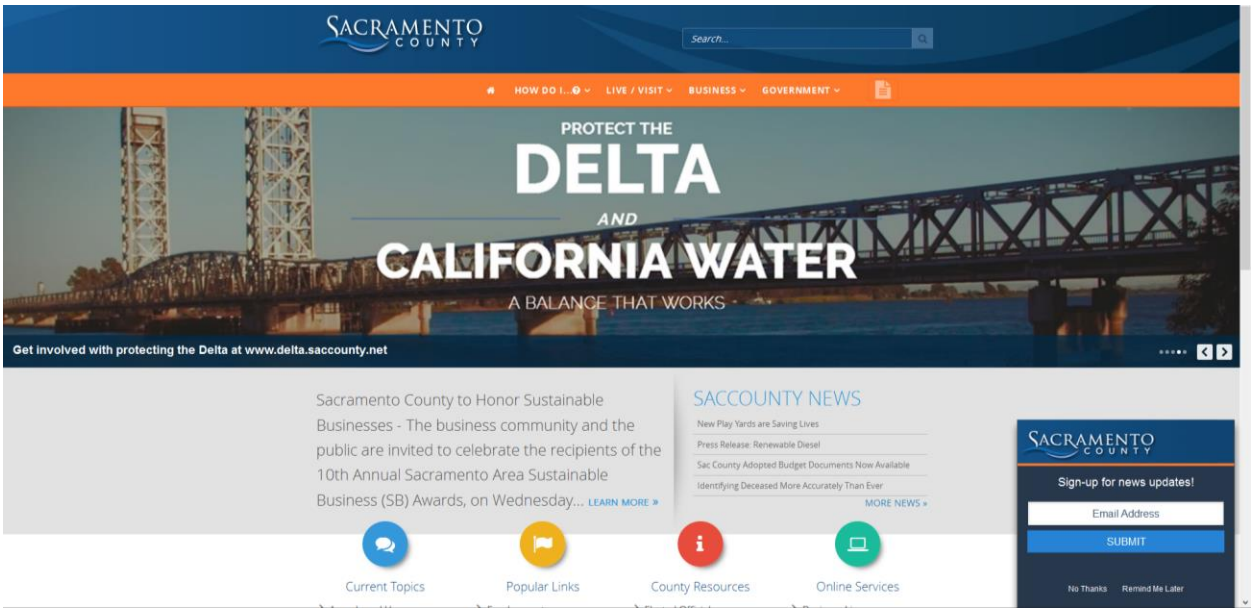
Sacramento County has structured its governmental organization to mitigate and respond to natural hazards. The discussion below highlights offices that have either direct or indirect responsibility for planning for or responding to natural hazards.

Office of Emergency Services

The Sacramento County Office of Emergency Services (OES) is the emergency management agency for Sacramento County. Sacramento County OES is headquartered in the City of Sacramento, the County seat. The office provides service countywide, in cooperation with cities and special districts, such as the fire department and law agencies.

OES also provides updated emergency-related information to the public on their website, SacramentoReady.org (shown in Figure 4-99). This site provides weather and flooding information, which includes guidance on protecting your home from winter storms, where to get sandbags, preparation for what to do before, during and after floods, etc. Also provided are links to national, state, and local information on fires, earthquakes, highway and road information, and general federal and state emergency information.

Figure 4-99 SacramentoReady.org Website



Source: www.sacramentoready.org

Agricultural Commission & Weights and Measures

The Agricultural Commissioner/Director of Weights and Measures monitors agriculture related commodities entering and exiting Sacramento Count. The agricultural division:

- Protects the public by enforcing pesticide laws and regulations, monitors applications for safety and environmental compliance, investigates pesticide related illnesses and complaints, and provides education to industry and the public on lawful pesticide usage.
- Monitors pest conditions and provides for the safe and efficacious control of those pests through issuance of restricted pesticide materials permits or alternative management methods.
- Monitors and facilitates the eradication of exotic pests harmful to California agriculture, including inspection of wholesale nursery stock and all plant material shipped to Sacramento through the postal, express and freight systems.
- Inspects plant products for export to a wide variety of foreign ports and issues export certificates required by importing countries.
- Collects and compiles crop and livestock statistics and prepares reports on crop damage and crop production.
- Manages the orderly burning of agricultural crop residues in an effort to allow the use of this important tool while minimizing the impact on urban areas, and works with producers to find alternative methods of agricultural waste removal.
- Administers the hazardous material storage inventory and carries out inspections of those facilities related to agricultural operations

County Engineering Department

Working with contractors, developers and homeowners we ensure safe and reliable construction projects, handle surveying for County projects and provide a call center that provides information to the community

about utilities and general service referral and takes reports of problems and routes them to the appropriate department. The Department of County Engineering includes the following divisions related to mitigation:

Building Inspection

The Building Inspection Department issues building permits and provides plan review and field inspection services for all private development building projects within unincorporated Sacramento County. Excluded are the cities of Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova and Sacramento.

Infill Development Program

Infill development is the re-use of land or existing developed sites within an urban/suburban area. Infill development promotes better use of sites through reuse and repositioning of obsolete or underutilized buildings. Infill uses vital land left vacant during early development and contributes to community revitalization. Infill is representative of smart growth.

Infill development is valuable not only for the environmental benefits of using land more efficiently and directing growth into existing urbanized areas, but also the benefit that quality projects bring to neighborhoods and communities. Good infill conserves open space, helps to energize communities and contributes to jobs, housing and area sustainability.

The County of Sacramento joined the City of Sacramento in an Infill Home Plan Program in 2010. Established by the City of Sacramento, this program was developed to streamline the process for development of high quality single family homes in older neighborhoods and redevelopment areas.

Planning and Community Development

The Department of Planning and Community Development administers the County's land use and planning programs in the unincorporated area, including:

- County-wide, specific and community planning
- Specific and community planning
- Current Planning and zoning
- Community Planning Advisory Councils
- Planning Review

Water Resources

The Department of Water Resources provides drainage, flood control, water supply, rain and creek level information, regulation and permits, flood insurance program and stormwater management services to various service areas of unincorporated Sacramento County and the Cities of Citrus Heights, Elk Grove and Rancho Cordova.

Erosion Capabilities

The County Department of Water Resources – Drainage Department tracks areas of erosion troubles and mitigates, to the extent possible, the root causes of erosion. These are shown on Table 4-100.

Table 4-100 Unincorporated Sacramento County Erosion Areas and Responses

Address	City/Area	Work Requested
6809 Thunderhead Cir	Orangevale	"Remove (7) trees from the south side of Arcade Creek 11H12. - One down tree, 30"" diameter, obstructing flow. - Six trees, <4"" DBH, accelerating erosion and reducing channel capacity. Trees reside on Orangevale Park District's property (APN 259-0310-024-0000). Note: Work request originated from service request call from 8094 Chipwood Way, with the homeowner complaining about erosion beneath his deck."
4843 Holyoke Way	Sacramento	"Remove tree obstructing outfall 360-185-C13. Tree permit 9144-11 attached. Tree can be left onsite for tenant use (at 4970 Walnut Ave). Redefine channel extending from outfall 360-185-C13 to west fence of 4843 Holyoke Way. Place riprap (4" angular) from outfall to approximately 5 feet beyond west fence. Riprap shall be underlain with geotextile fabric. Channel dimension should be approx. 3 feet wide and 1 foot deep. Weld two rebar grates with vertical bars spaced at 4 - 6 inches for allowing the flow to pas beneath the fences, attach to fence or anchor in soil. "
11917 Pyxis Cir	Rancho Cordova	"Place erosion control at outfall 316-218-C01 consisting of quarry rock 12-18 inches in diameter. Rock shall be underlain with a non-woven geotextile fabric. Erosion control shall be approximately 8 feet wide, extending 10 feet from the spillway structure. Down trees can remain, however, trees should be moved outside of stabilized area and left as wildlife habitat. "
4970 Walnut Ave	Sacramento	"Place and install riprap from outfall 360-185-C15 to 15' downstream of pipe. Rock should be 4"" angular quarry and underlain with geotextile fabric. Excavate soil to retain original channel capacity. Channel dimensions should be approximately 3' wide and 1' deep. NOTE: Originated from service request concerning runoff from Walnut Ave."
4632 Teal Bay Ct	Antelope	"Please clear and remove the vegetation and debris from the flowline of Sierra Creek 55P17. Find and expose outfall 378-182-C07 (12"" RCP). Place 4"" angular quarry rock from outfall and extend rock 3' out. Clear vegetation surrounding 378-182-436 (12"" CMP, open-end pipe), and install flared end. Note: This work request originated from a service request concerning street flooding and ditch maintenance."
5420 Marmith Ave	Sacramento	"Place riprap on the west side of Arcade Creek segment 11C01 to re-establish the slope toe near the southeast corner of 5420 Marmith Ave. Place 12""-14"" diameter angular quarry rock along slope toe. Rock should be underlain with a few layers of 2""-3"" diameter angular drain rock atop a geotextile fabric. Riprap should cover an area of 30' along creek alignment and 2' up slope. Approximately 5 cubic yards of rock will be required. Note: Work request originated from service request concerning erosion near corner of residence."
7445 20th St	Rio Linda	"Remove channel obstructions consisting of woody vegetation, down trees up to 2' in diameter, and shrubby snags from flowline of 27C08. Property owner is experiencing increased erosion as a result of the channel obstructions. Currently, material in the flowline forms an approximately 3' high dam which will impede flows and accelerate erosion. Mr. Kenning and Ablang met with property owner on 3/1/13. This request originated from Mr. S. Pedretti."

Address	City/Area	Work Requested
500 Ethan Way	Sacramento	"Near D-05 Howe Ave Pump Station. Place and install riprap from newly constructed berm to approximately 30' northwest (to the point where the ditch meets and levels out into the basin). Rock should be 4" - 6" angular quarry rock and underlain with geotextile fabric. Excavate soil to retain original ditch capacity. Maintain current grade. Facility map, aerial, and photos are attached. Note: The recent JOC project at D-05 constructed a concrete berm on the west side of the channel. This work request will help protect the existing ditch adjacent to this new berm."
2230 Arden Way	Sacramento	"Please remove the existing failed concrete panel sections (two locations, east and south of 2230 Arden Wy). Excavate and remove loose soil and vegetation from behind and near failed concrete sections. Exposed areas should be seeded and finished with high-quality turf reinforcement mat (Western Excelsior's Excel PP5-12 Permanent Turf Reinforcement Mat) and long-term synthetic wattle at toe. Secure Excel PP5-12 mat in place per manufacturer's specifications. Gaps between remaining panels and slope should be closed with concrete to prevent further undermining and erosion. Use BMPs (including sandbags), as necessary, to mitigate environmental impact. Facility map, photos, VRF, and Western Excelsior Erosion Control Blanket installation instructions are attached. "
9373 Winding Oak Dr	Fair Oaks	"Please re-build and widen the access road to allow for vehicular access and install riprap on the west side of Fair Oaks Stream Group 25MM1 to prevent further erosion. Work extents should be limited to 50' in length. Location is near the tennis courts, see attached aerial photo. Excavate soil along eroded area until firm and suitable soil is reached. Dig a trench at the toe to key-in the riprap. The key at the toe should be at least 2' deep. Cut benches angled slightly into the slope prior to placement. Benches should roughly parallel slope contours. Place 12"-14" diameter angular quarry rock, underlain with 2"-3" diameter angular quarry rock atop a geotextile fabric. Material should be placed in lifts not exceeding 12". See attached photos, facility map, VRF documentation, and easement information. NOTE: Work request originated from Park request concerning erosion and loss of their access road towards the north portion of the parcel. This work request will help alleviate concerns with the lack of access in regards to our drainage maintenance, Park's maintenance activities, fire abatement, and firefighter access."
5543 Locust Ave	Carmichael	"Install approximately 30LF of riprap to the north side of Arcade Creek 11N05, immediately downstream of outfall 356-188-C10, to mitigate undercutting at the creek toe. Rock should be 8"-12" diameter angular quarry rock, and underlain with a few layers of 2"-3" diameter angular gravel atop a geotextile fabric. Rock will need to cover an area approximately 30' L x 2' H x 2' W. See attached facility map, photos, Right-of-Entry, and VRF documentation. Take post-construction photos. NOTE: This work request originated with the homeowner's concerns regarding erosion along this creek stretch and drainage maintenance responsibilities. Homeowner has aggressively been pushing County to perform maintenance work."
10345 Peter A McCuen Blvd	Mather	"Please install rip-rap erosion protection from outfall 326-197-C12 extending to Morrison Creek 13QQ1. Excavate to suitable soil, and re-compact. Geotextile fabric shall be be placed over soil prior to rip-rap placement. Rip-rap placement should be balanced equally on both sides of pipe. Utilize 6"-10" diameter angular quarry rock, underlain with a few layers of 2"-3" diameter angular drain rock. NOTE: Originated from grizzly investigations."
9160 Madison Ave	Fair Oaks	"Install approximately 50LF of riprap to the south side of Fair Oaks Stream Group 25MM2, alongside parking lot adjacent to tennis courts. Rock should be 8"-12" diameter angular quarry rock, and underlain with a few layers of 2"-3" diameter angular gravel atop a geotextile fabric. Rock will need to cover an area approximately 50' L x 4' H x 3' W. See attached facility map, photos, and VRF documentation. Also, please remove two palm trees from flow line. NOTE: This work request originated with Rollingwood Commons' concern with erosion potentially compromising their parking lot."

Address	City/Area	Work Requested
4647 Winding Way	Sacramento	"Please backfill & compact eroded soil areas underneath and around existing concrete panel erosion protection at outfall 356-182-C03. Seal newly backfilled & compacted soil with additional new concrete. Placement of new concrete should overlap 12" on existing concrete, cover new soil, and extend 12" beyond to cover existing stable non-eroded soil. Note: This issue was identified during routine outfall grizzly inspection."
9160 Madison (B) Ave	Fair Oaks	"Repair existing headwall by placing Class B-2 concrete in voids on upstream and downstream sides of headwall. Also, place concrete in void under the headwall through a hole in the outfall pipe. Install 8-12"" quarry rock underlain with a few layers of 2-3"" diameter angular gravel atop a geotextile fabric. Rip rap should extend 5' upstream and downstream of headwall. Smooth transition to natural side slopes.
6809 Thunderhead Cir	Orangevale	"Please reset undermined and disconnected 10"" outfall pipe 372-212-C12. Trim vegetation overgrowth to allow for access to pipe, and also to clear flowpath from outfall pipe to main invert of Arcade Creek. Install rip-rap erosion protection at outfall pipe. This land is owned by Orangevale Recreation & Park District (OVRPD). Access to this work location shall be made on foot only (no motorized vehicles) via open land adjacent to 6809 Thunderhead Circle. Trimmings shall be removed from OVRPD property. Note: This issue was discovered during routine grizzly inspection."
5432 Olympic Way	Sacramento	"Please provide erosion control surrounding outfall 370-188-C42 and inlet structure 370-188-R04. Remove existing debris and unsuitable soil, and compact native material. Place 8-12"" angular rock underlain with a few layers of 2-3"" diameter angular rock atop a geotextile fabric. At R04, work shall extend approximately 6' on both sides of the pipe and 3-4' into the creek. At C42, work shall extend throughout the undermining areas below the outfall.
4336 Poseidon Ln	Sacramento	"Perform erosion control along southerly bank nearest the west corner of the house. Remove unsuitable soil, backfill, and compact to create a 1:1 slope. Place 8-12" angular rock underlain with a few layers of 2-3" diameter gravel atop a geotextile fabric for approximately 25'-30'. During construction, please make efforts to streamline the top and toe of bank upstream and downstream of the erosion. Please remove silt bars on the northerly bank of the creek to help minimize future erosion.
5151 Myrtle Ave	Sacramento	"Please perform the following work: 1. Reset disconnected outfall pipe at 360-185-C09 (24"" RCP). 2. Install rip-rap around outfall pipe C09 to prevent erosion from causing pipe to disconnect again. 3. Clear and remove heavy vegetation D/S of outfall pipe C09 in short tributary creek segment 11RR1. Access to C09 can be made via apartment complex parking lot at 5151 Myrtle Ave. Note: This issue was discovered routine grizzly inspection."
4990 Walnut Ave	Sacramento	"Perform erosion control along westerly bank on the north side of the property at the bend about 150' downstream of the box culvert. Remove unsuitable soil, backfill, and compact to create a 1:1 slope. Place 8-12" angular rock underlain with a few layers of 2-3"" diameter gravel, 1 1/2" gravel could also suffice, atop a geotextile fabric for approximately 20'. During construction, please make efforts to streamline the top and toe of bank upstream and downstream of the erosion.
4513 North Ave	Sacramento	"Fill void at outfall 348-182-C03 with concrete. Note: SR#24463 P.O. is concerned about erosion under outfall. Soukup reported small void about 6 ft deep under structure, see picture."
4904 Manzanita Ave	Carmichael	"Please repair undermining and erosion around outfall pipe 360-191-C03. Access to work location can be made via 2214 padlock & chain on temporary fencing adjacent to outfall pipe. Since the property is undeveloped, the PO (Rev. Sands; Church of the Holy Trinity) does not need to be notified prior to performing repairs. Note: This issue was discovered during routine grizzly inspection duty by DME staff."

Address	City/Area	Work Requested
9411 Wiltshire Way	Orangevale	"Please install erosion protection at the outfall to Linda Creek from the detention basin located at Wiltshire Wy and Main Ave. Please repair an 8' by 8' area at the end of the concrete channel by removing all unsuitable soil, backfilling and compacting with native soil, and then placing 4-6" angular rock atop a geotextile fabric."
7231 Lincoln Ave	Carmichael	"Please remove debris, vegetation, and CMP culverts with in flowline of creek segment 63F21 (see attached photos and facility map). In addition, please correct grade of creek by re-establishing flow line and stabilize bank erosion using native material and angular rock. Work should be completed after bird nesting season, and can be performed between, 9/15/16 - 10/15/16. Equipment access via 4310 Hussey Dr. Please see attached facility map, ROEs, photos and VRF. NOTE: Work request originated from owner concern of bank erosion encroaching on day care playground."
4310 Hussey Dr	Carmichael	"Please place angular rock along bank (approx. 25 sqft) to mitigate for erosion encroaching on homeowner's patio. Also remove downed tree and existing tree near creek bank. Existing tree could potentially fall causing further erosion. Please complete work in conjunction with 7231 Lincoln Ave work request. Note: Work Request originated from owners concern of bank erosion encroaching on patio."

Flood Capabilities

FloodSAFE California

FloodSAFE is a multifaceted and collaborative statewide initiative to improve public safety through integrated flood management. A long-term initiative, FloodSAFE is focused on the following goals: 1) Reduce the chance of flooding, 2) Reduce the consequences of flooding, 3) Sustain economic growth, 4) Protect and enhance the ecosystems, and 5) Promote sustainability. FloodSAFE will accomplish these goals through four types of activities: 1) improving emergency response, improving flood management systems, improving operations and maintenance, and informing and assisting the public.

Central Valley Flood Protection Plan

The Central Valley Flood Management (CVFMP) Program is one of several programs managed by DWR under FloodSAFE California (FloodSAFE), a multifaceted initiative launched in 2006 to improve integrated flood management in the State of California. The CVFMP Program addresses flood management planning activities within the Central Valley that require State leadership and participation.

The Central Valley of California has experienced some of the State's largest and most damaging floods. The existing flood management system, consisting of a number of projects (e.g., dams, reservoirs, weirs, levees, channels, bypasses and other features) individually constructed over the last 150 years, provides varying levels of flood protection. However, this legacy system is now characterized by aging infrastructure constructed using outdated techniques. This system is now relied on to provide benefits and levels of protection that were not envisioned when its elements were first constructed. As currently configured, the system is prone to erosive river forces, is easily distressed from high water, and does not support healthy ecosystem functions and natural floodplain habitats. Further, funding and other constraints have made it difficult to carry out adequate maintenance programs. At the same time, escalating development in the Central Valley floodplains has increased the population at risk and the potential for flood damages to homes, businesses, communities and critical statewide infrastructure. This increased vulnerability of the Central

Valley to catastrophic floods threatens the life safety, property and the financial stability of the State. As a result, in 2008, the DWR embarked on the CVFMP Program, a long-term planning effort to improve integrated flood management within the Central Valley.

The 2012 CVRPP will have three primary elements: vision for flood management in the Central Valley, a framework for implementing future projects to achieve this vision, and initial recommendations for improvements. (Source: Central Valley Flood Protection Plan, Progress Report, January 2011)

Delta Planning Initiatives

The Sacramento-San Joaquin River Delta (Delta) and Suisun Marsh, collectively referred to as the Delta Region, is the largest estuary in the western United States. The Delta Region is home to numerous plant and animal species and is also the hub of California's water supply system. Key transportation, transmission and communication lines cross the region. The region also supports a highly productive farming industry.

A complex system of over 1,330 miles of levees in the Delta Region protects property, infrastructure and people. Levees also protect the region's water supply and ecosystem functions. According to the Delta Risk Management Strategy Plan, the Delta Region levees and the areas and resources they protect are not sustainable under business-as-usual practices.

To address these concerns, numerous initiatives are ongoing that focus on long-term management strategies for the region, including various actions for reducing the risks and consequences of levee failure in the region.

A summary of Delta Planning Initiatives are:

- Conveyance and Flood Risk Reduction
  - ✓ 1.1 Improved Delta Levee Maintenance
  - ✓ 1.2 Upgraded Delta Levees
  - ✓ 1.3 Enhanced Emergency Preparedness/Response
  - ✓ 1.4 Pre-Flooding of Selected Islands
  - ✓ 1.5 Land Use Changes to Reduce Island Subsidence
  - ✓ 1.6 Armored Pathway Through Delta Conveyance (modified PPIC "Armored Island" Concept)
  - ✓ 1.7 Isolated Conveyance Facility Alternatives
  - ✓ 1.8a San Joaquin Bypass
  - ✓ 1.8b San Joaquin River Widening

- Infrastructure Risk Reduction
  - ✓ 2.1 Raise State Highways and Place on Piers (similar to I-80 across Yolo Bypass)
  - ✓ 2.2 Construct Armored Infrastructure Corridor Across Central Delta

- Environmental Risk Mitigation
  - ✓ 3.1. Suisun Marsh Tidal Wetland Restoration
  - ✓ 3.2 Tidal Marsh Cache Slough Restoration
  - ✓ 3.3 Install Fish Screens

- ✓ 3.4 Setback Levees to Restore Shaded Riverine Habitat
- ✓ 3.5 Reduce water exports from the Delta

Table 4-101, prepared by the Sacramento County Department of Water Resources, summarizes Delta projects and plans to mitigate natural hazards in the Delta. UDPATE

Table 4-101 Sacramento County Delta-centric Projects/Plans

Project Name	Responsible Agency/Department	Project Description/Intent	Target Due Dates
Bay Delta Conservation Plan (BDCP)	California Natural Resources Agency/State Department of Water Resources	The BDCP is being developed in compliance with the Federal Endangered Species Act (ESA) and the California Natural Communities Conservation Planning Act (NCCPA). When completed, the BDCP with provide the basis for the issuance of endangered species permits for the operation of state and federal water projects. The plan would be implemented over the next 50 years. BDCP staff now proposing a re-tooled public/stakeholder input process, lead by a ""Management Committee"" and augmented by 13 separate working groups (e.g., Governance, Levee Maintenance, BDCP Compatibility w/Agriculture, Stone Lakes National Wildlife Refuge, Conveyance Facility - size and configuration & Financing).	• May 18, 2011: 1st Management Committee convenes. Committee will meet every 2 weeks. • June 9, 2011: 1st Governance workgroup convenes. • 2013: Completion of the Plan still 2 years (approx) away. Monitor the revised schedule/workplan on the BDCP website.

Project Name	Responsible Agency/Department	Project Description/Intent	Target Due Dates
The Delta Plan	7-Member Delta Stewardship Council (DSC)	The DSC must adopt and implement a comprehensive management plan for the Sacramento-San Joaquin Delta by January 1, 2012. This Delta Plan is intended to guide state and local agencies to help achieve the coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The Delta Plan will also guide protection and enhancement of the unique resources, culture, and values of the Delta as an evolving place.	• Feb 14, 2010: Draft #1 released. • March 18, 2011: Draft #2 released. Sac Co. submitted written comments on April 15th. • April 22, 2011: Draft #3 released. Sac Co. submitted comments on May 6th. • June 13, 2011: Draft #4 released. Comments due to DSC by June 20th. • August 2011: Release of EIR for 45-day comment. • October 2011: Final draft of DP submitted to the Office of Administrative Law (OAL). • November 18, 2011: DSC will certify EIR and adopt the DP. • January 1, 2012: Delta Plan becomes law.
The Delta Economic Sustainability Plan	Delta Protection Commission (DPC)	The Sacramento-San Joaquin Delta Reform Act of 2009 (SB7X 1) requires the DPC to develop an Economic Sustainability Plan (ESP) to be completed by July 1, 2011. The Plan will include, but not be limited to the following: (1) Public safety recommendations, such as flood protection recommendations; (2) A summation of economic goals, policies, and objectives consistent with local general plans and other local economic efforts, including recommendations on continued socioeconomic sustainability of agriculture and its infrastructure and legacy communities in the Delta; (3) Comments and recommendations to the Department of Water Resources concerning its periodic update of the flood management plan for the Delta; and (4) Identification of ways to encourage recreational investment along the key river corridors, as appropriate	• December 6, 2010: Report on Phase I (ESP Framework Study) presented to the DPC. • May 26, 2011: Status of Phase II (preparation of the Plan) presented to the DPC. • August 2011: Final ESP to be adopted.

Project Name	Responsible Agency/Department	Project Description/Intent	Target Due Dates
The Primary Zone (PZ) Study	Delta Protection Commission (DPC)	The Sacramento-San Joaquin Delta Reform Act of 2009 (SB7X 1) requires the DPC to prepare and submit recommendations to the legislature regarding the expansion or change of/to the Delta Primary Zone (PZ). The key purpose of the PZ study is to define those areas of the Delta that contain viable agricultural, recreational, wildlife, and cultural resources that can be sustained into the future. Defining these unique Delta-related resources will be a key factor in the DPC's recommendations to the legislature. The 6 areas identified in the Reform Act include: Rio Vista, Isleton, Bethel Island, Brannan-Andrus Island, Cosumnes/Mokelumne floodway, and the San Joaquin /South Delta Lowlands.	• December 16, 2010: Consultant's recommendations presented to the DPC. DPC membership opted to defer/incorporate final recommendations into the forthcoming ESP. • January 14, 2011: DPC sent update/status letter to the Legislature.
National Heritage Area (NHA) Establishment	Delta Protection Commission and Federal Legislation	Concurrent processes are occurring at the state and federal levels. The Delta Protection Commission as provided for in the Delta Reform Act (Water Code Section 85301(b)(1)) is using the services of a consultant to craft the basic framework of an NHA and requisite management plan. The initial stages of this process include a comprehensive public outreach and education component. At the federal level, Senator Feinstein's office is drafting legislation to "establish" NHA boundaries that will cover the legal Delta, the Suisun Marsh and the Yolo Wildlife Area/Bypass. The Delta NHA will be the first of its kind in California and will provide $10 million over 20 years to fund Delta enhancement projects/programs. The NHA designation will not affect water rights or usurp local land use authority	• Federal authorization (via legislation): Nothing pending. • DPC's consultant continues to work on feasibilty study as called for in the Delta Reform Act (WC Section 85301(b)(1)). • December 2011: Consultant's findings presented to DPC.

Project Name	Responsible Agency/Department	Project Description/Intent	Target Due Dates
The Delta Strategic Plan	Delta Conservancy Board (DCB)	Per the Delta Reform Act, the DCB must prepare and adopt a strategic plan to achieve the goals of the conservancy. The plan will describe its interaction with local, regional, state, and federal land use, recreation, water and flood management, and habitat conservation and protection efforts within and adjacent to the Delta. The strategic plan must also establish priorities and criteria for projects and programs, based upon an assessment of program requirements, institutional capabilities, and funding needs throughout the Delta. The strategic plan must be consistent with the Delta Plan, the Delta Protection Commission's resources management plan, the Central Valley Flood Protection Plan, the Suisun Marsh Preservation Act of 1977, and the Habitat Management, Preservation and Restoration Plan for the Suisun Marsh.	• March 7, 2011: ExO, Campbell Ingram, hired. • March 16, 2011:Interim Strategic Plan (SP) adopted. • June 2011: Request for participation on five 5 SP workgroups (see DCB website). • December 2011: Adoption of final SP.
FEMA Mapping	County Water Resources	In 2006 FEMA began a nationwide process to update all Flood Insurance Rate Maps(FIRMs) including review of all levees which were previously certified to provide 100-year protection. Intent is to verify that original levee certification is valid and document basis of certification. Levee maintaining agencies were required to provide the original levee certification documentation, or new engineering analysis, to recertify the levees. Agencies providing sufficient initial information on maintenance could receive provisional accreditation. Ultimately, all levee maintaining agencies must provide sufficient information to fully certify their levees. Otherwise, these levees are to be decertified by FEMA and areas behind those levees will be mapped in the 100-year floodplain. The maps are scheduled to become effective in February 2012 (+/-) depending on public comments, which are due in August 201	• September 2010: FEMA released Preliminary Draft Flood Maps • October 2010: County staff meeting with FEMA to identify major issues/comment • Dec 2010/Jan 2011: FEMA to hold final public meeting • Jun-Aug 2011: 90 day public appeal period/public meetings in affected communities • March 2012: Final adoption of new FEMA maps.

Project Name	Responsible Agency/Department	Project Description/Intent	Target Due Dates
Central Valley Flood Protection Plan	CVFPP 200 year Floodplain Standard; State Department of Water Resources	The Central Valley Flood Protection Plan (CVFPP) is part of a larger Central Valley Flood Management Planning Program intended to develop a sustainable, integrated flood management plan for areas protected by facilities of the State-Federal flood protection system in the Central Valley. State legislation in 2007 (SB5, SB17, AB5, AB70, AB156) aimed at addressing the problems of flood protection and liability and helping direct use of bond funds also set strict regulation on cities and county to assure that homes are not being built at risk of flooding in the 200-year flood. These regulations take effect 24 months after the Central Valley Flood Protection Plan is adopted. At this time the engineers are working on the 200-year maps and the regulations. A public outreach meeting is scheduled for June 21, 2011 to discuss "FloodSafe" building standards. The CVFPP is scheduled to be published in December 2011, with adoption for follow in June 2012.	• July 1, 2012: CVFPP plan is to be adopted with 200-year flood maps scheduled to be published. • July 1, 2014: County General Plan must be updated to reflect new 200-year standard. • July 1, 2015: County Zoning Code must be updated to reflect 200-year standard. New 200-year standard becomes effective.

Source: Sacramento County Department of Water Resources

Levee and Streambank Erosion Capabilities

Throughout the Central Valley, levees provide essential protection for both urban and rural lands, preventing possible catastrophic flooding and loss of life. On February 24, 2006, following sustained heavy rainfall and runoff, Governor Arnold Schwarzenegger declared a State of Emergency for California's levee system, commissioning up to $500 million of state funds (AB142) to repair and evaluate State/federal project levees. This declaration was a necessary step in preventing possible catastrophic consequences of hurricane Katrina-like proportion.

Following the emergency declaration, Governor Schwarzenegger directed the California Department of Water Resources (DWR) to secure the necessary means to fast-track repairs of critical erosion sites. In addition, California's lengthy environmental permitting process was streamlined without compromising the protection of the important aquatic and terrestrial species inhabiting the river's ecosystem.

Repairs to State/Federal project levees are being conducted under the Levee Repairs Program funded by Section 821 of the Disaster Preparedness and Flood Prevention Bond Act of 2006 (Proposition 1E).

To date, nearly 300 levee repair sites, many of which are in Sacramento County, have been identified, with more than 100 of the most critical sites having already been completed with AB142 funds. Repairs to others are either in progress or scheduled to be completed in the near future, and still more repair sites are in the process of being identified, planned, and prioritized.

California Levee Database

California has over 13,000 miles of levees that protect residential and agricultural lands. The levee failures resulting from hurricane Katrina prompted the State and the Department of Water Resources (DWR) to initiate development of a state-of-the-art California Levee Database (CLD) for the purpose of better understanding and managing levees in California. The CLD is an efficient tool for assessing levee reliability risk factors using a GIS-enabled geospatial database.

Starting in 2005, partnering with the Federal Emergency Management Agency (FEMA) under the auspices of FEMA's Map Modernization Management Support program, the Department has started assembling critically needed levee information on ownership, location, and risk assessment factors for all the levees in California. Recognizing that other agencies are engaged in similar efforts, DWR is actively participating on national committees organized by FEMA and the U.S. Army Corps of Engineers (USACE) to ensure compatibility and coordination with other national efforts.

Currently, the California Levee Database has location information for more than 10,000 miles of levees and flood control structures throughout California. Major features of the CLD include

- Levee centerlines for both State-Federal project levees and non-project levees. The project levees use surveyed levee centerlines from USACE's National Levee Database.
- Boundaries, such as those of levee districts, state levee maintenance area, cities, federal congressional districts, state assembly districts, and hydrologic sub-basins.
- Feature locations, such as those of boreholes, burrow sites, cross sections, encroachments, high water marks, levee stress, levee failures, and levee relief wells.

These features are continuously refined and populated for all identified levees in California. Additionally, web-based levee profile viewer, levee information viewer, and technical resources viewer will be developed and released to public in the near future.

Natomas Levee Improvement Project

In December 2008, Natomas was mapped into the FEMA 100-year floodplain. SAFCA's efforts have been to restore at a minimum a 100-year level of protection, while working toward 200-year level of protection. SAFCA, in partnership with DWR and the CVFPB, began constructing levee improvements in 2007 in advance of the full authorization of the federal project, with the expectation of receiving credit for such work towards the non-federal share of the authorized project. SAFCA's work included levee improvements along the Natomas Cross Canal and the upper reaches of the Sacramento River levees in Natomas. With passage of the Water Resources Reform and Development Act of 2014, USACE is taking the lead on completion of the remaining components of the NLIP. USACE' FY 2014 Work Plan includes $1.0 million for preconstruction engineering and design work for the Natomas Common Features. USACE will commence construction of levee improvements along the southern and eastern portions of the Natomas Basin leading to 100-year and 200-year levels of flood protection over time. This estimated authorized project cost is approximately $1.1 billion.

American River Common Features

Currently, SAFCA and its partners are studying what improvements are needed to meet a 200-year standard of protection for Sacramento's levee system. These improvements will be identified in a report to be produced by USACE called the Common Features General Re-evaluation Report (GRR). This GRR will identify future improvements to the levee system to meet the goal of 200-year level flood protection and address erosion protection, vegetation, seepage, and access requirements. The levee systems being reviewed are the American River levees, the Sacramento River levees downstream of the American River, and the north area streams (Natomas East Main Drain Canal, Magpie Creek Diversion Channel, and Arcade Creek).

SAFCA expects the final report to be complete in late 2015. Until the report is complete, USACE will continue to strengthen various portions of the American River levee system over the next year, work that should be completed by the time the GRR is completed. Current authorization is $280 million. After the study, it is expected that the authorization project will cost over $1.5 billion.

Folsom Dam Modifications/Joint Federal Project (JFP)

This joint federal project consists of a six-gated control structure, a 2,100-foot auxiliary spillway with a stilling basin, and an approach channel in the reservoir leading to the control structure. The auxiliary spillway design can be used for flood control as well as ensuring dam safety. As a result of its joint purpose, portions of these improvements were being constructed by the Bureau, which has completed Phase 1 and Phase 2. The two phases of work almost finished the spillway. USACE in 2010 awarded Phase 3 (construction of the control structure itself) with approximate cost of $220 million. Work on Phase 3 was completed in 2015. Phase 4 (the last part needed for flood control) was awarded in 2013 with a completion of all flood control features to be done in late 2016. Total project cost is estimated at $810 million.

Folsom Dam Raise Project

The Folsom Dam Raise project will raise the height of the dikes around Folsom Lake by about 3.5 feet. Construction on this project will begin sometime around 2017 based on the progress of the JFP. The implementation of the JFP and the Dam Raise, along with downstream levee improvements, will give the City greater than 200-year level of flood protection along the American River. The Raise project should be complete in 2021/2022. The estimated project cost is $122 million.

South Sacramento Streams Group

This project is complete downstream of Franklin Boulevard. The Union Pacific Railroad embankment was completed at the end 2012. The Florin Creek Channel Project and Florin Creek Multi-Use Basin Project are expected to begin in 2016 to provide channel improvements and construct a detention basin. These projects will allow the 100-year flood event to be non-damaging to surrounding properties.

Sacramento River Bank Protection Program (Sac Bank)

USACE receives yearly appropriations to implement the Sac Bank program, which addresses erosion issues. As a result, erosion repair work occurs yearly along the river system. Over the last several years, the

Sacramento area has had an average of three to four sites a year repaired, averaging over $2 million per year.

Regional Planning

DWR launched the Regional Flood Management Plan (RFMP) effort to assist local agencies to develop long-term regional flood management plans that address local needs, articulate local and regional flood management priorities, and establish the common vision of regional partners. DWR is currently providing the funding and resource support to help develop phase 2 of the regional plans consistent with the 2012 CVFPP. There are six regions;and when the regional plans are completed, DWR will incorporate feasible components of the regional plans in the 2017 CVFPP update.

4.4.2. Sacramento County's Administrative/Technical Mitigation Capabilities

Table 4-102 identifies the County personnel responsible for activities related to mitigation and loss prevention in the County.

Table 4-102 Sacramento County Administrative/Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	
Mitigation Planning Committee	Y	Every five years hazards are reviewed by committee of officials from Countywide departments Planning, Stormwater, Agriculture, Transportation and more. Mitigation is planned and recorded.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Drainages throughout the County are cleared during routine maintenance, and inspected and cleared immediately before storms. Fire fuel (vegetative litter) is cleared though a grant funded program to prevent wildfires.
Mutual aid agreements	N	
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Y FT	
Floodplain Administrator	Y FT	There are five CFM in DWR and all staff are knowledgeable with the Floodplain Ordinance. Coordination between departments is effective and is ongoing for all permitted uses in the floodplain.
Emergency Manager	Y FT	
Community Planner	Y FT	

Civil Engineer	Y FT	County DWR –drainage unit has six staff that are licensed Civil Engineers whom are all educated in hazards & mitigation. Staffing is adequate.
GIS Coordinator	Y FT	
Other		
Technical	**Y/N**	**Describe capability Has capability been used to assess/mitigate risk in the past?**
Warning systems/services (Reverse 911, outdoor warning signals)		
Hazard data and information	Y FT	
Grant writing	Y FT	
Hazus analysis		
Other	Y	Dam Failure
How can these capabilities be expanded and improved to reduce risk?		

4.4.3. Sacramento County's Fiscal Mitigation Capabilities

Table 4-103 identifies financial tools or resources that the County could potentially use to help fund mitigation activities.

Table 4-103 Sacramento County Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Sacramento County has a Storm Water Utility that serves to make improvements to the existing storm drainage systems. The Sacramento County Water Agency has trunk drainage developer impact fee programs that fund installation of drainage systems serving 30(+) acre watershed.
Authority to levy taxes for specific purposes	Y	
Fees for water, sewer, gas, or electric services	Y	
Impact fees for new development	Y	
Storm water utility fee		
Incur debt through general obligation bonds and/or special tax bonds	Y	
Incur debt through private activities	Y	

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Community Development Block Grant	Y	
Other federal funding programs	Y	DMA, have been used to mitigate flood risk through home elevations and acquisitions. These programs have been successful and will be applied in the future when available.
State funding programs		
Other		
How can these capabilities be expanded and improved to reduce risk?		

4.4.4. Mitigation Education, Outreach, and Partnerships

Table 4-104 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table 4-104 Sacramento County Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Non-profits such as La Familia, WIC (Dept of Public Health) and food programs exist that could be used to implement mitigation activities or communicate hazard information. They currently are not being used in this capacity. Other groups such as the Environmental Justice Coalition for Water could assist.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes.	Non-profit organizations and government agencies Countywide do ongoing public education for preparedness on the topics of fire, flood and water use.
Natural disaster or safety related school programs		
StormReady certification	Yes	The County maintains a StormReady program and does public outreach regularly though radio, website, local events and the County's public counter.
Firewise Communities certification		
Public-private partnership initiatives addressing disaster-related issues	Yes	Capital Region Climate Readiness Collaborative could be used to inform mitigation activities and communicate hazard-related information.
Other		

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
How can these capabilities be expanded and improved to reduce risk?		
Social media to connect with most vulnerable populations in various languages (some rural areas don't have broadband, many do not watch tv/cable to get messages) Coordinate with public and mental health departments, service providers and organizations in providing information and utilizing their communication tools to connect with clients 2-1-1 is an effective resource in some areas but not all. Need to make it more robust so people know to use it and that it has reliable and timely information. Utilize neighborhood associations, schools, community watch groups to distribute information. Utilize "NextDoor" site to convey information		

UPDATE BELOW

Sacramento County works cooperatively and has many mutual aid agreements in place with various federal, state, and local agencies, groups, and districts. Examples include the U.S. Forest Service, Cal Fire, the California Department of Water Resources, Bureau of Reclamation, National Weather Service, the State Regional Board, CALFED, and the Delta Planning Commission.

Delta Planning Commission

The Delta Planning Commission is charged with the protection of the Delta, both in areas inside and outside of Sacramento County. The mission of the Delta Protection Commission is to adaptively protect, maintain, and where possible, enhance and restore the overall quality of the Delta environment consistent with the Delta Protection Act, and the Land Use and Resource Management Plan for the Primary Zone. This includes, but is not limited to, agriculture, wildlife habitat, and recreational activities. The goal of the Commission is to ensure orderly, balanced conservation and development of Delta land resources and improved flood protection.

The Planning Commission has released many studies and plans related to protecting the people and property in the Delta. Examples of these include:

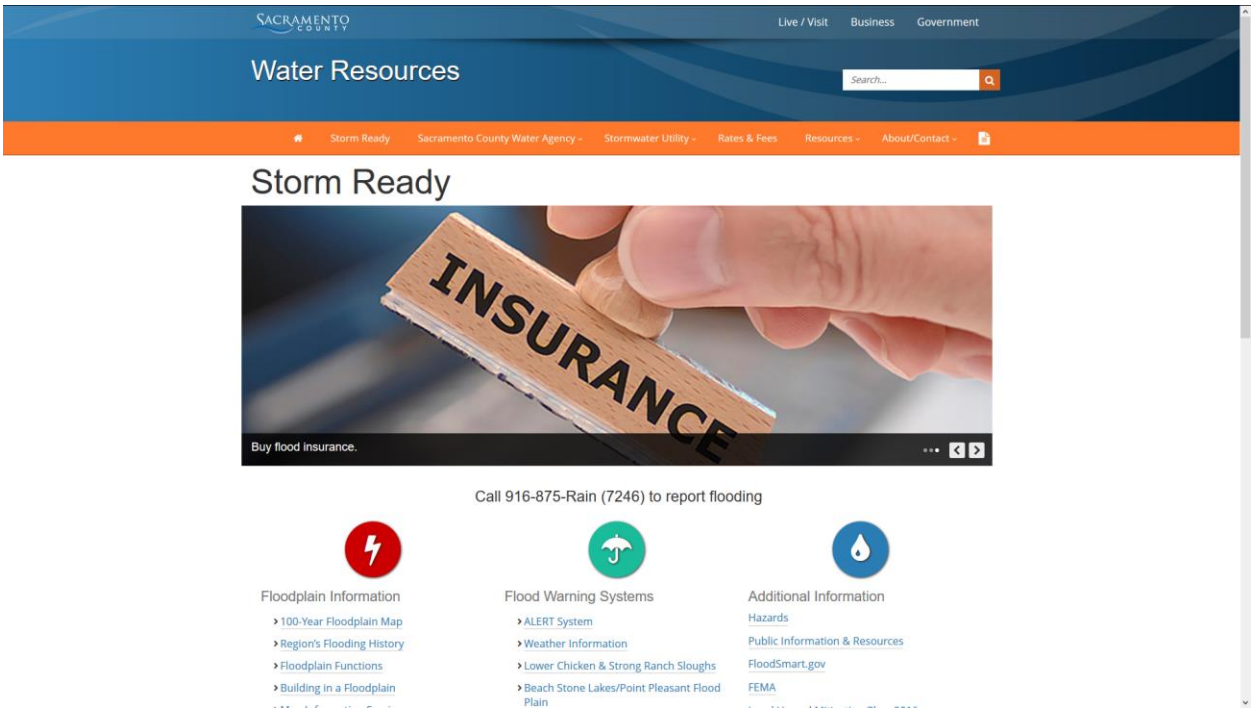
- The Economic Sustainability Plan
- Primary Zone Study
- Land Use and Resource Management for the Primary Zone of the Delta
- Strategic Plan 2006-2011
- Strategic Plan 2008-2009 Tasks
- Annual Reports

StormReady

Overview

Sacramento County Department of Water Resources' annual outreach program informs and educates residents within the unincorporated county and Rancho Cordova about being storm-ready. The homepage is shown in Figure 4-100.

Figure 4-100 StormReady Website



Source: http://www.msa.saccounty.net/waterresources/stormready/

Below is a summary of outreach tactics implemented.

Outreach Tactics

Utility Bill Insert (September through November 2008)

The utility bill insert includes current information about the flood insurance program including the region's history of flooding, flood plains in Sacramento County, how to obtain flood zone and flood insurance information and information on and proper steps to prepare for the rain season.

The utility bill insert is distributed in the billing cycle in late summer via the County Utility Billing Service. About 300,000 bill inserts are distributed to residents within the unincorporated Sacramento County and Rancho Cordova.

Direct Mailer

The direct mailer includes the same information as the utility bill insert, as well as additional information informing specific residents that they are in a flood hazard area. The mailer goes to about 28,000 addresses within special flood risk areas.

Billboards Fall (October) and Winter (January)

Fifteen billboards are placed throughout Sacramento County reminding area residents to prepare for the rain season. Specifically, the billboards include the department's drainage information line, 875-RAIN and Web site for more information. During the fall run, information about removing debris from gutters and storm drains is displayed; in January, the message relates to preparing for winter storms.

Radio Advertising

A radio campaign accompanies other outreach efforts to further inform and educate county residents about storm preparedness. Fifteen and thirty-second advertisements run during weather events throughout the rain season on select stations, including KFBK 1560, KSTE 650, Y 92.5 and V 101.1. More than 750,000 impressions are generated. The messages run during morning and evening traffic reports. The airing of the spots is triggered by storm events.

Brochure

An outreach brochure was redeveloped to include latest information about the flood insurance program. This brochure is made available at the front counter at Water Resources downtown office, as well as at stormwater and other related outreach events throughout the year.

Website

The StormReady Web contains new and expanded information on flood safety, family disaster planning, sandbag information, flood insurance, maps, flood warning system, local creek and stream levels, community flood preparedness and links to other information to help. Users now have the opportunity to request flood zone information online, as well as view the 100-Year Flood Area Map.

Flood Maps

The County of Sacramento and the City of Sacramento have prepared various detailed maps showing hypothetical levee breaks, inundation levels and the time it would take for waters to rise in affected neighborhoods, and rescue and evacuation zones. The maps come in pairs.

- Flood Depth Maps: show where the water would flow over time and how deep it would get given the hypothetical flooding scenario.
- Rescue and Evacuation Route Maps: show rescue areas, evacuation areas, and potential evacuation routes.

In addition to augmenting the evacuation plan, the StormReady website shows evacuation and flood maps by area. Example maps are shown in Figure 4-101 and Figure 4-102. There are 18 areas in the County for which flood depth and evacuation maps are available:

- Arcade Creek 1
- Arcade Creek 2
- Arden
- Campus Commons 1
- Campus Commons 2
- CSU Sacramento
- Downtown 1
- Downtown 2
- Goethe
- Mayhew
- Natomas 1
- Natomas 2
- Natomas 3
- Natomas 4
- Natomas 5
- Pocket
- River Park
- South Sacramento

Figure 4-101 Arcade Creek 1 Flood Depth Map

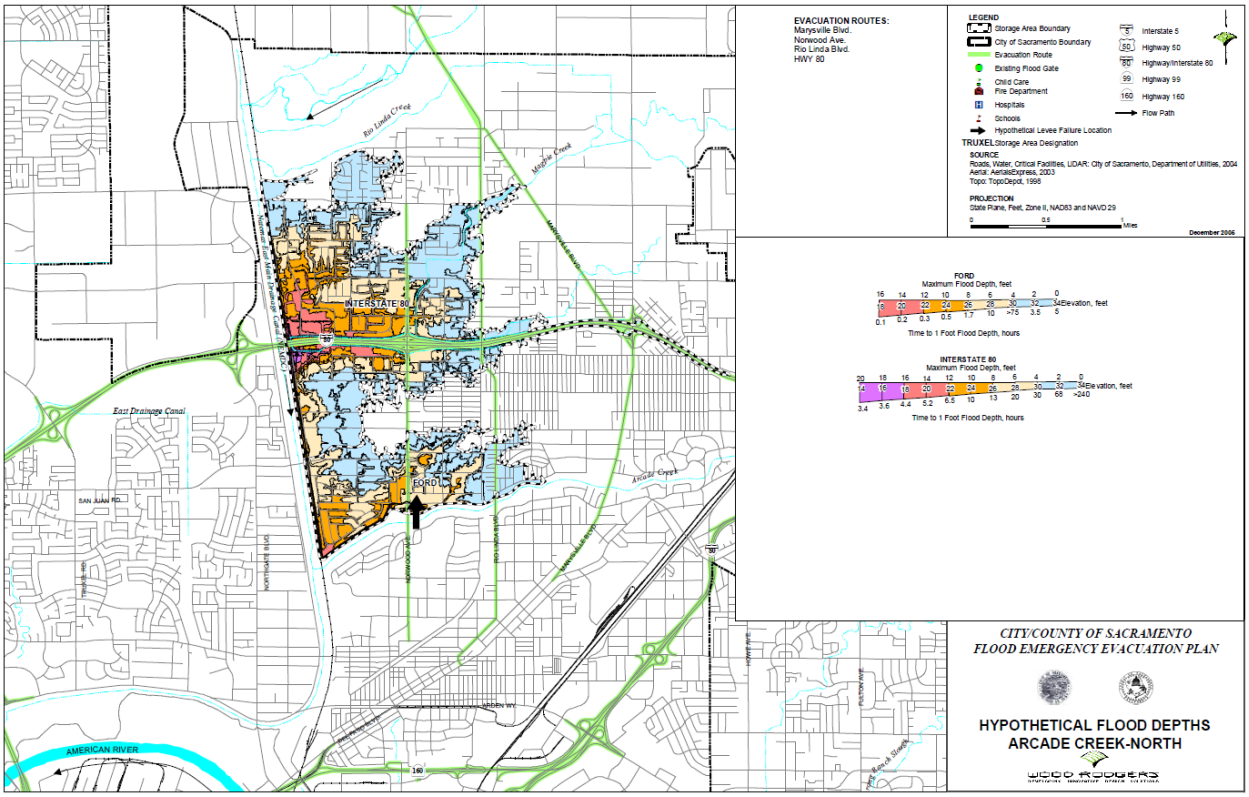
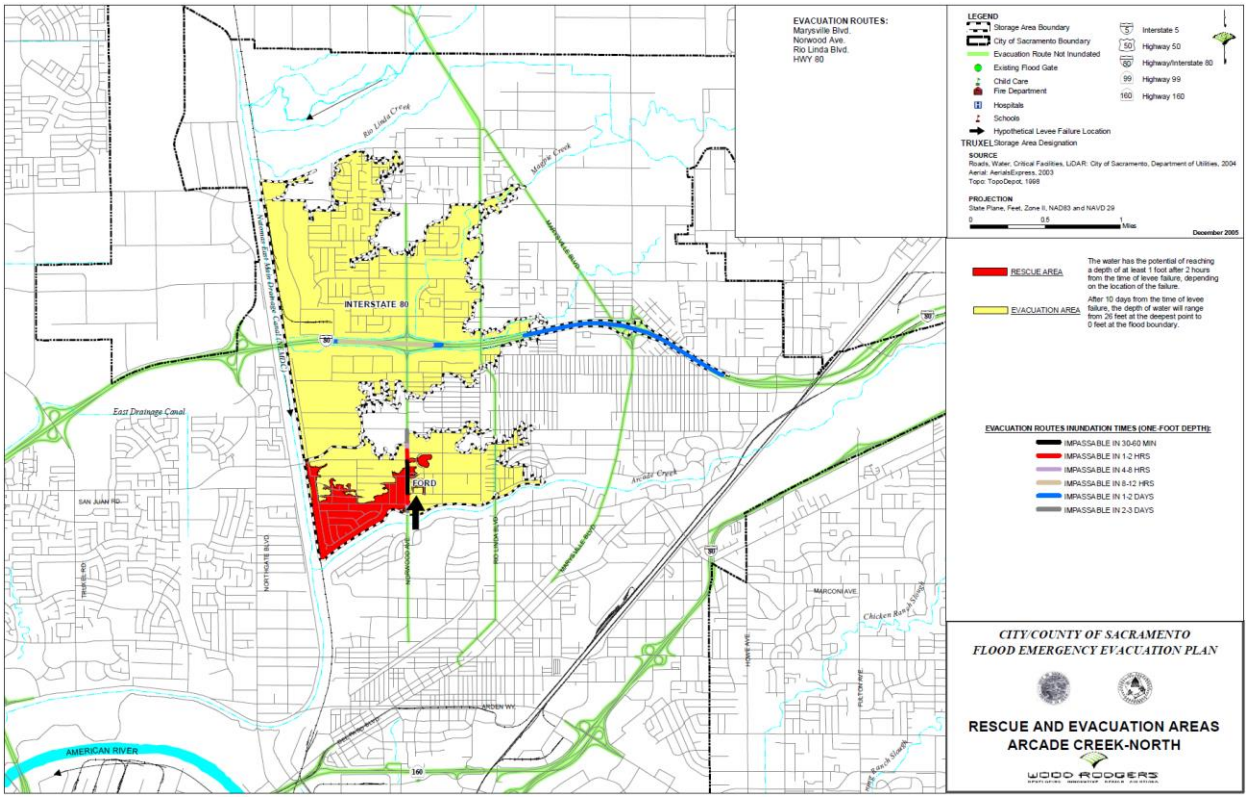


Figure 4-102 Arcade Creek 1 Flood Evacuation Map



4.4.5. Other Mitigation Efforts

OTHER ITEMS NOT CAPTURED ABOVE?

Section 2 What's New details mitigation projects implemented since the 2011 plan. The County also has many planned and ongoing projects focused on minimizing future losses associated with identified hazards. Many of these projects are sponsored and implemented by one or more County departments and/or other state and local agencies and organizations. Current projects include those listed below in this section.

The County noted some flooding projects that have been completed since 2010:

- Bridge replacement on Vineyard Road at Laguna Creek – the bridge was raised by several feet over the creek.
- First phase of road improvements on El Camino Avenue – added larger storm drain pipes and extended drain inlets to better pick up neighborhood storm drain run off.
- Freedom Park Drive – this roadway reconstruction added drainage swales to absorb storm runoff into landscaped area before going into storm drain pipes with the goals of filtering waters to do run to creeks and reducing flows into creeks. The reduced runoff lessens flooding concerns.

Future County projects planned to improve flooding issues include:

- Bridge replacement on Elk Grove-Florin Road at Elder Creek – the bridge will be raised by several feet over the creek.
- Michigan Bar Bridge replacement at the Consumnes River – the bridge will be raised by about a foot over the river.
- Second phase of road improvements on El Camino Avenue – will add larger storm drain pipes and extended drain inlets to better pick up neighborhood storm drain run off.

SAFCA and the Sacramento County Airport System drained rice fields next to the Sacramento Airport. This was done to reduce the population of migrating waterfowl near the airport runways and in the Airport Runway Protection Zones.

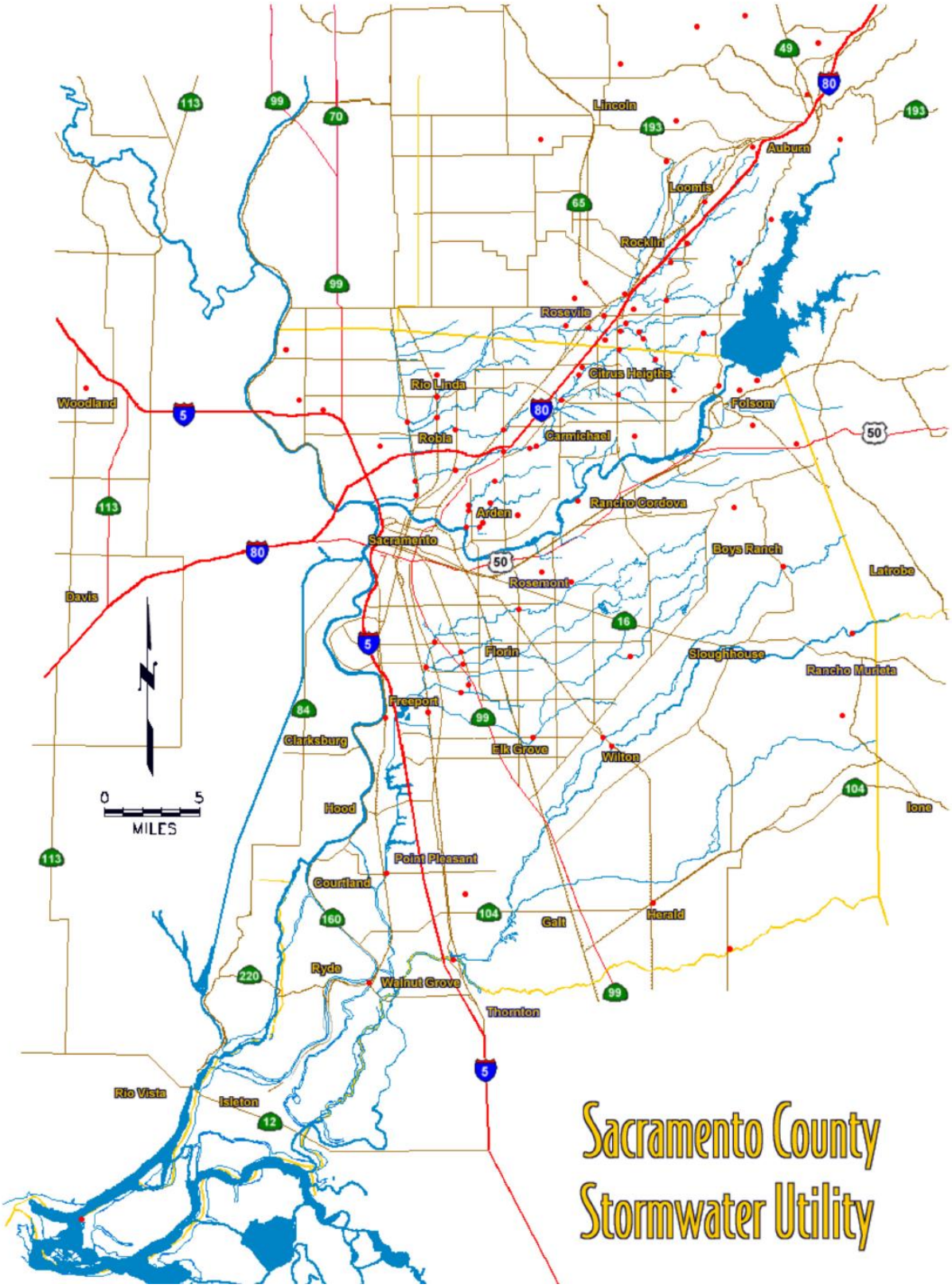
The Bureau of Reclamation, in cooperation with California State Parks, the Sacramento Metropolitan Fire District and the Sacramento Regional Conservation Corps (SRCC), recently began implementing a fire fuels reduction project along Lake Natoma's shoreline and adjacent to private property on Monday, May 23, 2011. The work is expected to continue through mid-June. The purpose of the project was to reduce flammable vegetation along Lake Natoma's boundary to help mitigate the risk of wildfire. The work will be accomplished by SRCC crews and was made possible by grant funding obtained by the SRCC. Crews removed dead vegetation and excessive foliage within 50 to 100 feet of property boundaries. The amount of vegetation removed varied based on its density in different areas. In some locations, minimal work was be needed, while other areas will require the removal of a noticeable amount of foliage. The project minimized the removal of mature native trees focused on removing non-native trees and shrubs.

The State of California has mitigation effort and actions undertaken as part of the California State Hazard Mitigation Plan that have direct impacts on mitigation efforts in Sacramento County. These programs include:

- The Delta Risk Management Strategy document
- Levee Evaluation and Repair (along the Sacramento and San Joaquin River valleys and the Delta)
- Initiation of the California Levee Database
- An Aerial Levee Survey Project
- Levee Flood Protection Zones (see Figure 4-47)

ALERT Gages–Sacramento County Department of Water Resources maintains many ALERT gages throughout the County. There are 50 stream gages and 59 rainfall gages that monitor flooding and potential flooding conditions throughout the County. These are shown on Figure 4-103.

Figure 4-103 Sacramento County ALERT Gage Locations



Folsom Dam Improvements

The pictures provided are the excavation of the auxiliary spillway for Folsom Dam. This work is for the downstream chute and stilling basin. At the upper end of the picture (the stepped slope) is where the actual control structure with six tainter gates will be constructed. The Corps of Engineers is currently building the control structure and then they will concrete line the excavated spillway that is seen in the photograph. The bridge seen in the photograph is carrying a water line that serves the City of Folsom.

Chapter 5 Mitigation Strategy

Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for the Sacramento County Local Hazard Mitigation Plan Update. It describes how the County and participating jurisdictions met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

5.1 Mitigation Strategy: Overview

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of the HMPC led to the mitigation strategy and mitigation action plan for this LHMP Update. As part of the plan update process, a comprehensive review and update of the mitigation strategy portion of the plan was conducted by the HMPC. Some of the initial goals and objectives from the 2011 plan were refined and reaffirmed, some goals were deleted, and others were added. The end result was a new set of goals, reorganized to reflect the completion of 2011 actions, the updated risk assessment and the new priorities of this Plan Update. To support the new LHMP goals, the mitigation actions from 2011 were reviewed and assessed for their value in reducing risk and vulnerability to the planning area from identified hazards and evaluated for their inclusion in this Plan Update (See Chapter 2 What's New). Section 5.2 below identifies the new goals and objectives of this Plan Update and Section 5.4 details the new mitigation action plan.

Taking all of the above into consideration, the HMPC developed the following umbrella mitigation strategy for this LHMP Update:

- Communicate the hazard information collected and analyzed through this planning process as well as HMPC success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.
- Implement the action plan recommendations of this plan.
- Use existing rules, regulations, policies, and procedures already in existence.
- Monitor multi-objective management opportunities so that funding opportunities may be shared and packaged and broader constituent support may be garnered.

5.1.1. Continued Compliance with NFIP

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP) by all communities and participation by Sacramento County, the City of Sacramento and others, as appropriate, in the Community Rating System (CRS). Detailed below is

a description of Sacramento County's flood management program to ensure continued compliance with the NFIP. Also to be considered are the numerous flood mitigation actions contained in this LHMP that support the ongoing efforts by the county to minimize the risk and vulnerability of the community to the flood hazard and to enhance their overall floodplain management program. A summary of the flood management programs and continued compliance with the NFIP for the incorporated communities are detailed in their jurisdictional annexes.

Sacramento County's Flood Management Program

Sacramento County has participated in the Regular Phase of the NFIP since 1979. Since then, the County has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The County will continue to manage their floodplains in continued compliance with the NFIP. An overview of the County's NFIP status and floodplain management program are discussed on Table 5-1.

Table 5-1 Sacramento County NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	10,468 $5,542,955 $2,939,536,100
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	1,193 $22,391,338.96 95
How many structures are exposed to flood risk within the community?	3,862 (1% Annual Chance)) 21,778 (0.2% Annual Chance)
Describe any areas of flood risk with limited NFIP policy coverage	INSERT
Is the Community Floodplain Administrator or NFIP Coordinator certified?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Floodplain Management reviews and approves permit s,
What are the barriers to running an effective NFIP program in the community, if any?	Public acknowledgment of the hazards
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	October 2015
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	1979

NFIP Topic	Comments
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Meet and Exceed: See Appendix C for Details
Provide an explanation of the permitting process.	Clearly outlined in the floodplain ordinance. This process is strictly enforced.
Community Rating System	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	3
What categories and activities provide CRS points and how can the class be improved?	Sacramento County actively maintains programs that satisfy or surpass all CRS activities in the 300s, 400s, 500s and some 600s. These programs are regularly improved by staff for completeness. Two activities that have room for improvement are 610 and 620.
Does the plan include CRS planning requirements?	Yes, in accordance with the CRS Activity 510 requirements of the 2013 CRS Coordinator's Manual

Source: FEMA/Sacramento County

The Community Rating System (CRS) was created in 1990. Sacramento County has been in the CRS program since 1992. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, Sacramento County is currently ranked Class 3 community, which gives a 35% premium discount to individuals in the Sacramento County Special Flood Hazard Area (SFHA), and a 10% discount to policyholders outside the SFHA. Sacramento County is the only CRS Class 3 community, ranking them fifth in the nation (where there are three Class 2's and one Class 1) and second in California of all CRS communities.

The activities credited by the CRS provide direct benefits to Sacramento County and its residents, including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that Sacramento County implements and receives CRS credits include:

- INSERT DURING NEXT ITERATION

5.2 Goals and Objectives

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point in the planning process, the HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals, objectives, and mitigation actions were developed based on these tasks. The HMPC held a series of meetings and exercises designed to achieve a collaborative mitigation strategy as described further throughout this section. Appendix C documents the information covered in these mitigation strategy meetings, including information on the goals development and the identification and prioritization of mitigation alternatives by the LHMP Update Steering Committee and HMPC working group.

During the initial goal-setting meeting, the HMPC reviewed the results of the hazard identification, vulnerability assessment, and capability assessment. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the HMPC to formulate planning goals and objectives and to develop the mitigation strategy for the Sacramento County Planning Area.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- A time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

HMPC members were provided with the list of goals from the 2011 plan as well as a list of other sample goals to consider. They were told that they could use, combine, or revise the statements provided or develop new ones, keeping the risk assessment in mind. Each member was given three index cards and asked to write a goal statement on each. Goal statements were collected and grouped into similar themes and displayed on the wall of the meeting room. The goal statements were then grouped into similar topics. New goals from the HMPC were discussed until the team came to consensus. Some of the statements were determined to be better suited as objectives or actual mitigation actions and were set aside for later use. Next, the HMPC developed objectives that summarized strategies to achieve each goal.

Based on the risk assessment review and goal setting process, the HMPC identified the following mission statement, goals, and objectives, which provide the direction for reducing future hazard-related losses within the Sacramento County Planning Area.

Mission Statement: ***This LHMP assesses natural hazards of concern to the Sacramento community; evaluates risk to life safety, public health, property, and the environment; and evaluates mitigation measures to reduce these risks and vulnerabilities, minimize losses, and increase community resilience.***

GOAL 1: Minimize risk and vulnerability of the Sacramento County community to the impacts of natural hazards and protect lives and reduce damages and losses to property, public health, economy, and the environment.

Objectives:

- Protect, preserve, and promote public health and safety, livability, and the environment
- Assure long term protection and resiliency of existing and future development (including infill areas) from natural hazards
- Protect critical facilities from natural hazards and minimize interruption of essential infrastructure, utilities, and services
- Protect natural resources; Protect and enhance water quality and supply, critical aquatic resources and habitat for beneficial uses.
- Maintain/enhance the flood mitigation program to provide 100/200/500 year flood protection
- Minimize risk of levee breach, overtopping or other failures
- Mitigate Repetitive Loss Properties
- Continued enhancement of CRS programs
- Address localized drainage issues
- Reduce the potential of wildfire in Sacramento County and protect the community
- from adverse effects of wildfire, including secondary impacts such as air quality
- Protect vulnerable populations from the threat of natural hazards
- Address climate change influence in project design and development
- Promote hazard mitigation as an integrated public policy and as a standard business practice

GOAL 2: Improve public outreach, awareness, education, and preparedness for all hazards to minimize hazard related losses

Objectives:

- Increase outreach, communication and awareness of natural hazards and reduce exposure to all hazard related losses, including climate change
- Improve the communities' understanding of natural hazards and how to effectively be prepared and take action to mitigate the impacts of hazard events
- Develop and target outreach and education for each hazard type and risk area
- Increase access to natural hazard information via enhanced web and mobile applications before, during, and after a disaster
- Enhance public outreach programs to target all vulnerable populations, including multi-language communications and multi-mode delivery
- Continued promotion of flood insurance

GOAL 3: Improve the capabilities of the community to mitigate losses and to be prepared for, respond to, and recover from a disaster event

Objectives:

- Promote interagency coordination of mitigation planning and implementation efforts
- Minimize hazard-related damage in order to maintain current service levels
- Continued enhancements to emergency services capabilities, integrating new technologies to reduce losses and save lives
- Promote intergovernmental and interagency coordination, planning, training, exercising and communication to ensure effective community preparedness, response, and recover
- Increase the use of coordinated, shared resources between agencies
- Promote public/private partnerships in hazard mitigation and preparedness programs
- Identify, coordinate, and implement countywide evacuation and shelter in place planning for all populations and increase community awareness of these activities

GOAL 4: Assure conformance to Federal and State Hazard Mitigation Initiatives and Maximize Potential for Mitigation Implementation

Objectives:

- Maintain FEMA Eligibility/Position Jurisdictions for Grant Funding
- Maintain good standing with FEMA and State hazard mitigation programs, regulations and requirements
- Develop an overall mitigation funding strategy to prioritize and pursue mitigation projects in an equitable manner to benefit all populations
- Maximize funding opportunities through identification and tracking of all types of Federal and state grant programs to implement identified mitigation projects

5.3 Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified in Section 4.1 was evaluated. Only those hazards that were determined to be a priority hazard were considered further in the development of hazard-specific mitigation actions.

These priority hazards (in alphabetical order) are:

- Agricultural Hazards
- Bird Strike
- Climate Change
- Dam Failure
- Drought and Water Shortage
- Earthquake
- Earthquake: Liquefaction

- Flood: 100/200/500-year
- Flood: Localized/Stormwater Flooding
- Levee Failure
- River/Stream/Creek Bank Erosion
- Severe Weather: Extreme Temperatures – Heat
- Severe Weather: Heavy Rain and Storms
- Wildfire

The HMPC eliminated the hazards identified below from further consideration in the development of mitigation actions because the risk of a hazard event in the County is unlikely or nonexistent, the vulnerability of the County is low, or capabilities are already in place to mitigate negative impacts. The eliminated hazards are:

- Landslides
- Severe Weather: Extreme Temperatures – Cold/Freeze
- Severe Weather: Fog
- Severe Weather: Wind and Tornadoes
- Subsidence
- Volcano

It is important to note, however, that all the **Hazards Addressed** in this plan are included in the countywide multi-hazard public awareness mitigation action as well as in other multi-hazard, emergency management actions.

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- Prevention (required to be evaluated)
- Property protection
- Structural projects
- Natural resource protection
- Emergency services
- Public information

The HMPC was provided with examples of potential mitigation actions for each of the above categories. The HMPC was also instructed to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. Appendix C provides a detailed review and discussion of the six mitigation categories to assist in the review and identification of possible mitigation activities or projects. Also utilized in the review of possible mitigation measures is FEMA's publication on Mitigation Ideas, by hazard type. Prevention type mitigation alternatives were discussed for each of the priority hazards. This was followed by a brainstorming session that generated a list of preferred mitigation actions by hazard.

5.3.1. Prioritization Process

Once the mitigation actions were identified, the HMPC was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE sustainable disaster recovery criteria; Smart Growth principles; and others, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE stands for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations)
- Technical: Is the action technically feasible? Does it solve the problem?
- Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?
- Political: Who are the stakeholders? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. Other criteria used to assist in evaluating the benefit-cost of a mitigation action includes:

- Contribution of the action to save life or property
- Availability of funding and perceived cost-effectiveness
- Available resources for implementation
- Ability of the action to address the problem

In addition to reviewing and incorporating the actions from the 2011 plan, the committee also considered and defined several new actions. A comprehensive review of mitigation measures was performed using the criteria (alternatives and selection criteria) in Appendix C.

With these criteria in mind, HMPC members were each given a set of nine colored dots, three each of red, blue, and green. The dots were assigned red for high priority (worth five points), blue for medium priority (worth three points), and green for low priority (worth one point). The team was asked to use the dots to prioritize actions with the above criteria in mind. The point score for each action was totaled. Appendix C contains the total score given to each identified mitigation action.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to prioritize recommended mitigation actions. During the voting process, emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis. The team agreed that prioritizing the actions collectively enabled the actions to be ranked in order of relative importance and helped steer the development of additional actions that meet the more important objectives while eliminating some of the actions which did not garner much support.

Benefit-cost was also considered in greater detail in the development of the Mitigation Action Plan detailed below in Section 5.4. The cost-effectiveness of any mitigation alternative will be considered in greater detail

through performing benefit-cost project analyses when seeking FEMA mitigation grant funding for eligible actions associated with this plan.

Recognizing the limitations in prioritizing actions from multiple jurisdictions and departments and the regulatory requirement to prioritize by benefit-cost to ensure cost-effectiveness, the HMPC decided to pursue actions that contributed to saving lives and property as first and foremost, with additional consideration given to the benefit-cost aspect of a project. This process drove the development of a determination of a high, medium, or low priority for each mitigation action, and a comprehensive prioritized action plan for the Sacramento County Planning Area.

5.4 Mitigation Action Plan

Requirement §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This action plan was developed to present the recommendations developed by the HMPC for how the Sacramento County Planning Area can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Emphasis was placed on both future and existing development. The action plan summarizes who is responsible for implementing each of the prioritized actions as well as when and how the actions will be implemented. Each action summary also includes a discussion of the benefit-cost review conducted to meet the regulatory requirements of the Disaster Mitigation Act.

Table 5-2 identifies the mitigation actions and lead jurisdiction for each action. Only those actions where the County is the lead jurisdiction are detailed further in this section. Actions specific to other participating jurisdictions, or where other jurisdictions are taking the lead, are detailed in each respective jurisdictional annex to this plan.

The action plan detailed below contains both new action items developed for this Plan Update as well as old actions that were yet to be completed from the 2011 plan. Table 5-2 indicates whether the action is new or from the 2011 plan and Chapter 2 contains the details for each 2011 mitigation action item indicating whether a given action item has been completed, deleted, or deferred.

It is important to note that Sacramento County and the participating jurisdictions have numerous existing, detailed action descriptions, which include benefit-cost estimates, in other planning documents, such as stormwater and drainage plans, community wildfire protection plans/fire plans, and capital improvement budgets and reports. These actions are considered to be part of this plan, and the details, to avoid duplication, should be referenced in their original source document. The HMPC also realizes that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, as necessary, as long as they conform to the overall goals of this plan.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The participating communities are not obligated by this document to implement any or all of these projects. Rather this mitigation strategy represents the desires of the community to mitigate the risks and vulnerabilities from identified hazards. The actual selection, prioritization, and implementation of these actions will also be further evaluated in accordance with the CRS mitigation categories and criteria contained in Appendix C.

It should be noted that many of the projects submitted by each jurisdiction in Table 5-2 benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority.

GOALS ADDRESSED AND CRS CATEGORIES WILL BE FILLED OUT FOR NEXT ITERATION OF PLAN

Table 5-2 Sacramento County Planning Area's Mitigation Actions

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Sacramento County						
Multi-Hazard Actions						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan		2011 Action	X	X	X	
Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness		2011 Action	X	X		
Increase pedestrian and bicycle evacuation routes by constructing regional bike/pedestrian trail infrastructure, and expanding connection to neighborhoods (particularly in vulnerable areas)		New Action	X	X		
Community Rating System (CRS) Program for Public Information (PPI)	1, 2, 3, 4	2011 Action	X	X	X	
Flood Insurance Assessment, Awareness, and Promotion	1, 2, 3, 4	New Action	X	X	X	
Public Outreach Mailers	1, 2, 3, 4	2011 Action	X	X	X	
Public Outreach Mailers	1, 2, 3, 4	2011 Action	X	X	X	
Community Rating System (CRS) Program for Public Information (PPI)	1, 2, 3, 4	New Action	X	X	X	
Flood Insurance Assessment, Awareness, and Promotion	1, 2, 3, 4	New Action	X	X	X	
Climate Change Actions						
Increase average fuel efficiency and reduce GHG emissions from the County Fleet and Fuels		New action	X	X		
Reduce Sacramento County's vulnerability to Climate Change by reducing GHG emissions in the commercial and residential sectors by making energy efficiency a priority through building code improvements		New action	X	X		

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Mitigate Climate Change impacts by integrating climate change research and adaptation planning into County operations and services		New action	X	X		
Reduce Sacramento County's vulnerability to extreme heat events and associated hazards by Increase tree planting/canopy preservation/enhancement		New action	X	X		
Flood and Localized Flood Actions						
Keep the PPI current		New action	X	X	X	
Alder Creek flood control		New action	X	X	X	
Alder Creek flood mitigation (dam)		New action	X	X	X	
Alder Creek miners reservoir, property owned by the City of Folsom		New action	X	X	X	
Delta Small Communities flood protection - structural and nonstructural mitigation		New action	X	X	X	
Gum Ranch flood control - joint use basin		New action	X	X	X	
Implement Storm Drain CIP		New action	X	X	X	
Implement Water Supply CIP		New action	X	X	X	
Laguna Creek at Triangle Aggregate flood control -joint use basins		New action	X	X	X	
Laguna Creek mitigate flood hazard south of Jackson Highway		New action	X	X	X	
Model Sacramento River levee breach (LAMP) south of Freeport		New action	X	X	X	
Morrison Creek Miners Reach Flood Insurance Study		New action	X	X	X	
Morrison Creek miners reach levee improvements		New action	X	X	X	
Outreach stormwatch guide (ALERT, Stormready, weather radio)		New action	X	X	X	
Peak flow floodplain mitigation Arcade Creek near Auburn Blvd		New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Risk Map (flood frequency, depth, velocity)		New action	X	X	X	
Elevation & Acquisition Projects (to Mitigate Flood Risk)		2011 Action	X	X	X	
Repetitive Loss Properties (to Mitigate Flood Risk)		2011 action	X	X	X	
Five-Year Capital Improvement Plan – Drainage Projects		New action	X	X	X	
Arcade Creek Corridor Plan		New action	X	X	X	
Elevate Homes on Long Island (Grand Island Road, Sacramento River)		New action	X	X	X	
Repetitive Loss Church Building on Dry Creek		New action	X	X	X	
South Branch Arcade Creek – Gum Ranch Basin (with Fair Oaks Park District) and Kenneth Avenue Bridge Improvements (with Sacramento County Department of Transportation)		New action	X	X	X	
Dry Creek Flood Hazard Mitigation Acquisitions with County Regional Park Department		New action	X	X	X	
Arcade Creek at Evergreen Estates Floodwall Improvements		New action	X	X	X	
Linda Creek Peak Flow Mitigation		New action	X	X	X	
Flood Preparation in the American River Parkway		New action	X	X	X	
Improve County ALERT (Automated Local Evaluation in Real Time) System of Stream and Rain Gauges		2011 Action	X	X	X	
Update County Hydrology Standards		New action	X	X	X	
Woodside Condominiums Repetitive Flood Loss Property		New action	X	X	X	
Bridge Replacement on Elk Grove Florin Road at Elder Creek	1, 2, 3, 4	New action	X	X	X	
Michigan Bar Bridge Replacement at the Cosumnes River	1, 2, 3, 4	New action	X	X	X	
El Camino Avenue Phase 2 Road Improvements	1, 2, 3, 4	New action	X	X	X	
Levee Failure Actions						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Improve Flood Protection and/or Evacuation Planning for Mobile Home/RV Park at Manzanita/Auburn. Alternatively, the Park Should Establish Flood Warning and evacuation procedures.		New action	X	X	X	
Hydromodification and Stormwater Quality Countywide		2011 action	X	X	X	
Wildfire Actions						
Wildfire Suppression		New Action	X	X		Property Protection
Wildfire Fighting - Support		New Action	X	X		
Wildfire Suppression – Regional Parks and Open Space (urban interface)		New Action	X	X		
City of Citrus Heights						
City of Elk Grove						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan, as well as other Local Planning Efforts	1, 2, 3, 4	2011 Action	X	X	X	
Mutual Aid Agreements	1, 2, 3, 4	New action	X	X		
Elk Grove Green Street Project: Repurposing Urban Runoff with Green Instructure Technologies	1, 2, 3	New action	X	X		
Hazard Education and Risk Awareness	1, 2, 3, 4	New action	X	X	X	
City of Elk Grove's Storm Drainage Master Plan (SDMP)	1, 2, 3, 4	New action	X	X	X	
City of Folsom						
City of Galt						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
City of Isleton*						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	1, 2, 3, 4	New Action	X	X		
Storm Water Runoff Rehabilitation Project	1, 2, 3, 4	New Action	X	X	X	
Wastewater Treatment Plant Pond Levee Elevation Raise to 200-year Flood Standard	1, 2, 3, 4	New Action	X	X	X	
City of Rancho Cordova						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	1, 2, 3, 4	2011 Action	X	X	X	
Sunrise Boulevard Widening Kiefer to Jackson	1, 2, 3	2011 Action	X	X		
City of Rancho Cordova Disaster Debris Management Plan	1, 2, 3, 4	New Action	X	X		
Transportation Interconnectivity	1, 2, 3, 4	New Action	X	X		
Intergovernmental Agreement between the County of Sacramento and the City of Rancho Cordova	1, 2, 3	New Action	X	X		
Land Use (Long range)	1, 2, 3, 4	New Action	X	X		
Post disaster training for staff	1, 2, 3, 4	New Action	X	X		
Update/Maintain Emergency Operation Plans (EOPs)	1, 2, 3, 4	New Action	X	X		
Increase Everbridge Enrollment	1, 2, 3, 4	New Action	X	X		
Developing and maintaining a database to track community vulnerability.	1, 2, 3, 4	New Action	X	X		
City Website HMP and City Website, Press Notification, and Social Media Emergency Information	1, 2, 3	New Action	X	X		
Building & Safety Division Disaster Inspector Training	1, 2, 3, 4	New Action	X	X		
Landscape and Irrigation Requirements/Retro	1, 2, 3, 4	New Action	X	X		
Landscape Ordinance	1, 2, 3	New Action	X	X		
Impervious surface	1, 3, 4	New Action	X	X		
Porous pavement and vegetative buffers	1, 3, 4	New Action	X	X		

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Storm Water Pump Station Infrastructure Upgrades	1, 2, 3, 4	New Action	X	X	X	
SB-5 Urban Level of Flood Protection	1, 2, 3, 4	New Action	X	X	X	
Channel Vegetation Management and Erosion Control	1, 2, 3, 4	New Action	X	X	X	
Floodplain Manager Certification	1, 2, 3, 4	New Action	X	X	X	
Adoption of Hydromodification and Low Impact Development (LID) Standards	1, 2, 3, 4	New Action	X	X	X	
Stormwater Capital Improvement Program Master Plan	1, 2, 3, 4	New Action	X	X	X	
Sunrise Blvd. & Monier Circle Drainage Improvements	1, 2, 3, 4	New Action	X	X	X	
Roundabouts	1, 2, 3, 4	New Action	X	X	X	
City of Sacramento						
Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	1, 2, 3, 4	2011 action	X	X	X	
Coordination with Relevant Organizations and Agencies to Consider the Impacts of Urbanization and Climate Change on Long-Term Natural Hazard Safety	1, 2, 3, 4	New action	X	X		
Maintain and Identify Changes in Critical Facilities GIS Layer to Support Emergency Management Efforts	1, 2, 3, 4	New action	X	X	X	
Community Outreach on Multi-Hazard Preparation & Pre-mitigation	1, 2, 3, 4	New action	X	X	X	
Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas	1, 2, 3, 4	2011 Action	X	X	X	
Retrofit of Repetitive Loss Properties	1, 2, 3, 4	2011 Action	X	X	X	
Safeguard Essential Communication Services	1, 2, 3, 4	New action	X	X		
Multi-lingual Disaster Education	1, 2, 3, 4	New action	X	X		
Cal OES Safety Assessment Program Evaluators	1, 2, 3, 4	New action	X	X		
National Flood Insurance Program & Community Rating System Continuation	1, 2, 3, 4	New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Coordinate with Sacramento Area Flood Control Agency on Completion of South Sacramento Streams Group Projects	1, 2, 3, 4	New action	X	X	X	
Develop a Master Generation Plan for Pump Stations	1, 2, 3, 4	New action	X	X	X	
Develop a Disaster Housing Plan	1, 2, 3, 4	New action	X	X	X	
Disaster Resistant Business Program	1, 2, 3, 4	New action	X	X	X	
Develop Enhanced Emergency Planning for Special Needs Populations in the City of Sacramento Emergency Operations Plan and Other Planning Documents	1, 2, 3, 4	New action	X	X	X	
Establish a Post-Disaster Action Plan	1, 2, 3, 4	New action	X	X	X	
Flood Recovery Plan	1, 2, 3, 4	New action	X	X	X	
Public Information Flood Response Plan	1, 2, 3, 4	New action	X	X	X	
Construction of a new Emergency Operation Center (EOC)	1, 2, 3, 4	New action	X	X	X	
Protection of Transportation Infrastructure	1, 2, 3, 4	New action	X	X	X	
Public Education Campaign for Everbridge System	1, 2, 3, 4	New action	X	X	X	
Regional Emergency and Disaster Preparedness Exercises to Test Operational & Emergency Plans	1, 2, 3, 4	New action	X	X	X	
Special Needs and Critical Facilities Database and Advanced Warning System	1, 2, 3, 4	New action	X	X	X	
Multi-Jurisdictional Modeling for Drainage Watersheds Greater Than 10 Square Miles	1, 2, 3, 4	New action	X	X	X	
Map and Assess Vulnerability to Sea Level Rise	1, 2, 3, 4	New action	X	X	X	
Aquifer Storage	1, 2, 3, 4	New action	X	X	X	
Perform a Groundwater Recharge Feasibility Study	1, 2, 3, 4	New action	X	X	X	
Map and Assess Community Vulnerability to Earthquakes	1, 2, 3, 4	New action	X	X	X	
Seismic Vulnerability Assessment on Sacramento Levees, Infrastructure & Buildings	1, 2, 3, 4	New action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Heating Centers in High Priority Locations	1, 2, 3, 4	New action	X	X	X	
Cooling Centers in High Priority Locations	1, 2, 3, 4	New action	X	X	X	
Extreme Weather Outreach Strategy	1, 2, 3, 4	New action	X	X	X	
Coordinate with Stakeholder on Proposed Flood Control Project on Magpie Creek	1, 2, 3, 4	New action	X	X	X	
Adopt Additional Floodplain Development Standards	1, 2, 3, 4	2011 action	X	X	X	
Drainage Projects for Repetitive Loss Properties	1, 2, 3, 4	2011 Action	X	X	X	
Preferred Risk policy (PRP) Outreach Campaign	1, 2, 3, 4	2011 Action	X	X	X	
Emergency Notification and Evacuation Planning	1, 2, 3, 4	2011 Action	X	X	X	
Historic Magpie Creek	1, 2, 3, 4	2011 Action	X	X	X	
Natomas Internal Drainage Canals/Levees	1, 2, 3, 4	New action	X	X	X	
Drainage Projects from the City's Priority Drainage Project List	1, 2, 3, 4	2011 Action	X	X	X	
Tree Trimming & Debris Removal	1, 2, 3, 4	New action	X	X		
Upgrading Overhead Utility Lines & Burying Critical Power Lines	1, 2, 3, 4	New action	X	X		
Stabilization of Erosion Hazard Areas	1, 2, 3, 4	New action	X	X		
Implement a Fire Education and Information Program	1, 2, 3, 4	New action	X	X		
Cosumnes Community Services District						
Los Rios Community College						
District Wide Roofing Renovations	1, 2, 3	2011 Action	X	X		
ARC Drainage at Arcade Creek	1, 2, 3	New Action	X	X		
Protect District Property	1, 2, 3	New Action	X	X		

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Metro Fire District						
Relocate the essential facilities in the 200-year flood plain	1, 2, 3, 4	New Action	X	X	X	
Perform seismic study of all district facilities and identify those facilities at greatest risk for earthquake damage.	1, 3, 4	New Action	X	X		
Implement a Wildland Urban Interface (WUI) Building/Fire Code	1, 3, 4	New Action	X	X		
Develop and Implement a comprehensive WUI fuels management program.	1, 2, 3, 4	New Action	X	X		
Deploy 2 remote automated weather stations (RAWS) in Metro Fire jurisdiction	1, 2, 3, 4	New Action	X	X		
Defensible space ordinance	1, 2, 3, 4	New Action	X	X		
Brannan Andrus Levee Maintenance Disrict						
Implement Bioengineered Bank Stabilization techniques	1, 2, 3, 4	New Action	X	X		
Development of Dredge Stockpile Site	1, 2, 3, 4	New Action	X	X		
Georgiana Slough Waterside Erosion Repair	1, 2, 3, 4	New Action	X	X		
Hydrographic surveys and data collection	1, 2, 3, 4	New Action	X	X		
Mokelumne River Crown Raising	1, 2, 3, 4	New Action	X	X		
San Joaquin River Waterside Erosion Repair	1, 2, 3, 4	New Action	X	X		
Sevenmile Slough French Drain and Seepage Berm	1, 2, 3, 4	New Action	X	X		
Reclamation District #3*						
Reclamation District #341*						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Reclamation District #554*						
Apply for a Letter of Map Revision (LOMR) to bring the District back into Zone X.	1, 2, 3, 4	New Action	X	X	X	
Fill Abandoned Slough	1, 2, 3, 4	New Action	X	X		
Geotechnical Investigation	1, 2, 3, 4	New Action	X	X		
Snodgrass Slough Levee Improvements	1, 2, 3, 4	New Action	X	X	X	
Reclamation District #556*						
Flood Response Activities, Georgiana Slough Weir	1, 2, 3, 4	New Action	X	X	X	
Georgiana Slough Vegetation Management	1, 2, 3	New Action	X	X		
Georgiana Slough Waterside Erosion Repair	1, 2, 3, 4	New Action	X	X	X	
Topographic and Hydrographic Surveys and Data Collection	1, 2, 3, 4	New Action	X	X	X	
Reclamation District #563*						
Rock Slope Protection Project	1, 3	New action	X	X		Property Protection Structural projects Natural resource protection
HMP and PL-8499 Levee Improvement Projects	1, 3	New action	X	X	X	Property Protection Structural projects Natural resource protection
Reclamation District #800						
Reclamation District #1000						
2014 Capital Improvement Plan	1, 2, 3, 4	New action	X	X		
Implement Supervisory Control and Acquisition Data system (SCADA) on District canals and pump stations	1, 2, 3	New Action	X	X	X	

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Public Outreach and Education	1, 2, 3, 4	New action	X	X	X	
Stockpile and pre-stage flood emergency response materials	1, 2, 3, 4	New action	X	X		
Emergency response improvements including radios for communications	1, 2, 3, 4	New action	X	X		
Emergency Back-up Generator for pump stations	1, 2, 3, 4	New action	X	X		
Reclamation District #1002*						
Geotechnical Investigation	1, 2, 3	New Action	X	X		
Snodgrass Slough Levee Improvements	1, 2, 3	New Action	X	X	X	
Snodgrass Slough Vegetation Management	1, 2, 3	New Action	X	X		
Reclamation District #1601*						
Levee Improvement Project	1, 3	New action	X	X	X	Property Protection Structural projects Natural resource protection
Reclamation District #2111*						
Rock Slope Protection Project	1, 2, 3, 4	New action	X	X	X	
HMP and PL-8499 Levee Improvement Projects	1, 2, 3, 4	New action	X	X	X	
Sacramento Regional County Sanitation District						
South River Pump Station Flood Protection Project	1, 2, 3, 4	New action	X	X		
Sacramento Area Sewer District						
MOU for Dedicated Cell Phone Tower and Cell Phone Pack	1, 2, 3	New Action	X	X		
Southgate Recreation and Park District						

Action Title	Goals Addressed	New Action/ 2011 Action	Address Current Development	Address Future Development	Continued Compliance with NFIP	CRS Category
Twin Rivers School District						

* These jurisdictions are included in the Delta Annex to this plan

Multi-Hazard Actions

FOR ALL ACTIONS BELOW, THE GOALS ADDRESSED WILL BE COMPLETED IN THE NEXT ITERATION

Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan

Hazards Addressed: All hazards

Goals Addressed:

Issue/Background: Local jurisdictional reimbursement for mitigation projects and cost recovery after a disaster is guided by Government Code Section 8685.9 (AB 2140). Specifically, this section requires that each jurisdiction adopt a local hazard mitigation plan (LHMP) in accordance with the federal Disaster Mitigation Act of 2000 as part of the Safety Element of its General Plan. Adoption of the LHMP into the Safety Element of the General Plan may be by reference or incorporation.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Safety Element of General Plan

Responsible Office: Sacramento County Planning Department

Priority (H, M, L): High

Cost Estimate: Jurisdictional board/staff time

Potential Funding: Local budgets

Benefits (avoided Losses): Incorporation of an adopted LHMP into the Safety Element of the General Plan will help jurisdictions maximize the cost recovery potential following a disaster.

Schedule: As soon as possible

Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness

Hazards Addressed: All (priority and non-priority) hazards

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Sacramento County, its incorporated jurisdictions, and special districts are participating jurisdictions to the Sacramento County Local Hazard Mitigation Plan Update. Each jurisdiction plays a key role in public outreach/education efforts to communicate the potential risk and vulnerability of their community to the effects of natural hazards. A comprehensive multi-hazard public

education program will better inform the community of natural hazards of concern and actions the public can take to be better prepared for the next natural disaster event.

Project Description: A comprehensive multi-hazard outreach program will ascertain both broad and targeted educational needs throughout the community. The County, cities, and special districts will work with other agencies as appropriate to develop timely and consistent annual outreach messages in order to communicate the risk and vulnerability of natural hazards of concern to the community. This includes measures the public can take to be better prepared and to reduce the damages and other impacts from a hazard event. The public outreach effort will leverage and build upon existing mechanisms, will include elements to meet the objectives of Goal 3 of this LHMP Update, and will consider:

- Using a variety of information outlets, including websites, local radio stations, news media, schools, and local, public sponsored events;
- Creating and distributing (where applicable) brochures, leaflets, water bill inserts, websites, and public service announcements;
- Displaying public outreach information in County and City office buildings, libraries, and other public places and events;
- Developing public-private partnerships and incentives to support public education activities.

Other Alternatives: Continue public information activities currently in place.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Existing County, City, and other special district outreach programs will be reviewed for effectiveness and leveraged and expanded upon to reach the broader region.

Responsible Office: Sacramento County, Cities, and all other participating jurisdictions

Priority (H, M, L): High

Cost Estimate: Annual costs to be determined, and will depend on the scope and frequency of activities and events as well as volunteer participation

Benefits (Losses Avoided): Increase residents' knowledge of potential hazards and activities required to mitigate hazards and be better prepared. Protect lives and reduce damages, relatively low cost to implement.

Potential Funding: Local budgets, grant funds

Schedule: Ongoing/Annual public awareness campaign

Action 3. Increase pedestrian and bicycle evacuation routes by constructing regional bike/pedestrian trail infrastructure, and expanding connection to neighborhoods (particularly in vulnerable areas)

Hazards Addressed: Multi-Hazard – Climate Change, Flood, Wildfire

Goals Addressed: 1, 2, 3, 4

Issue/Background: During extreme weather events and other emergencies, the public may frequently have to walk or bicycle out of areas to seek safety. In the event of an evacuation, pedestrian and bicycle trails can be used and have often served as the secondary transportation backbone.

Filling gaps in trail segments and connections and maintaining important trail infrastructure is not only an important measure for evacuation, but can also provide additional access for emergency vehicles and workers, and provide access for other mitigation work such as fuel reduction.

Project Description: Maintain existing regional and local trail systems and infrastructure. Design and construct new trail segments to better connect neighborhoods and communities. Coordinate with cities throughout the county in comprehensive planning of a well-design trail network. Coordinate with Sac Metro Fire, SMUD and others in designing trails.

Other Alternatives: No Action

Existing Planning Mechanism(s) through which Action Will Be Implemented:

- Coordinate with County Dept of Transportation in expanding trail network and connecting with public roads, easements and points of access.
- Coordinate with County Dept of Transportation in prioritizing bicycle and pedestrian facilities and improvements, on and off street.
- Coordinate with other partners in trail planning and construction
- Include trails and construction in Specific Plans, Subdivisions and new projects

Responsible Office/Partners:

- Department of Regional Parks
- Department of Transportation
- Community Development-Planning

Project Priority: Medium-High

Cost Estimate: $20,000,000

Benefits (Losses Avoided): Increase evacuation options and provide a secondary transportation network

Potential Funding:

- Measure A Bond Funding-Trails
- State Grants
- Projects with partners
- New Development – included in project

Timeline: On-going and new activities

Action 4. Community Rating System (CRS) Program for Public Information (PPI)

Hazards Addressed: Flood, Dam Failure, Levee Failure

Goals Addressed: 1, 2, 3, 4

Issue/Background: Well-informed people make better decisions and they take steps to protect themselves from flooding by retrofitting their homes, buying flood insurance, and planning the actions they will take during the next flood. They are also more likely to support local floodplain management efforts and measures to protect the natural functions of their community's floodplain.

The CRS provides credit for a full range of public information activities that inform people about flooding and ways to address potential flood damage to their property, including map information, outreach projects, real estate disclosure, libraries, websites, and providing technical advice and assistance. Research shows that when public information efforts are planned and coordinated, people will take steps to protect themselves from flood damage. The CRS provides additional credit for public outreach efforts that are coordinated through an adopted program for public information.

Project Description: A program for public information (PPI) is an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities that meet specific local needs. The CRS credits the implementation of public outreach PROJECTS identified in a PPI. Through the PPI planning process, projects are monitored, evaluated, and revised to improve their effectiveness. The PPI will be reviewed annually and updated if needed.

Other Alternatives: Continue designing and carrying out public outreach projects without a PPI.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Resolution #2015-0864 approves DWR's efforts to continue participation in the CRS. The PPI was identified as a document that direct continued progress in an important floodplain management activity.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: Public outreach and planning activities within the PPI and additional programs, estimated to be $50,000 annually, are included in the Fiscal Year 2015-16 Sacramento County Water Agency Zone 13 Adopted Budget.

Benefits (Losses Avoided): Research has found that floodplain residents in communities with outreach projects know more about their flood risk and are more likely to take protection measures such as buying flood insurance.

Potential Funding: None identified

Timeline: Ongoing

Action 5. Flood Insurance Assessment, Awareness, and Promotion

Hazards Addressed: Flood, Dam Failure, Levee Failure

Goals Addressed: 1, 2, 3, 4

Issue/Background: A flood insurance assessment (FIA) is an analysis of a community's level of flood insurance coverage that identifies where increased coverage would be beneficial. It is the first step toward developing a flood insurance coverage improvement plan in the community. In the case of Sacramento County, the FIA was done within the Program for Public Information (PPI).

Project Description: There are five steps in the FIA assessment process: 1) Collect flood insurance information, 2) Determine the level of flood insurance coverage, 3) Prepare the document, 4) Submit to the governing body, and 5) Reassess. This process was conducted with the PPI process and is within the PPI document. The PPI will be reviewed annually and updated if needed.

Other Alternatives: Continue flood insurance awareness and promotion without the assessment

Existing Planning Mechanism(s) through which Action Will Be Implemented: Resolution #2015-0864 approves DWR's efforts to continue participation in the CRS. The PPI was identified as a document that direct continued progress in an important floodplain management activity. The FIA is within the PPI.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: Public outreach and planning activities within the PPI and additional programs, estimated to be $50,000 annually, are included in the Fiscal Year 2015-16 Sacramento County Water Agency Zone 13 Adopted Budget.

Benefits (Losses Avoided): Research has found that floodplain residents in communities with outreach projects know more about their flood risk and are more likely to take protection measures such as buying flood insurance.

Potential Funding: None identified

Timeline: Ongoing

Action 6. Public Outreach Mailers

Hazards Addressed: Flood, Dam Failure, Levee Failure

Goals Addressed: 1, 2, 3, 4

Issue/Background: A program for public information (PPI) is an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities that meet specific local needs. The CRS credits the implementation of public outreach PROJECTS identified in a PPI. The PPI identified mailers as one of the projects.

Project Description: Every year a mailer communicating, Sacramento County's 10 messages identified in the PPI, is developed for inclusion in the Sacramento County utility bill (CUBS bill) which is mailed directly to each resident. In addition to the 10 message points, the following topics for other activity requirements, are included in the CUBS mailer:

- Activity 320 – Publicize Availability of Elevation Certificates
- Activity 360 – Publicize Flood Protection Assistance
- Activity 540 – Publicize Stream Dumping Regulations
- Activity 610 – Publicize Flood Warnings and Safety Measures

Other Alternatives: Develop another project that is distributed yearly with the 10 messages

Existing Planning Mechanism(s) through which Action Will Be Implemented: Resolution #2015-0864 approves DWR's efforts to continue participation in the CRS. The PPI was identified as a document that direct continued progress in an important floodplain management activity.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: Public outreach and planning activities within the PPI and additional programs, estimated to be $50,000 annually, are included in the Fiscal Year 2015-16 Sacramento County Water Agency Zone 13 Adopted Budget.

Benefits (Losses Avoided): Research has found that floodplain residents in communities with outreach projects know more about their flood risk and are more likely to take protection measures such as buying flood insurance.

Potential Funding: None identified

Timeline: Ongoing

Action 7. Public Outreach Mailers

Hazards Addressed: Flood, Dam Failure, Levee Failure

Goals Addressed: 1, 2, 3, 4

Issue/Background: A program for public information (PPI) is an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities that meet specific local needs. The CRS credits the implementation of public outreach PROJECTS identified in a PPI. The PPI identified mailers as one of the projects.

Project Description: Every year a mailer communicating, Sacramento County's 10 messages identified in the PPI, is developed for inclusion in the Sacramento County utility bill (CUBS bill) which is mailed directly to each resident. In addition to the 10 message points, the following topics for other activity requirements, are included in the CUBS mailer:

- Activity 320-Publicize Availability of Elevation Certificates
- Activity 360- Publicize Flood Protection Assistance
- Activity 540-Publicize Stream Dumping Regulations
- Activity 610-Publicize Flood Warnings and Safety Measures

Other Alternatives: Develop another project that is distributed yearly with the 10 messages

Existing Planning Mechanism(s) through which Action Will Be Implemented: Resolution #2015-0864 approves DWR's efforts to continue participation in the CRS. The PPI was identified as a document that direct continued progress in an important floodplain management activity.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: Public outreach and planning activities within the PPI and additional programs, estimated to be $50,000 annually, are included in the Fiscal Year 2015-16 Sacramento County Water Agency Zone 13 Adopted Budget.

Benefits (Losses Avoided): Research has found that floodplain residents in communities with outreach projects know more about their flood risk and are more likely to take protection measures such as buying flood insurance.

Potential Funding: None identified

Timeline: Ongoing

Action 8. Community Rating System (CRS) Program for Public Information (PPI)

Hazards Addressed: Flood, Dam Failure, Levee Failure

Goals Addressed: 1, 2, 3, 4

Issue/Background: Well-informed people make better decisions and they take steps to protect themselves from flooding by retrofitting their homes, buying flood insurance, and planning the actions they will take during the next flood. They are also more likely to support local floodplain management efforts and measures to protect the natural functions of their community's floodplain.

The CRS provides credit for a full range of public information activities that inform people about flooding and ways to address potential flood damage to their property, including map information, outreach projects, real estate disclosure, libraries, websites, and providing technical advice and assistance. Research shows that when public information efforts are planned and coordinated, people will take steps to protect themselves from flood damage. The CRS provides additional credit for public outreach efforts that are coordinated through an adopted program for public information.

Project Description: A program for public information (PPI) is an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities that meet specific local needs. The CRS credits the implementation of public outreach PROJECTS identified in a PPI. Through the PPI planning process, projects are monitored, evaluated, and revised to improve their effectiveness. The PPI will be reviewed annually and updated if needed.

Other Alternatives: Continue designing and carrying out public outreach projects without a PPI.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Resolution #2015-0864 approves DWR's efforts to continue participation in the CRS. The PPI was identified as a document that direct continued progress in an important floodplain management activity.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: Public outreach and planning activities within the PPI and additional programs, estimated to be $50,000 annually, are included in the Fiscal Year 2015-16 Sacramento County Water Agency Zone 13 Adopted Budget.

Benefits (Losses Avoided): Research has found that floodplain residents in communities with outreach projects know more about their flood risk and are more likely to take protection measures such as buying flood insurance.

Potential Funding: None identified

Timeline: Ongoing

Action 9. Flood Insurance Assessment, Awareness, and Promotion

Hazards Addressed: Flood, Dam Failure, Levee Failure

Goals Addressed: 1, 2, 3, 4

Issue/Background: A flood insurance assessment (FIA) is an analysis of a community's level of flood insurance coverage that identifies where increased coverage would be beneficial. It is the first step toward developing a flood insurance coverage improvement plan in the community. In the case of Sacramento County, the FIA was done within the Program for Public Information (PPI).

Project Description: There are five steps in the FIA assessment process: 1) Collect flood insurance information, 2) Determine the level of flood insurance coverage, 3) Prepare the document, 4) Submit to the governing body, and 5) Reassess. This process was conducted with the PPI process and is within the PPI document. The PPI will be reviewed annually and updated if needed.

Other Alternatives: Continue flood insurance awareness and promotion without the assessment

Existing Planning Mechanism(s) through which Action Will Be Implemented: Resolution #2015-0864 approves DWR's efforts to continue participation in the CRS. The PPI was identified as a document that direct continued progress in an important floodplain management activity. The FIA is within the PPI.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: Public outreach and planning activities within the PPI and additional programs, estimated to be $50,000 annually, are included in the Fiscal Year 2015-16 Sacramento County Water Agency Zone 13 Adopted Budget.

Benefits (Losses Avoided): Research has found that floodplain residents in communities with outreach projects know more about their flood risk and are more likely to take protection measures such as buying flood insurance.

Potential Funding: None identified

Timeline: Ongoing

Climate Change Actions

Action 10. Increase average fuel efficiency and reduce GHG emissions from the County Fleet and Fuels.

Hazards Addressed: Climate Change

Goals Addressed: 1, 2, 3, 4

Issue/Background: Greenhouse gases (GHG) trap heat and make the planet warmer. The largest source of greenhouse gas emissions in the United States is from burning fossil fuels for electricity, heat, and transportation. According to the US EPA, over 26% of GHG emissions in the US comes from transportation primarily come from burning fossil fuel for cars, trucks, ships, trains, and planes. Over 90 percent of the fuel used for transportation is petroleum based, which includes gasoline and diesel. Reducing GHG emissions in the transportation sector can help reduce the continued warning of the planet and our environment.

Project Description: Increase the average fuel efficiency and reduce GHG emissions of municipal fleet vehicles by progressively converting fleet to zero emission vehicles; reduce reliance on fossil fuels utilizing electricity, water, renewable fuels and gas; launch an employee education program on: ZEV's, driving practices that improve fuel efficiency including anti-idling messages; utilize renewable diesel fuel in diesel vehicles; utilize renewable CNG in CNG vehicles as available. Procure and install PEV chargers as needed as well as other infrastructure to support this action.

Other Alternatives: No Action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Implementation has been occurring for several years and this is an on-going action. Existing fleet is regularly turned over and new purchases made. Current practices have been to replace fleet with cleaner and more environmentally-friendly vehicles and fuels. This is evidenced through the new CNG fueling station constructed by the county and the conversion of the Waste Management Fleet to CNG. Existing fleet also includes electric, hybrid and hydrogen fuel vehicles. Existing fuel contracts include renewable diesel.

Responsible Office/Partners:

- Department of General Services (DGS), Fleets Division
- Sacramento Metropolitan Utility District (SMUD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- Clean Cities
- State and National Departments of Energy
- State Air Resources Board

Project Priority: Medium-High

Cost Estimate: $12,000,000

Benefits (Losses Avoided): Reduce Sacramento County's vulnerability to extreme heat events and associated hazards

Potential Funding:

- County DGS Fleet and Fuels Budget
- State and Federal Grants
- Funding partnerships with others including SMUD, SMAQMD
- Other funding sources (i.e. Volkswagen Settlement Fund)

Timeline: On-going and new activities

Action 11. Reduce Sacramento County's vulnerability to Climate Change by reducing GHG emissions in the commercial and residential sectors by making energy efficiency a priority through building code improvements

Hazards Addressed: Climate Change

Goals Addressed: 1, 2, 3, 4

Issue/Background: Greenhouse gases (GHG) trap heat and make the planet warmer. According to the US EPA, over 12% of GHG emissions in the US come from commercial and residential. GHG emissions. Emissions from businesses and homes arise primarily from fossil fuels burned for heat, the use of certain products that contain greenhouse gases, and the handling of waste. The greatest contributor of GHG emissions is Electricity production. In 2014 approximately 67% of our electricity comes from burning fossil fuels, mostly coal and natural gas Reducing GHG emissions in the transportation sector can help reduce the continued warning of the planet and our environment.

Project Description: Make energy efficiency a priority through building code improvements. Encourage Developers, Businesses, Architects and Engineers to incorporate Tier 1 or 2 of the Ca Green Building Code into their projects. Include these Tiers as negotiating points in Development Agreements.

Other Alternatives: No Action

Existing Planning Mechanism(s) through which Action Will Be Implemented:

- Developer Agreements
- Incentive funding for projects

Responsible Office/Partners:

- County Office of Sustainability
- Sacramento Metropolitan Utility District (SMUD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- Clean Cities
- State and National Departments of Energy
- State Air Resources Board

Cost Estimate: $8,000,000

Benefits (Losses Avoided): Reduce Sacramento County's vulnerability to Climate Change and associated hazards

Potential Funding:

- State and Federal Grants
- Funding partnerships with others including SMUD, SMAQMD
- Other funding sources

Timeline: On-going and new activities

Project Priority: Medium-High

Action 12. Mitigate Climate Change impacts by integrating climate change research and adaptation planning into County operations and services

Hazards Addressed: Climate Change, Extreme Heat, Flooding, Drought

Goals Addressed: 1, 2, 3, 4

Issue/Background: The County Vulnerability Assessment provides an overview of the primary and secondary threats associated with climate change, and identifies the ones most likely to affect Sacramento County. Climate adaptation strategies are supported by mitigation activities to address and reduce these threats. Adverse effects on natural resources and the human population include: rising sea levels and increased local/regional flooding; changes in rainfall and snowpack leading to changes in water supply, flood and drought; increased stress to vegetation, agriculture, biological resources and sensitive species; changes in frequency and duration of heat events and drought; and increased wildfire hazards.

Project Description: Integrate climate adaptation into county operations and services. Working with departments, and utilizing the established County Green Team, integrate adaptation planning and actions into county projects, programs, policies and community development. Various departments have already started climate change integration (DOT-complete and sustainable streets, bike/ped projects; Water Resources-Green Street, River friendly landscape design guidelines, creek naturalization; Planning-Tree Shading/Greenprint policies, open space preservation, design guidelines; etc. Provide increased education and training on climate mitigation and sustainable projects and program development.

Other Alternatives: No Action

Existing Planning Mechanism(s) through which Action Will Be Implemented:

- Education and training with support from the Capital Region Climate Readiness Collaborative, State Departments (OPR, Natural Resources, Air Resources Board, etc).
- Other training and education on Green Infrastructure

- On-going implementation of Zoning Codes and Design Guidelines, particularly those directed at sustainability, energy efficiency, urban greening, active design, detention and groundwater recharge basins.
- Provide training on the basic science and impacts of climate change and on climate adaptation strategies.
- Integrate climate change adaptation considerations, with particular attention on how the public's health will be impacted, into templates for staff reports to the Planning Commission and Board of Supervisors.

Responsible Office/Partners:

- Each respective County Department
- Support and assistance provided by the Sustainability Manager
- County Green Team Members

Project Priority: Medium-High

Cost Estimate: $750,000

Benefits (Losses Avoided): Reduce the potential for loss of life, injury and economic damage to Sacramento County residents and businesses from: extreme heat events, flooding, drought, wildland-urban interface fire/smoke, climate change and the cascading impacts of these hazards.

Potential Funding:

- Existing County Departmental Operational Budgets
- State & Federal Grants
- Utilization of education services provided at no charge by others

Timeline: On-going and new activities

Action 13. Reduce Sacramento County's vulnerability to extreme heat events and associated hazards by Increase tree planting/canopy preservation/enhancement

Hazards Addressed: Climate Change, Extreme Heat

Goals Addressed: 1, 2, 3, 4

Issue/Background: Trees have many benefits, of particular importance during extreme heat events is that trees create cooler environments through the process of evapotranspiration. Evapotranspiration occurs when trees transpire, and trees transpire water to cool themselves. When the transpired water evaporates, the area surrounding the tree cools as well. The EPA notes that evapotranspiration and shade can help to lessen peak summer temperatures by 2 to 9 degrees. Planting and maintaining trees is one of the best ways to combat harmful environmental effects. Introducing more vegetation, like trees, into urban environments helps with everything from basic shade refuge to cleaner air to the reduction of energy costs. Trees and the related shading will help mitigate climate impacts particularly during extreme heat events.

Project Description: Maintain healthy urban forests; restore trees and tree canopy in commercial parking lots. Promote and increase tree planting to increase shading and to absorb CO2, PM to improve air quality, reduce urban heat islands and associated hazards.

Other Alternatives: No Action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Tree Preservation Ordinance (existing) and planned update. Code enforcement efforts with commercial property owners to replace lost trees in parking lots (enforcement of parking lot tree canopy requirements).

Additional mechanisms:

- Through support from the Capital Region Climate Readiness Collaborative; monitor and support regional and State-level efforts to forecast the impact of climate change on temperatures and incidence of extreme heat events in Sacramento and the region.
- Create and maintain shading by sustaining municipal tree planting efforts and continuing to maintain the health of existing trees.
- On-going implementation of Zoning Code and Design Guideline Tree Planting requirements and recommendations.
- (New) In collaboration with the Sacramento Tree Foundation, Implementation of a Neighborhood Forest Certification (NFC) program that offers guidelines and educational services on how to optimize the performance of trees in the design and build-out of new neighborhoods.

Responsible Office/Partners:

- Planning & Environmental Review Division staff, Tree Coordinator
- Sacramento Tree Foundation

Cost Estimate: $8,000,000

Benefits (Losses Avoided): Reduce Sacramento County's vulnerability to extreme heat events and associated hazards

Potential Funding:

- Tree planting: Tree Mitigation Fund, State grants, SMUD, PG & E
- PG & E Mitigation Funding
- Collaboration with Sacramento Tree Foundation

Timeline: On-going and new activities

Flooding and Localized Flooding Actions

Action 14. Keep the PPI current

Hazards Addressed: Flooding and Localized Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: Table 5-3 contains initiatives that are in place that support the goal and CRS messages that are conducted by organizations other than Sacramento County. The list was composed by County staff research and PPI Committee members' feedback.

Table 5-3 PPI Outreach Initiatives

OP#	Organization/Stakeholder	Project	Subject Matter	Frequency	Outreach Classification	Target Audience
16	Homeowner's Association	Association meeting	Message: 1-10	Once a year	General Outreach	All County Residents
17	SAFCA	website	Message: 1, 2, 4, 6	Year-round	Informational Material	All County Residents
18	Sacramento Stormwater Quality Partnership	website	Message: 6, 9, 10	Year-round	Informational Material	All County Residents
		Events	Message: 6, 9, 10	Year-round	General Outreach	All County Residents
19	Department of Water Resources' (DWR) FloodSAFE California Initiative	Levee Mailer	Message: 1, 2, 3, 5	Fall	Targeted Outreach	Areas Protected by Levees
20	Sacramento Association of Realtors	member newsletter	Message: 1,2,7	Year-round	Informational Material	All County Residents
21	Sacramento Area Creeks Council	Creek Week	Message: 9	April	General Outreach	All County Residents
		Tours	Message: 6	multiple	General Outreach	School-Aged Children
		Website	Message: 9	Year-round	Informational Material	All County Residents
22	U.S. Fish & Wildlife Service (Stone Lakes National Wildlife Refuge)	Website	Message: 6	Year-round	Informational Material	All County Residents
		Tours		All County Residents	Tours	General Outreach
23	Sacramento County Parks and Recreation District	Scoop the Poop	Message: 10	Year-round	General Outreach	All County Residents
24	Sacramento Valley Conservancy (Deer Creek Hills)	Website	Message: 6	Year-round	Informational Material	All County Residents
		tours			General Outreach	All County Residents

OP#	Organization/Stakeholder	Project	Subject Matter	Frequency	Outreach Classification	Target Audience
25	Cosumnes River Preserve	Website	Message: 6	Year-round	Informational Material	All County Residents
		Tours			General Outreach	All County Residents
26	Sacramento Splash	Website	Message: 6	Year-round	Informational Material	All County Residents
		tours			General Outreach	School-Aged Children
27	American River Flood Control District	levee maintenance	Message: 1, 2, 4, 6	Year-round	Informational Material	SFHA residents along American River
28	Water Education Foundation	tours, lectures	Message: 1, 4, 5, 6	Year-round	Informational Material	School-Aged Children
29	Sacramento Regional County Sanitation District	Environmental Protection	Message: 6, 9, 10	Year-round	General Outreach	All County Residents
		Walk on the Wild Side	Message: 6	May	General Outreach	All County Residents
30	American Red Cross Sierra-Delta Chapter	trainings, community events, social media messaging, website, telephone/tablet applications	Message: 1,2, 3	Year-round	General Outreach	All County Residents

Project Description:

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office:

Priority (H, M, L):

Cost Estimate:

Benefits (Losses Avoided):

Potential Funding:

Schedule:

Action 15. Alder Creek flood control

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: The drainage study for the development plan at the AeroJet site includes flood control work on Alder Creek

Project Description: Bike/pedestrian crossing upstream and drainage structure at the Regional Transit crossing downstream. Additional work may be needed at the Ford dealership, Folsom Automall.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented: Glenborough at Easton development plan, Folsom also has land planning in the upper Alder Creek watershed

Responsible Office/Partners: Water Resources with the City of Folsom

Cost Estimate:

Project Priority: Medium

Benefits (Losses Avoided):

Potential Funding:

Timeline: 2017-2022

Action 16. Alder Creek flood mitigation (dam)

Hazards Addressed: Flood and miners sediment containment

Goals Addressed: 1, 2, 3, 4

Issue/Background: Circa 1890, gold miners constructed a dam in Alder Creek. The reservoir is loaded with sediment and the dam is in a state of disrepair

Project Description: The City of Folsom happens to own the property which is surrounded by AeroJet.

Folsom should investigate the stability of the dam and determine what repairs are needed.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: City of Folsom, with AeroJet and County Water Resources

Project Priority: high

Cost Estimate: $3,000,000 (?)

Benefits (Losses Avoided):

Potential Funding: Local, AeroJet, developers, state and federal grants

Timeline: 2017-2022

Action 17. Alder Creek miners reservoir, property owned by the City of Folsom

Hazards Addressed: Sediment behind the dam, water quality

Goals Addressed: 1, 2, 3, 4

Issue/Background: The gold miner beginning in about 1890 constructed a dam in Alder Creek. It is nearly full of sediment. The quality of the water and constituents in the sediment is a possible concern.

Project Description: Inspect water quality and sediment samples and assure that corrective actions, if necessary, are prosecuted

Other Alternatives: Remove the dam and reservoir sediment or assure that it is safe and secured in place.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Water Resources is working with the City of Folsom and AeroJet

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: Not known until the sampling is analyzed in 2017

Cost Estimate: $1,000,000

Benefits (Losses Avoided): The is much redevelopment planned for the AeroJet site. The miners reservoir will be an attraction for residents new to the Alder Creek area.

Potential Funding: AeroJet, the developer, the City of Folsom, rants

Timeline: 2016-2019

Action 18. Delta Small Communities flood protection - structural and nonstructural mitigation

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: The Sacramento County Delta communities of Pleasant Grove, Hood, Courtland, Walnut Grove (east and west), Locke, and Isleton, as well as, the mobilehome and recreational vehicle resorts and small subdivisions are subject to potential catastrophic flooding should a levee breach occur.

Project Description: Levee fragility, Risk-map and Hazus analyses to determine flood hazard risk. Consider structural flood control improvements and non-structural measures to reduce the flood risk. This effort will be planning level, engaging the community.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: high

Cost Estimate:

Benefits (Losses Avoided):

Potential Funding: CA DWR, FEMA hazard mitigation, the Army Corps of Engineers

Timeline: 2017-2020

Action 19. Gum Ranch flood control - joint use basin

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: There is an existing flood hazard, from South Branch of Arcade Creek, at Manana Way and Hoffman Way and upstream of Kenneth Avenue.

Project Description: South Branch Arcade Creek downstream of Kenneth Avenue, Gum Ranch Subdivision Map, there is an opportunity to mitigate peak flow, reduce downstream flooding, improve capacity under Kenneth Avenue, potential reduction in base flood elevation upstream, and there may be an opportunity for a joint use recreation property, working with Fair Oaks Park and Recreation.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented: Water Resources is working with the developer and his engineer and talking with Fair Oaks Park and Recreation.

Responsible Office/Partners: Sacramento County Department of Water Resources / Sacramento County Water Agency / Fair Oaks Park and Recreation

Project Priority: high

Cost Estimate: $2,500,000

Benefits (Losses Avoided): Flood control, park, open space

Potential Funding: Local funding with state or federal grants

Timeline: 2017-2020

Action 20. Implement Storm Drain CIP

Hazards Addressed: Local drainage and flooding hazards

Goals Addressed: 1, 2, 3, 4

Issue/Background: Annually, the storm drain capital improvement plan (CIP) is updated looking forward several years. Many of these projects are will reduce flood risk to structures.

Project Description: The projects include creeks and channel improvement, basins, pump station upgrades, and pipes

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: Sacramento County Department of Water Resources / Sacramento County Water Agency

Project Priority: high

Cost Estimate:

Benefits (Losses Avoided):

Potential Funding: Stormwater Utility, developer impact fees, state and federal grants

Timeline:

Action 21. Implement Water Supply CIP

Hazards Addressed:

Goals Addressed:

Issue/Background:

Project Description:

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners:

Project Priority: high

Cost Estimate:

Benefits (Losses Avoided):

Potential Funding: Local fees, development impact fees, state and federal grants

Timeline:

Action 22. Laguna Creek at Triangle Aggregate flood control - joint use basins

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: There is an interim detention basin on the north side of Florin Road west of Sunrise Blvd and there is more development planned in the City of Rancho Cordova. This is downstream of an existing flooding problem on Sunrise Blvd.

Project Description: Construct a weir on Laguna Creek at the area excavated by the Triangle miners, the project may include groundwater infiltration, a pump station, open space and active recreation

Other Alternatives: The proposed developments upstream could determine an alternate way to mitigate flood impacts

Existing Planning Mechanism(s) through which Action Will Be Implemented: Suncreek development plan in Rancho Cordova

Responsible Office/Partners: Water Resources and City of Rancho Cordova with Southgate Recreation and Park District

Project Priority: medium

Cost Estimate: $2,000,000

Benefits (Losses Avoided):

Potential Funding: Local developer impact fees, state and federal grants

Timeline: 2018-2025

Action 23. Laguna Creek mitigate flood hazard south of Jackson Highway

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: Existing condition flooding (about 1:20 year frequency) on Sunrise Blvd between Highway 16 and Grantline Road

Project Description: There is much planned development in the area (County and City of Rancho Cordova). SacDOT must determine if flooding on Sunrise is acceptable (there is alternate routing available) and the developers must mitigate their impacts. Ultimately, there should be a plan to reduce flooding on this roadway.

Other Alternatives: Status quo- allow this section of Sunrise to be flood prone

Existing Planning Mechanism(s) through which Action Will Be Implemented: Suncreek land development planning upstream in the City of Rancho Cordova

Responsible Office/Partners: Water Resources, Sacramento County Transportation, City of Rancho Cordova

Project Priority: medium

Cost Estimate: $3,000,000

Benefits (Losses Avoided):

Potential Funding: CA gas tax, development impact fees

Timeline: 2018-2025

Action 24. Model Sacramento River levee breach (LAMP) south of Freeport

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: The Sacramento River levees south of Freeport were de-accredited on the effective Flood Insurance Rate Map, dated August 16, 2012. An estimate of the levee breach base flood elevation was included on the map, but it did not include breach of the existing historic railroad embankment. Neither did it use the levee analysis mapping procedure (LAMP).

Project Description: Analyze the levee system south of Freeport, using LAMP

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: Sacramento County Department of Water Resources / Sacramento County Water Agency

Project Priority: medium

Cost Estimate: $300,000

Benefits (Losses Avoided): Better understanding of floodplain water surface elevation allows for better application of building standards.

Potential Funding: FEMA Cooperative Technical Partner Grant

Timeline: 2017-2021

Action 25. Morrison Creek Miners Reach Flood Insurance Study

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: Open pit aggregate miners, in the alignment of Morrison Creek (near Highway 16 and Bradshaw Road), relocated the stream and constructed a side channel weir.

Project Description: Analyze the existing condition floodplain.

Determine what constitutes high ground and what is a levee.

Develop a long term plan to assure functionality.

Other Alternatives: Status quo, there is a weir maintenance agreement and FEMA mapped much of the mined area in Zone A.

Existing Planning Mechanism(s) through which Action Will Be Implemented: West Jackson development planning

Responsible Office/Partners: Sacramento County Department of Water Resources / Sacramento County Water Agency

Project Priority: medium

Cost Estimate: $200,000

Benefits (Losses Avoided):

Potential Funding: The miners

Timeline: 2016-2018

Action 26. Morrison Creek miners reach levee improvements

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: Beginning 25 years ago, construction/mining companies removed aggregate from the Morrison Creek floodplain. They squeezed Morrison Creek into a constructed channel and constructed a weir to spill flood peak flow into the mined area.

Project Description: Improve the constructed flood system in a manner that will be sustainable and adequate for the necessary flood protection.

Other Alternatives: Status quo, the area is mapped Zone A

Existing Planning Mechanism(s) through which Action Will Be Implemented: West Jackson development proposal

Responsible Office/Partners: The aggregate miner and Water Resources, there will also be input from FEMA and the CA Central Valley Flood Protection Board

Project Priority: medium

Cost Estimate: $5,000,000 to $50,000,000

Benefits (Losses Avoided): Cost depends if anyone desires to construct structures that would be protected by the flood control system.

Potential Funding: Miners, developers, state or federal grants

Timeline: 2019-2030

Action 27. Outreach stormwatch guide (ALERT, Stormready, weather radio)

Hazards Addressed: Local flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: There is a system of stream and rain gages in Sacramento County, and various maps and analyses that have been prepared by staff over the years. How can a property owners know based on a weather forecast and real time rain and stream gage information whether to flood fight at his property?

Project Description: Seeking a system to help the public understand how to answer the above question.

Other Alternatives: Status quo is working okay, but this outreach plan could improve understanding

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: Sacramento County Department of Water Resources / Sacramento County Water Agency

Project Priority: medium

Cost Estimate: $100,000

Benefits (Losses Avoided):

Potential Funding: Federal or state grant

Timeline: 2017-19

Action 28. Peak flow floodplain mitigation Arcade Creek near Auburn Blvd

Hazards Addressed: Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: The Auburn Blvd bridge over Arcade Creek may be improve by the City of Sacramento, the County is asking for hydraulic improvement such as a larger opening to reduce overtopping and to mitigate existing upstream flood fighting measures.

Project Description: The floodwall at Evergreen Estates is de-accredited but it still serves as a significant flood fighting measure. The County desires to make that system even more flood resistant. This requires more flow capacity under Auburn Blvd and may require peak flow basin downstream of Auburn Blvd.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: Sacramento County Department of Water Resources / Sacramento County Water Agency

Project Priority: high

Cost Estimate: $5,000,000

Benefits (Losses Avoided):

Potential Funding: State and federal grants, CA gas tax, local, developers

Timeline: 2017-20

Action 29. Risk Map (flood frequency, depth, velocity)

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: FEMA Flood Insurance Rate Maps only describe the water surface elevation and aerial extent of a floodplain in the 1:100 year storm event. It does not tell property owners the true risk of flooding.

Project Description: Additional information may be developed using FEMA Risk Map modeling and mapping thereby reporting the water surface elevation in a range of storm events, as well as depth and velocity.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners:

Project Priority: medium

Cost Estimate: $200,000

Benefits (Losses Avoided):

Potential Funding: FEMA Cooperating Technical Partner Grant, local and state funding

Timeline: 2018-2025

Action 30. Elevation & Acquisition Projects (to Mitigate Flood Risk)

Hazards Addressed: Structural Damage to Buildings and Property Loss from Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: Many residential and business structures in Sacramento County are at risk of flooding from various sources. The County constructs many capital improvements to stormwater conveyances to improve drainage, yet many structures can only be protected by elevation or otherwise, acquisition and removal from the floodplain.

Project Description: Home elevation is a process that lifts the existing home from the foundation while a (engineered) foundation is built higher whereby the FFE is above the BFE.

Home acquisition is a process whereby the jurisdictional agency purchases the home for the appraised value and, after the owner moves to another location, and the home is destroyed leaving the land unimproved. This is process is ideal for areas where multiple homes experience repeated flooding. When multiple homes are removed, it allows more capacity for floodwater while creating open space and habitat.

Other Alternatives: Flood-proofing (for lower flooding depths), create berms (for homes with acreage).

Existing Planning Mechanism(s) through which Action Will Be Implemented: Sacramento County has successfully completed over seventy home elevations to bring each structure 1.5' above the BFE. The County has a proven process to assist homeowners elevated their homes when funding is available through grants. County DWR staff make application for funding from FEMA grants to perform this work.

Responsible Office/Partners: Sacramento County Department of Water Resources/Office of Emergency Services & FEMA

Project Priority: Medium

Cost Estimate: Home elevation is approx. $100k per 1500 sf– Acquisition is market value of each home.

Benefits (Losses Avoided): Avoidance of property damage and (potentially) loss of life and avoidance of flood insurance claims.

Potential Funding: FEMA Grants, local share (match) and like-kind project management contribution

Timeline: Home elevations take approximately six – ten months to complete once funding is available

Action 31. Repetitive Loss Properties (to Mitigate Flood Risk)

Hazards Addressed: Damage to buildings and property loss from flooding, and health and safety of residents

Goals Addressed: 1, 2, 3, 4

Issue/Background: Over 100 homes in Sacramento County are Repetitive Loss structures, having flooded two or more times in a ten year period with insurance claims over $1,000 after each event.

Project Description: Home elevation is a process that lifts the existing home from the foundation while a (engineered) foundation is built higher whereby the FFE is above the BFE by 1.5 feet.

Home acquisition is a process whereby the jurisdictional agency purchases the home for the appraised value and, after the owner moves to another location, the home is destroyed leaving the land unimproved. This process is ideal for areas where multiple homes experience repeated flooding. When multiple homes are removed, it allows more capacity for floodwater while creating open space and habitat.

Flood-proofing – where flood depths are low, use materials that impede water infiltration.

Other Alternatives: For homes with acreage, ring levees may work though this option is expensive, requires more land areas and extensive environmental review.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Sacramento County does annual outreach to owners of repetitive loss properties to educate them on flood risk, insurance and

options to mitigate. When funds are available, DWR offers assistance with home elevation mitigation for to these homeowners.

Responsible Office/Partners: Sacramento County Department of Water Resources/

Office of Emergency Services and FEMA

Project Priority: Medium

Cost Estimate: Home elevation is approx. $100k per 1500 sf, acquisition is market value of each home, flood-proofing depends on house. Staff costs depends on how the homes and how lengthy the grant application.

Benefits (Losses Avoided): Avoidance of property damage and (potentially) loss of life and avoidance of flood insurance claims.

Potential Funding: FEMA Grants, local share (match) and like-kind project management contribution

Timeline: Grants are available annually. Elevations take approximately six – ten months to complete.

Action 32. Five-Year Capital Improvement Plan – Drainage Projects

Hazards Addressed: Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: The Sacramento County Board of Supervisors approved a Five-Year Capital Improvement Plan (CIP) that addresses improvements to drainage. The Department of Water Resources designs and oversees the construction of these improvements which mitigate flooding by replacing, rehabilitating, and upgrading existing facilities as well as installing new facilities. Drainage facilities include inlets, manholes, pipes, creeks/channels, pump stations, generators and basins.

Project Description: On June 14, 2016, the current Five-Year CIP was approved for Fiscal Years 2016-17 thru 2020-21. The Five-Year CIP includes 26 drainage improvement projects consisting of 12 pipe projects, eight pump station projects, three creek/channel projects, two maintenance projects, and one dam project. Individual projects are described in detail in Appendix I of the Five-Year CIP.

The following is a list of the 26 projects: Channel Lining Rehabilitation – Chicken Ranch Slough, Cordova Creek Naturalization Project, D01 Hagginbottom Storm Drain Pump Station Rehabilitation, D05 Howe Avenue Storm Drain Pump Station Rehabilitation, D06 North Mayhew Storm Drain Pump Station Rehabilitation, D10 Manlove Storm Drain Pump Station Generator Improvement, D24 North Lindale Storm Drain Pump Station Rehabilitation, D45 Franklin/Morrison Storm Drain Pump Station Rehabilitation, El Camino Transportation Project – Phase 1, Foster Way Storm Drain Improvement, I Street/32nd Street Storm Drain Improvement, Keeney Way Storm Drain Improvement, Kings Way/Verna Way Storm Drain Improvement, Mather Dam Improvement, Miramar Storm Drain Improvement, Ravenwood Avenue/Eastern Avenue Storm Drain Improvement, Rich Hill Drive Storm Drain Improvement, Silver

Legends Storm Drain Improvement, Storm Drain Improvements – 2020, Storm Drain Improvements – 2021, Storm Drain Maintenance & Operations Equipment, Storm Drain Maintenance & Operations Projects – Various Locations, Storm Drain Pump Stations Rehabilitation – Phase 5, Storm Drain Pump Stations Rehabilitation – Phase 6, Storm Drain Rehabilitation – Job Order Contracts (JOCs), and Upper Gerber Creek Improvements.

Other Alternatives: Do nothing

Existing Planning Mechanism(s) through which Action Will Be Implemented: The Sacramento County Board of Supervisors approves the Five-Year CIP annually and each project individually when its design is finalized and it is ready to go out to bid for construction.

Responsible Office/Partners: Sacramento County Department of Water Resources

Project Priority: High

Cost Estimate: $41,649,227

Benefits (Losses Avoided):

Potential Funding: Sacramento County Stormwater Utility, Sacramento County Water Agency Zone 11, U.S. Air Force Cooperative Agreement, State of California Natural Resources Agency Grant

Timeline: 2016-2021

Action 33. Arcade Creek Corridor Plan

Hazards Addressed: Improve water quality, reduce flooding potential, provide recreational opportunities, improve habitat.

Goals Addressed: 1, 2, 3, 4

Issue/Background: The Arcade Creek Watershed Group was formed in 2002 with initial support from the City of Sacramento and the US EPA. The group's mission is to improve water quality, reduce flood damage, enhance habitat, increase recreational opportunities, and encourage local participation in protection efforts. A CALFED grant administered by the State Water Resources Control Board was used to conduct studies and implement some projects within the City of Sacramento. Most of the Phase II projects and studies have been completed. Remaining is execution of the Arcade Creek Corridor Plan. This plan identifies numerous remedial and maintenance projects along Arcade Creek and Cripple Creek that will fulfill the goals of the Arcade Creek Watershed Group.

Project Description: The types of projects identified are as follows: remove debris jam and flow obstructions, remove invasive nonnative vegetation, stabilize banks, improve pipe outfalls, restore recreational trails, improve floodplain function, reconfigure the channel, control runoff from parking lots, stabilize swales, remove sediment and vegetation at creek crossings, remove concrete lined channel.

Identified projects are located within the City of Sacramento, Sacramento County and the City of Citrus Heights.

Other Alternatives: Do nothing.

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with California State Office of Emergency Services, FEMA and/or the California State Department of Water Resources, Arcade Parks. and Recreation.

Project Priority: Medium

Cost Estimate: $2.5 to $4.5 million

Benefits (Losses Avoided): Improve water quality, reduce flood damage, enhance habitat, increase recreational opportunities, and encourage local participation in protection efforts.

Potential Funding: California State Office of Emergency Services, FEMA and/or the California State Department of Water Resources.

Timeline: 24-48 months after grant approval and environmental review

Action 34. Elevate Homes on Long Island (Grand Island Road, Sacramento River)

Hazards Addressed: Residential flooding.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Long Island is located within the Sacramento River in the delta area of Sacramento County. The structures located there are pre-FIRM and have all been elevated except for the three remaining low structures. To prevent neighborhood checker-boarding and for the furtherance of good floodplain management, these two structures should be elevated. There are no structural project options available to provide flood protection at this location.

Project Description: The project would comprise removing the three structures from their foundations, hydraulically lifting them, supporting them with temporary cribbing, constructing new foundations beneath them at the elevation required by the floodplain management ordinance, then lowering the homes and attaching them to their new foundations.

Other Alternatives: Do nothing.

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with California State Office of Emergency Services and FEMA.

Project Priority: Medium

Cost Estimate: $300,000

Benefits (Losses Avoided): Prevent flooding of residences.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs.

Timeline: 24-36 months from grant approval to project completion.

Action 35. Repetitive Loss Church Building on Dry Creek

Hazards Addressed: Structure flooding.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Structure was built too low adjacent to a creek. Flood damage occurred in 1986, 1995, 1997, 1998, 2000, 2005.

Project Description: The structure should be elevated, flood proofed, or torn down and reconstructed in accordance with the Sacramento County Floodplain Management Ordinance.

Other Alternatives: Do nothing, insurance, flood proofing, mitigation after next flood

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with California State Office of Emergency Services and FEMA.

Project Priority: Medium

Cost Estimate: $300,000 to $1,000,000 depending on form of mitigation.

Benefits (Losses Avoided): Prevent flooding of structure.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs and local contributions from the church congregation.

Timeline: 24-36 months from grant approval to project completion and agreement by owner.

Action 36. South Branch Arcade Creek – Gum Ranch Basin (with Fair Oaks Park District) and Kenneth Avenue Bridge Improvements (with Sacramento County Department of Transportation)

Hazards Addressed: Reduce flooding potential, provide recreational opportunities, improve habitat.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Gum Ranch is a large master planned project located within the South Arcade watershed. The extensive flooding that occurs downstream of the project location can be reduced with the installation of an oversized flood detention basin on the Gum Ranch project. In addition, by improving a bridge crossing on Kenneth Avenue upstream of the basin, upstream flooding could be reduced.

Project Description: The basin planned at Gum Ranch could be upsized to comprise greater flood capacity and in addition, recreational facilities for a dual use facility. The bridge crossing at Kenneth Avenue upstream of the basin currently is undersized and caused the flooding to backup upstream of the bridge. By opening up the structure, the backup could be reduced or prevented and the greater flows could be mitigated in the basin.

Other Alternatives: Do nothing.

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with California State Office of Emergency Services, FEMA and/or the California State Department of Water Resources.

Project Priority: Medium

Cost Estimate: $0.5 to $1.5 million

Benefits (Losses Avoided): Improve water quality, reduce flood damage, increase recreational opportunities, and encourage local participation in protection efforts.

Potential Funding: California State Office of Emergency Services, FEMA and/or the California State Department of Water Resources.

Timeline: 24-48 months after grant approval and environmental review

Action 37. Dry Creek Flood Hazard Mitigation Acquisitions with County Regional Park Department

Hazards Addressed: Residential structure flooding and emergency access issues.

Goals Addressed: 1, 2, 3, 4

Issue/Background: The Dry Creek Parkway project is a multi-agency project designed to return an area of Dry Creek floodway to a regional park site and open space. The floodway at this location is very broad compromising access during flood emergencies. The Parkway project goals and good floodplain management mandate the removal of the remaining residential structures located within the floodway. At this time, 17 residential structures are still remaining.

Project Description: The structures would be torn down and the land returned to open space under the ownership of the County of Sacramento.

Other Alternatives: Do nothing, insurance, flood proofing, mitigation after next flood

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with California State Office of Emergency Service, FEMA, and the County of Sacramento Parks and Recreation Department.

Project Priority: Medium

Cost Estimate: Market value, approximately $3 million.

Benefits (Losses Avoided): Prevent flooding of structures; prevent emergency access issues in the Dry Creek floodway during flood events.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs and local contributions from the church congregation.

Timeline: 24-36 months from grant approval and agreement by owner.to project completion

Action 38. Arcade Creek at Evergreen Estates Floodwall Improvements

Hazards Addressed: Residential structure flooding.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Evergreen Estates is a low lying pre-FIRM development located next to Arcade Creek. It is currently protected to a maximum 25 year event by a de-accredited levee. Site improvements necessary to provide 100 year flood protection include raising the levee and also raising an adjacent street named Winding Way. These improvements have been identified in a feasibility level study.

Project Description: Enhance protection offered by levee/floodwall system on Arcade Creek. In addition, regrade surface streets in the vicinity of the area to cut off flood water.

Other Alternatives: Do nothing, insurance, flood proofing, mitigation after next flood

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with California State Office of Emergency Service, FEMA.

Project Priority: Medium

Cost Estimate: $2.2 million.in 2008 dollars.

Benefits (Losses Avoided): Prevent flooding of structures.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs and local contributions from the church congregation.

Timeline: 24-36 months from grant approval to project completion

Action 39. Linda Creek Peak Flow Mitigation

Hazards Addressed: Residential structure flooding.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Linda Creek and its tributaries comprise a 3580 acre watershed in Orangevale area draining to the City of Roseville, which is a tributary to Dry Creek, which ultimately drains back to Elverta and Rio Linda in Sacramento County. The Linda Creek watershed is 99.5% developed. Flooding impacts within Placer County can be mitigated with a detention basin project in Sacramento County.

Project Description: Construct a detention basin to mitigate flooding impacts in Placer County.

Other Alternatives: Do nothing, insurance, flood proofing, mitigation after next flood

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Sacramento County DWR in partnership with Placer County, California State Office of Emergency Service, and FEMA.

Project Priority: Medium

Cost Estimate: To be determined

Benefits (Losses Avoided): Prevent flooding of structures.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs and local contributions from the church congregation.

Timeline: 24-36 months from grant approval to project completion

Action 40. Flood Preparation in the American River Parkway

Hazards Addressed: Mitigation flood impacts to park infrastructure.

Goals Addressed: 1, 2, 3, 4

Issue/Background: The American River Parkway is a Designated Floodway within the State of California. All of our park facilities may be exposed to flooding during high flow events.

Project Description: Evacuation Planning for park areas during various flood stages

Pre-flood preparation (such as) evacuation planning for park areas during various flood stages, pumping and sealing vault toilets, Removing electrical panels, Removing trash cans, closing gates and setting out barricades, evacuating park areas, including homeless "camps", and securing bridge railings for flooding, and/or river bank erosion protection.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: Coordination with local agencies including Sacramento County Sheriff and Office of Emergency Services and Metro Fire. Planned procedures on securing facilities with direction from Parks' Sr. Maintenance staff and evacuation by Parks' Rangers with assistance from Sacramento County Sheriff and Metro Fire.

Responsible Office/Partners: Sacramento County Department of Regional Parks, U.S. Bureau of Reclamation, Sacramento Area Flood Control Agency

Project Priority: High

Cost Estimate: Flexible, depending on size and scope of project

Benefits (Losses Avoided): Minimize damage to our park infrastructure, including restrooms, bridges, as well as keeping park visitor safe from by effectively evacuating park areas.

Potential Funding: Agency Funds and post disaster grant funds.

Timeline: Real Time

Action 41. Improve County ALERT (Automated Local Evaluation in Real Time) System of Stream and Rain Gauges

Hazards Addressed: Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: The County's ALERT system has been in operation since 1985. The collection and dissemination of real time stream and rain data through the Internet provides County staff, as well as local agencies and the public, with real time rainfall amounts and stream levels. This information is used to warn of imminent and/or in progress flooding. Archived data is also used in support of studies on a variety of floodplain and watershed issues. Currently, the County's ALERT system is being upgraded to utilize a newer radio protocol called ALERT2. The newer protocol will improve data quality. Additionally, the County's FIRM maps were updated to use the NAVD88 datum in March 2012. And although the ALERT system reports in NAVD88, the staff gauges at the ALERT stream gauge locations need to be converted from NGVD29 to NAVD88 to allow for field verification of reported stream levels. Lastly, new ALERT stations are added to the system as gaps in the rain gauge network are identified or when stream levels need to be monitored in developing areas. One ALERT station was added to the system since 2011, a weather station located at the Vineyard Surface Water Treatment Plant in the Gerber/Elder Creeks watershed.

Project Description: 1. Finish upgrade to ALERT2 protocol. Six ALERT stations still require an upgrade pending approval of a State DWR grant. 2. QA/QC, format and then upload archived ALERT data to the new data collection system. 3. Fix staff gages to be in NAVD88 vertical datum. 4. Add additional ALERT stations when identified to fill gaps in the rain gauge network or to provide warning of local flooding issues.

Other Alternatives: No action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Maintenance of the ALERT system is required by the MOU between the County and the National Weather Service which allows the County to use the Federal hydrologic frequencies. Additionally, maintenance of the ALERT system is required in order to receive credit under the CRS program.

Responsible Office/Partners: Sacramento County DWR – Drainage Development Review/Hydrology

Project Priority: Medium

Cost Estimate: $150,000

Benefits (Losses Avoided): Life Safety, Property Protection

Potential Funding: Various grants and local cost share

Timeline: 3 – 5 years

Action 42. Update County Hydrology Standards

Hazards Addressed: Flood

Goals Addressed: 1, 2, 3, 4

Issue/Background: The effective Sacramento County Hydrology Standards were developed in the early/mid 1990's and might be due for updating.

If necessary, update County Hydrology Standards, consider climate change affect on Q100 and Q200 at local level

Project Description: Attain expert advice whether or not the hydrology standards should be updated.

In particular, look at the 1:200 year hydrology and consider climate change studies.

Other Alternatives: none

Existing Planning Mechanism(s) through which Action Will Be Implemented: Sacramento County Department of Water Resources / Sacramento County Water Agency

Responsible Office/Partners: Department of Water Resources

Project Priority: high

Cost Estimate: $150,000

Benefits (Losses Avoided): Allow better planning for local drainage and flood control

Potential Funding: Federal or state grant

Timeline: 2016-2018

Action 43. Woodside Condominiums Repetitive Flood Loss Property

Hazards Addressed: Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: This is a 700+ unit condominium development., 60+/- units flooded four times, many more flooded once

Project Description: Elevate the lowest buildings, dry flood-proof others

Other Alternatives: Prepare a plan to mitigate using NFIP Increased Cost of Compliance insurance to mitigate after next flood event

Existing Planning Mechanism(s) through which Action Will Be Implemented:

Responsible Office/Partners: Partner: Water Resources

Project Priority: Depends on property owner willingness

Cost Estimate: $5,000,000

Benefits (Losses Avoided): When the flooded 12/31/2005, a 20 year storm event, they experienced about $3M damage, plus affected residents were displaced for ½ year.

Potential Funding: FEMA flood mitigation grant programs

Timeline: Depends on Woodside's willingness to apply for the grant

Action 44. Bridge Replacement on Elk Grove Florin Road at Elder Creek

Hazards Addressed: Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: The existing Bridge is inundated in the 100-year flood and constricts the flow of Elder Creek, increasing the upstream 100-year water surface and related flooding.

Project Description: The bridge will be replaced. The replacement bridge soffit will be two feet above the 200-year storm water surface.

Other Alternatives: None.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Capital project. Implementation based on funding and the project priority list

Responsible Office/Partners: Sacramento County DOT

Project Priority: The project is considered a high priority project and so it is funded.

Cost Estimate: Construction cost is estimated to be $4,100,000

Benefits (Losses Avoided): The project raises the County roadway, with an average daily traffic volume of 23,000 vehicles, out of the 100-year flood zone and so improvement transportation in the region during flood events. The project also reduces upstream flooding.

Potential Funding: The project is funded by the federal Highway Bridge Program.

Timeline: Construction is planned for the summer of 2018.

Action 45. Michigan Bar Bridge Replacement at the Cosumnes River

Hazards Addressed: Flooding

Goals Addressed: 1, 2, 3, 4

Issue/Background: Existing bridge is structurally deficient and so replacement is necessary. In future flood conditions there is the possibility that the existing structure could fail and increase flooding.

Project Description: The new bridge will be constructed about a foot higher than the existing bridge is over the river, allow for better flow in flood conditions. The new bridnge will have only one supporting column in the river as compared with the two existing supports. With less supporting structures in the river,

the river will be better able to convey flows. The new bridge will provide many decades of service without the current concern about failing in flood conditions.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: The project has been funded and is currently in design.

Responsible Office/Partners: Sacramento County DOT

Project Priority: The project's priority is high and so it is a funded.

Cost Estimate: $3,600,000

Benefits (Losses Avoided): Decreased flooding and a long lasting bridge that will provide decades of good service to replace a failing structure.

Potential Funding: The project is funded by federal Highway Bridge Program funds.

Timeline: Construction is planned for the summer of 2018.

Action 46. El Camino Avenue Phase 2 Road Improvements

Hazards Addressed: Flooding

Issue/Background: The Del Paso Mainor neighborhood to the north of El Camino had flooding issues and the Count's Water Resources Dept. has a project in design to resolve the problem, but that plan required additional piped drainage capacity in El Camino Avenue. The current project on El Camino Avenue installed a new truck drainage pipe and resolved localized flooding issues. In addition, stub pipes from El Camino Avenue to Roslyn Way and Verra Way were installed for connections to the future drainage project.

Project Description: This project will add larger storm drain pipes and extended drain inlets to better pick up neighborhood storm drain runoff and upgrade existing drainage inlets to the current standard.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: Capital project. Implementation based on funding and the project priority list

Responsible Office/Partners: Sacramento County DOT with cooperation from the Dept. of Water Resources

Cost Estimate: $2,020,000

Benefits (Losses Avoided): Improved storm drainage helps prevent further degradation of the roadway and damage to abutting private properties.

Potential Funding: Storm Water Utility Fees, Measure A Sales Tax and Federal ATP funds

Timeline: Project is currently under construction. Expected completion date is October 30, 2016

Project Priority: High

Levee Failure Actions

Action 47. Improve Flood Protection and/or Evacuation Planning for Mobile Home/RV Park at Manzanita/Auburn. Alternatively, the Park Should Establish Flood Warning and evacuation procedures.

Hazards Addressed: Flood overtopping creek and a floodwall that was not design reviewed by the County.

Goals Addressed: 1, 2, 3, 4

Issue/Background: The tributary of Arcade Creek tends to rise very rapidly. On 12/31/2005 this property flooded leaving may people without a place to live.

Project Description: Analyze, engineer and potentially reconstruct wall.

Other Alternatives: Do nothing, evacuation planning, insurance

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: Property owner with assistance from County DWR.

Project Priority: Medium

Cost Estimate: To be determined

Benefits (Losses Avoided): Prevent damage to structures, health and safety of residents.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs and local contributions.

Timeline: 24-36 months from grant approval to project completion

Action 48. Hydromodification and Stormwater Quality Countywide

Hazards Addressed: Levee failure, erosion and deposition in streambeds.

Goals Addressed: 1, 2, 3, 4

Issue/Background: The County of Sacramento stormwater group is working on a hydromodification plan to improve stormwater quality and reduce erosion and deposition in streambeds.

Project Description: Analyze priority sites for protection and design hydromodification standards.

Other Alternatives: Do nothing

Existing Planning Mechanism(s) through which Action Will Be Implemented: By inclusion in the LHMP, this project would be eligible for grant funding by FEMA through the HMGP, PDM, or potentially FMA grant programs.

Responsible Office/Partners: County DWR/ USCOE, SAFCA, US Reclamation Boards, Local Reclamation Districts

Project Priority: Medium

Cost Estimate: To be determined

Benefits (Losses Avoided): Manage degradation of flood conveyance and levee features.

Potential Funding: FEMA through the HMGP, PDM, or FMA grant programs and local contributions.

Timeline: 24-36 months from grant approval to project completion

Wildfire Actions

Action 49. Wildfire Suppression

Hazards Addressed: Wildfire

Goals Addressed: 1, 2, 3, 4

Issue/Background: Large areas of Sacramento County's rural areas and open space are susceptible to wildfire. Areas of concern include Regional Parks and Open Space areas, especially at the urban interface. The multi-year drought conditions have stressed trees and other vegetation, increasing flammability and lengthening the fire season. The County has recently experienced more and larger wildfires than in years past. Wildfire suppression is needed to reduce fire loads and to reduce response time to minimize wildfire size and intensity.

Project Description: Mitigation includes: Clearance for access roadways and firebreaks, adding fire access signage, new technology to report fires and share information on access routes, hydrants, sensitive habitat, and cultural resource areas. Providing areas for wildfire training (burns) for fire departments,

Other Alternatives: No Action

Existing Planning Mechanism(s) through which Action Will Be Implemented: American River CWPP and other area fire plans and programs

Responsible Office/Partners: Sacramento County Department of Regional Parks, Sacramento Metropolitan Fire District, City of Sacramento Fire Department

Project Priority: High

Cost Estimate: Flexible, depending on size and scope of project

Benefits (Losses Avoided): Protecting park lands and facilities, adjacent neighborhoods, high priority forests, wildlife habitats, and cultural resources.

Potential Funding: FEMA grants, Fire grants, County Budgets

Timeline: Periodic scheduled work, at minimum implemented on an annual timetable.

Action 50. Wildfire Fighting - Support

Hazards Addressed: Wildfire risk within Sacramento County Regional Parks (Parks) and in Open Space at the urban interface.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Large areas of Sacramento County's rural areas and open space are susceptible to wildfire. The multi-year drought conditions have stressed trees and other vegetation, increasing

flammability and lengthening the fire season. The County has experienced more and larger wildfires than in years past. Wildfire suppression is needed to reduce fire loads

and reduce response time to minimize wildfire size and intensity.

Project Description: Mitigation includes: Clearance for access roadways and firebreaks, adding fire access signage, new technology to report fires and share information on access routes, hydrants, sensitive habitat, and cultural resource areas. Providing areas for wildfire training (burns) for fire departments,

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented: Parks has identified locations for road clearance and has evaluated new technology to report emergency events in real time. Planning with other agencies is ongoing to prioritize hazardous conditions and make efficient use of funds.

Responsible Office/Partners: Sacramento County Department of Regional Parks / Sacramento Metropolitan Fire District, City of Sacramento Fire Department

Project Priority: High

Cost Estimate: $40,000

Benefits (Losses Avoided): Protecting park lands, adjacent neighborhoods, high priority forests, wildlife habitats, and cultural resources.

Potential Funding: Agency funding, FEMA grants with local and like-kind match.

Timeline: Periodic scheduled work, at minimum on an annual timetable.

Action 51. Wildfire Suppression – Regional Parks and Open Space (urban interface)

Hazards Addressed: Hazard - Loss of residential and business structures and loss of habitat from wildfire. Post hazard results in sedimentation of creeks and rivers.

Goals Addressed: 1, 2, 3, 4

Issue/Background: Large areas of Sacramento County's rural areas and open space are susceptible to wildfire. The multi-year drought conditions have stressed trees and other vegetation, increasing flammability and lengthening the fire season. The County has experienced more and larger wildfires than in years past. Wildfire suppression is needed to reduce fire loads and reduce response time to minimize wildfire size and intensity.

Project Description: Mitigation includes: Fire fuel reduction and firebreaks maintenance. The method used depends on the terrain and type of fire fuel to remove (dry vegetation, limb ladders, etc), such as hand crews with manual tools, livestock grazing, prescribed burns, mechanical fuels removal, planting of fire resilient vegetation and/or invasive species removal.

Other Alternatives:

Existing Planning Mechanism(s) through which Action Will Be Implemented: Parks has a fire fuel reduction plan in place with prioritized areas based on the threat level and proximity to people and structures balanced against the available funding . Parks coordinates with other agencies for efficiencies in use of funds and man power.

Responsible Office/Partners: Sacramento County Department of Regional Parks / Sacramento Metropolitan Fire District, City of Sacramento Fire Department

Project Priority: High

Cost Estimate: $150,000

Benefits (Losses Avoided): Protecting park lands, adjacent neighborhoods, high priority forests, wildlife habitats, and cultural resources.

Potential Funding: Agency funding, FEMA grants with local and like-kind match.

Timeline: Periodic scheduled work, at minimum on an annual timetable.

Chapter 6 Plan Adoption

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, county commissioner, Tribal Council).

The purpose of formally adopting this plan is to secure buy-in from Sacramento County and participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan, in accordance with the requirements of DMA 2000. This adoption also establishes compliance with AB 2140 requiring adoption by reference or incorporation into the safety element of the general plan. The governing board for each participating jurisdiction has adopted this Local Hazard Mitigation Plan by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix D: Adoption Resolutions.

Chapter 7 Plan Implementation and Maintenance

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

Chapter 3 Planning Process includes information on the implementation and maintenance process since the 2011 Plan was adopted. This section includes information on the implementation and maintenance process for this plan update.

7.1 Implementation

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile actions, the participating jurisdictions will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other plans and mechanisms, such as the general plans, stormwater plans, and Community Wildfire Protection Plans (CWPPs) for Sacramento County and participating jurisdictions. The County and participating jurisdictions already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits to each program and the Sacramento County community and its stakeholders. This effort is achieved through the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When

funding does become available, the participating jurisdictions will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal programs and earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

Responsibility for Implementation of Goals and Activities

The elected officials and officials appointed to head each department within the County are charged with implementation of various activities in the plan. During the quarterly reviews as described later in this section, an assessment of progress on each of the goals and activities in the plan will be determined and noted. At that time, recommendations were made to modify timeframes for completion of activities, funding resources, and responsible entities. On a quarterly basis, the priority standing of various activities may also be changed. Some activities that are found not to be doable may be deleted from the plan entirely and activities addressing problems unforeseen during plan development may be added.

7.1.1. Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, the participating jurisdictions will be responsible for the plan implementation and maintenance. The HMPC Steering Committee identified in Appendix A (or a similar committee) will reconvene quarterly each year to ensure mitigation strategies are being implemented and the County and participating jurisdictions continue to maintain compliance with the NFIP. As such, Sacramento County and participating jurisdictions agree to continue its relationship with the HMPC Steering Committee and:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the various governing boards or councils of all participating jurisdictions; and
- Inform and solicit input from the public.

The primary duty of the participating jurisdictions is to see the plan successfully carried out and to report to their community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the County website (and others as appropriate).

7.2 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized.

7.2.1. Maintenance Schedule

The Sacramento County DWR is responsible for initiating plan reviews and consulting with the other participating jurisdictions. In order to monitor progress and update the mitigation strategies identified in the action plan, Sacramento County DWR and the individual jurisdictions will revisit this plan annually and following a hazard event. The HMPC will meet quarterly to review progress on plan implementation and will provide annual evaluation reports for each participating CRS community. The HMPC will also submit a five-year written update to the State and FEMA Region IX, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. With this plan update anticipated to be fully approved and adopted in 2016, the next plan update for the Sacramento County Planning Area will occur in 2021.

7.2.2. Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- Increased vulnerability as a result of new development (and/or annexation).

Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

Changes will be made to the plan to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. All mitigation actions will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as the HMPC deems appropriate and necessary, and as approved by the appropriate governing boards or councils of the other participating jurisdictions. In keeping with the five-year update process, the HMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the governing boards or councils.

Quarterly Plan Review Process

For the 2016 hazard mitigation plan update review process, the Sacramento County DWR will be responsible for facilitating, coordinating, and scheduling reviews and maintenance of the plan. The review of the Hazard Mitigation Plan will normally occur on a quarterly basis each year and will be conducted by the HMPC as follows:

- The Sacramento County OES will place an advertisement in the local newspaper advising the public of the date, time, and place for each quarterly review of the plan and will be responsible for leading the meeting to review the plan.
- Notices will be mailed to the members of the Steering Committee, HMPC, federal, state, and local agencies, non-profit groups, local planning agencies, representatives of business interests, neighboring communities, and others advising them of the date, time, and place for the review.
- County/City/District officials will be noticed by email and telephone or personal visit and urged to participate.
- Members of the Communities' Planning Commission and other appointed commissions and groups will also be noticed by email and either by telephone or personal visit.
- Prior to the review, department heads and others tasked with implementation of the various activities will be queried concerning progress on each activity in their area of responsibility and asked to present a report at the review meeting.
- The local news media will be contacted and a copy of the current plan will be available for public comment at Sacramento County.
- After the review meeting, minutes of the meeting and a quarterly report will be prepared by the Steering Committee/HMPC and forwarded to the news media (public) and the ISO/CRS specialist for the CRS program. The report will also be presented to the County/City/participating jurisdictions' governing boards for review, and a request will be made that the Board take action to recognize and adopt any changes resulting from the review.

Criteria for Quarterly Reviews

The criteria recommended in 44 CFR 201 and 206 will be utilized in reviewing and updating the plan. More specifically, the quarterly reviews will include the following information:

- Community growth or change in the past quarter.
- The number of substantially damaged or substantially improved structures by flood zone.
- The renovations to public infrastructure including water, sewer, drainage, roads, bridges, gas lines, and buildings.
- Natural hazard occurrences that required activation of the Emergency Operations Center (EOC) and whether or not the event resulted in a presidential disaster declaration.
- Natural hazard occurrences that were not of a magnitude to warrant activation of the EOC or a federal disaster declaration but were severe enough to cause damage in the community or closure of businesses, schools, or public services.
- The dates of hazard events descriptions.
- Documented damages due to the event.
- Closures of places of employment or schools and the number of days closed.
- Road or bridge closures due to the hazard and the length of time closed.
- Assessment of the number of private and public buildings damaged and whether the damage was minor, substantial, major, or if buildings were destroyed. The assessment will include residences, mobile homes, commercial structures, industrial structures, and public buildings, such as schools and public safety buildings.
- Review of any changes in federal, state, and local policies to determine the impact of these policies on the community and how and if the policy changes can or should be incorporated into the Hazard Mitigation Plan. Review of the status of implementation of projects (mitigation strategies) including projects completed will be noted. Projects behind schedule will include a reason for delay of implementation.

7.2.3. Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other County and City plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As previously stated in Section 7.1 of this plan, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. The point is re-emphasized here. As described in this plan's capability assessment, the County and participating jurisdictions already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include:

- County and City general and master plans
- County and City Emergency Operations Plans
- County and City ordinances
- Flood/stormwater management/master plans
- Community Wildfire Protection plans
- Capital improvement plans and budgets
- Other plans and policies outlined in the capability assessments in the jurisdictional annexes
- Other plans, regulations, and practices with a mitigation focus

HMPC members involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc, as appropriate. As described in Section 7.1 Implementation, incorporation into existing planning mechanisms will be done through the routine actions of:

- monitoring other planning/program agendas;
- attending other planning/program meetings;
- participating in other planning processes; and
- monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Examples of incorporation of the LHMP into existing planning mechanisms include:

1. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this LHMP into the Safety Element of their General Plan(s). Evidence of such adoption (by formal, certified resolution) shall be provided to CAL OES and FEMA.
2. Integration of wildfire actions identified in this mitigation strategy with the actions and implementation priorities established in existing Community Wildfire Protection Plans (CWPPs), such as the American River CWPP. This is already in process. Key people responsible for development of the American River CWPP participated on the HMPC in the development of this LHMP. They identified key projects in the CWPPs and integrated them into the Mitigation Strategy of this LHMP. Likewise, actual implementation of these wildfire projects will likely occur through the CWPP implementation process.

3. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Watershed and Stormwater Drainage Plans. This is already in process. Specifically, key people responsible for development of the Watershed Master Plan for the County and various jurisdictional watershed plans and stormwater drainage plans participated on the HMPC in the development of this LHMP. They identified key projects from their watershed and stormwater plans and integrated them into the Mitigation Strategy of this LHMP. Likewise, actual implementation of these flood mitigation projects will likely occur through the actual watershed and stormwater plans' implementation process through the efforts of the responsible jurisdictions
4. Using the risk assessment information to update the hazard analysis in the Sacramento County and Sacramento County Emergency Operations Plan, which are currently being updated.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

7.2.4. Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stores from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

Public Involvement Process for Quarterly Reviews

The public will be noticed by placing an advertisement in the newspaper specifying the date and time for the review and inviting public participation. The HMPC, Steering Committee, local, state, and regional agencies will be notified and invited to attend and participate.

Public Involvement for Five-year Update

When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. In reconvening, the Steering Committee and HMPC plan to identify a public outreach subcommittee, which will be responsible for coordinating the activities necessary to involve the greater public. The subcommittee will develop a plan for public involvement and will be responsible for disseminating information through a variety of media channels detailing the plan update process. As part of this effort, public meetings will be held and public comments will be solicited on the plan update draft. The subcommittee will also coordinate this public outreach process with the public information program established pursuant to the 2013 guidelines from the Community Rating System (CRS)

Prelude to Jurisdictional Annexes

For this 2016 Sacramento County LHMP Update, the **Jurisdictional Annexes**, working in conjunction with the Base Plan, detail the hazard mitigation planning elements specific to participating jurisdictions. Each Annex is not intended to be a standalone document, but appends to, supplements, and incorporates by reference the information contained in the Base Plan, as the umbrella document for this planning effort. As such, all Chapters 1- 7 of the Base Plan and associated appendices, including the planning process and other procedural requirements and planning elements apply to and were met by each participating jurisdiction.

These Jurisdictional Annexes provide additional information specific to each participating jurisdiction, with a focus on providing additional details on the risk assessment and mitigation strategy beyond that provided in the Base Plan. As part of these Jurisdictional Annexes, a **Delta Annex** was also created which provides an umbrella base document specific to the Delta Area, which then contains the Annexes (or Chapters) for the participating jurisdictions (City of Isleton and Delta Reclamation Districts) located within the Delta Region.