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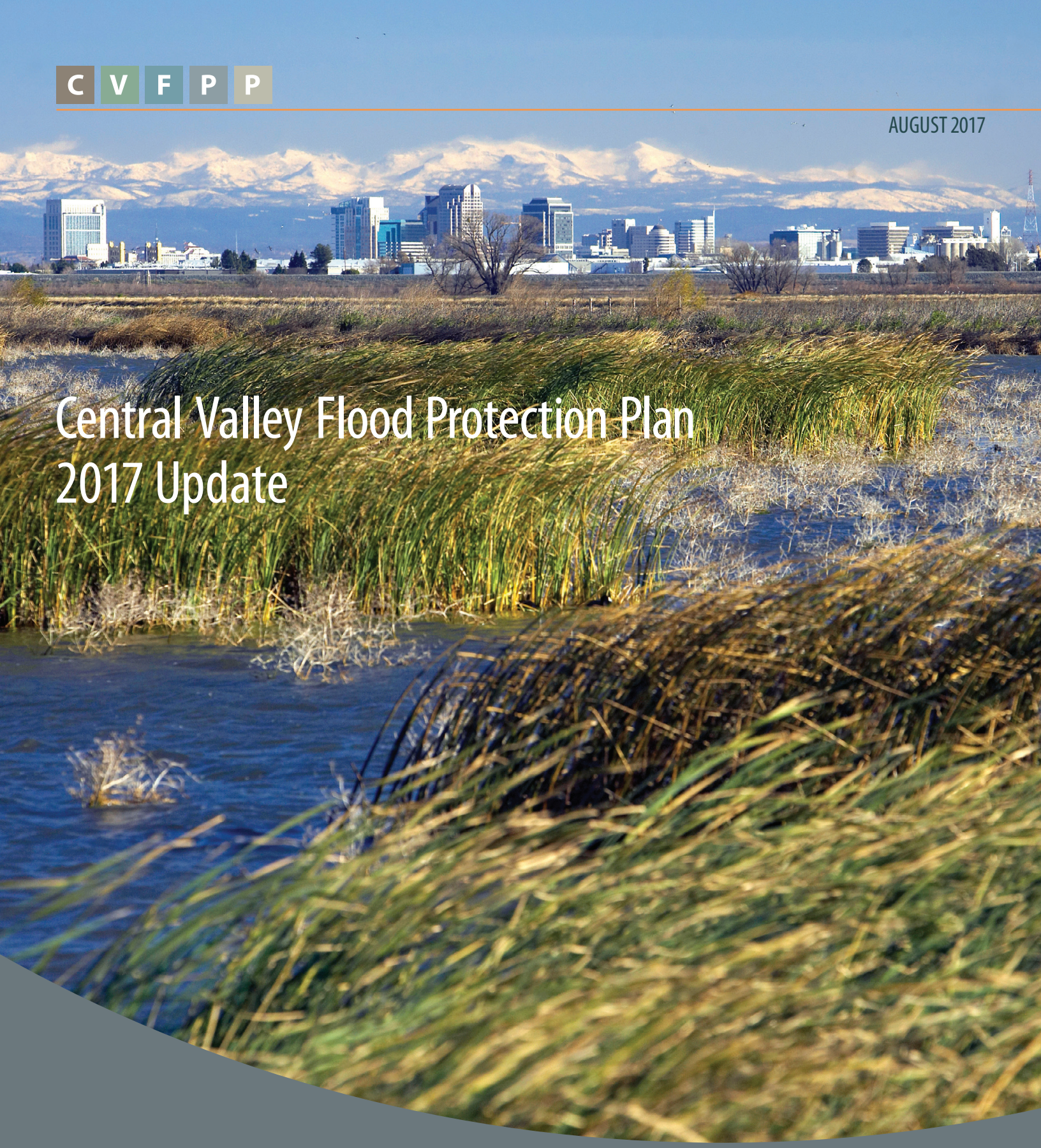
AUGUST 2017



Central Valley Flood Protection Plan 2017 Update

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Central Valley Flood Protection Plan 2017 Update

August 2017

This document was prepared for submission to the Central Valley Flood Protection Board Pursuant to the California Central Valley Flood Protection Act of 2008.

by

Grant Davis

Director, Department of Water Resources
The California Natural Resources Agency State of California

Gary B. Bardini

Deputy Director, Integrated Water Management
Department of Water Resources

Preparation Team

Department of Water Resources

Eric Koch
Chief, Division of Flood Management

Michael Mierzwa
Chief, Flood Planning Office

Jon Ericson
Chief, Hydrology and Flood Operations Office

Mark List
Acting Chief, Flood Maintenance Office

Jeremy Arrich
Chief, Flood Projects Office

Dave Mraz
Principal Engineer

Ray McDowell
Chief, Habitat Project Implementation Branch

Mary Jimenez
Chief, Flood Planning Branch

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Foreword

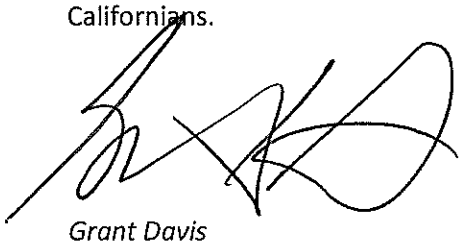
The importance of investing in California's aging flood management systems is an urgent priority. Despite great progress realized by recent flood system investments due in part to California voters approving flood bond measures in 2007, residual flood risk in California's Central Valley remains among the highest in the country.

Since its adoption by the Central Valley Flood Protection Board in June 2012, the CVFPP has guided California's flood risk management investments to improve emergency preparedness and response capabilities, increase critical flood protection in vulnerable Central Valley communities, and address maintenance deficiencies in the flood system. This first 5-year update to the CVFPP, as required by the Central Valley Flood Protection Act of 2008, incorporates the latest information about systemwide and regional flood management needs, advancements in the best available science, refined objectives for improving ecosystem functions along our floodways, a robust investment strategy, and a series of policy issues and focused recommendations needed for continued implementation of the CVFPP.

The 2017 CVFPP Update contains four primary themes:

- **Development of partnerships through robust stakeholder engagement.** Stakeholder participation was a cornerstone in the development of the 2017 CVFPP Update and will continue to be essential as the CVFPP is implemented. The regional flood management planning effort, in particular, represents an unprecedented partnership and level of engagement among Central Valley planning entities, and can serve as a model as California moves ahead to meet its future flood and water management needs.
- **Integration with broader water resources objectives.** Consistent with the Governor's Water Action Plan, we must continue to work on a diverse portfolio of solutions to address California's water management challenges. The 2017 CVFPP Update emphasizes the importance of investing in long-term, multi-benefit actions to improve flood risk management while improving ecosystem functions, modernizing operations and maintenance practices, and strengthening institutional support for flood management.
- **Identification of policy issues and recommended actions to resolve them.** The 2017 CVFPP Update identifies long-standing policy issues that present challenges to our shared management and improvement of the flood system, and provides recommended actions to begin to resolve them. Now more than ever, local, State, and federal entities must come together to tackle the flood management policy issues needed to continue effective implementation of the CVFPP.
- **Establish stable funding to manage and improve the flood system.** Continued implementation of the CVFPP requires substantial additional investment from the State and federal government, and local agencies. The 2017 CVFPP Update proposes a funding plan to move towards sustainable funding over the next 30 years.

By working together, we can build an effective, resilient, and sustainable flood system that benefits all Californians.



Grant Davis
Director, Department of Water Resources

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Letter from the Central Valley Flood Protection Board President

On June 29, 2012, it was my privilege to preside over the Central Valley Flood Protection Board (Board) as we adopted the new Central Valley Flood Protection Plan (CVFPP). It was a historic day that culminated five years of very hard work.

Over one hundred years had passed since a new flood protection plan had been contemplated. The old plan consisted of a levee and bypass system, which successfully reduced the frequency of flooding to primarily agricultural lands. These levees, however, did not have a sophisticated design or seepage controls, resulting in failures from time to time. Over the years, rural homes, urban subdivisions, and high-value permanent crops became the norm on these lands. After Hurricane Katrina in 2005, the U.S. Army Corps of Engineers evaluated much of our flood control system and determined that it was substandard. A new flood protection plan for California's Central Valley was long overdue. In 2007, the State Legislature directed the Department of Water Resources and the Board to prepare a new flood protection plan.

This 2017 document represents the first required five-year update to the 2012 CVFPP. It calls for changes, refinements, and more specificity to the concepts in the 2012 CVFPP. Changes include significant State investment in levees and other flood risk reduction improvements to protect major urban areas, along with levee improvements and non-structural and multi-benefit improvements for small communities. Changes for rural areas include State investment to repair erosion sites, construction of all-weather roads on top of rural levees, repair of identified weak spots in the levees, and removal of non-compliant encroachments. Other changes focus on improving operations and maintenance of the flood control system, re-operating and better coordinating releases from large reservoirs to mitigate downstream damage, improving the flood emergency response system, and constructing improved and better managed habitats to protect and enhance the environment by integrating them as part of projects.

This update is ambitious. Already, about $4 billion of federal, State, and local funds have been spent on improvements, such as modifications to Folsom Dam, levee improvements to the lower American River levees near Sacramento, and improvements to Feather River levees near the Yuba City and Marysville urban areas. However, over the next 30 years, much more investment in improvements is needed: between $17 and $21 billion, which is much more than we are used to spending on flood control.

This update is also inclusive. Prepared in cooperation with local agencies, landowners, and stakeholders, it represents a major accomplishment of involvement and engagement for the Board. Based upon our discussions and public testimony, we believe that there is significant support for this update. This extensive, ambitious plan will only come to fruition if everyone – federal, State, local governments, land owners, and stakeholders – all work together and agree to support, help fund, and implement the work contemplated in this update.

William H. Edgar

William H. Edgar
President, Central Valley Flood Protection Board

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Acronyms and Abbreviations

AB 52	Assembly Bill 52, Native Americans: California Environmental Quality Act
AB 1482	Assembly Bill 1482, Climate Adaptation
AB 2087	Assembly Bill 2087, Regional Conservation Investment Strategies
BMP	best management practice
BWFS	basin-wide feasibility study
Cal-IPC	California Invasive Plant Council
Cal OES	California Office of Emergency Services
CDEC	California Data Exchange Center (DWR)
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CLVRP	California Levee Vegetation Research Program
CMIP5	Coupled Model Intercomparison Project Phase 5
Conservation Strategy	Central Valley Flood Protection Plan Conservation Strategy
Conservation Strategy IAC	Conservation Strategy Interagency Advisory Committee
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVIFMS	Central Valley Integrated Flood Management Study
CVP	Central Valley Project
CWAP	California Water Action Plan
CWC	California Water Code
DFM	Division of Flood Management (DWR)
DLIS	Delta Levee Investment Strategy
DWR	California Department of Water Resources
EIP	Early Implementation Program
ESA	Endangered Species Act
Exchange	Central Valley Habitat Exchange
F-CO	forecast-coordinated operations
FCSSR	Flood Control System Status Report
FEMA	Federal Emergency Management Agency
FERIX	Flood Emergency Response Information Exchange
F-IO	forecast-informed operations
FSRP	Flood System Repair Project
FSSR	Flood System Status Report

GRR	General Re-evaluation Report
HEC-FDA	Hydrologic Engineering Center's Flood Damage Analysis
HEC-FIA	Hydrologic Engineering Center's Flood Impact Analysis
HQT	habitat quantification tool
IPCC	Intergovernmental Panel on Climate Change
IWM	integrated water management
JFP	Joint Federal Project
LFPZ	levee flood protection zone
LMA	local maintaining agency
LVMS	Levee Vegetation Management Strategy
NFIP	National Flood Insurance Program
NGO	non-governmental organization
NRC	National Research Council
NRCS	Natural Resources Conservation Service
O&M	operations and maintenance
OMRR&R	operations, maintenance, repair, rehabilitation, and replacement
PEIR	Program Environmental Impact Report
RCIS	Regional Conservation Investment Strategies
Reclamation	Bureau of Reclamation, U.S. Department of the Interior
RFMP	regional flood management plan
SB 5	Senate Bill 5, Central Valley Flood Protection Act of 2008
SCFRR Program	Small Communities Flood Risk Reduction Program
SERP	Small Erosion Repair Program
SJRRP	San Joaquin River Restoration Program
SPFC	State Plan of Flood Control
SRA	shaded riverine aquatic (habitat)
SSIA	State Systemwide Investment Approach
State	State of California
TM	technical memorandum
UFRR Program	Urban Flood Risk Reduction Program
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VIC	Variable Infiltration Capacity hydrological model
WRDA	Water Resource Development Act
WYBC	western distinct population segment of the yellow-billed cuckoo

The CVFPP is a strategic and long-range plan for improving flood risk management in the Central Valley.

Updating the Central Valley Flood Protection Plan

Chapter 1

The Central Valley Flood Protection Plan (CVFPP) has guided the State's participation in managing flood risk in areas protected by the State Plan of Flood Control (SPFC) since the plan's adoption pursuant to the Central Valley Flood Protection Act of 2008 in 2012. A strategic, long-range plan, the CVFPP and its updates describe a programmatic vision for flood system improvements over time in accordance with the requirements of the 2008 Act. The CVFPP was prepared by the Department of Water Resources (DWR) and adopted by Central Valley Flood Protection Board (CVFPB) through Resolution 2012-25. As conceived by the legislature, the CVFPP is updated every 5 years, beginning in 2017.

1.1 Historical Setting and Context

Floods have had devastating effects on life and property in the Central Valley and on the economic prosperity of Californians. According to the U.S. Army Corps of Engineers (USACE), the most recent major floods in the Central Valley, which occurred in 1986 and 1997, together caused over $1 billion in damage. Despite the protection provided by the current flood management system, residual flood risk in the Central Valley remains among the highest in the country.

CVFPP Updates

- The CVFPP is a long-range plan updated on a 5-year cycle.
- Five-year updates are prepared in accordance with the requirements of the Central Valley Flood Protection Act of 2008 and California Water Code Sections 9600 through 9625.
- The CVFPP is descriptive, not decisional; it is not a funding or permitting decision for specific projects.
- The 2017 CVFPP Update includes recommendations on investments and policies to support comprehensive flood risk management actions locally, regionally, and systemwide, rather than promoting specific projects.

The Central Valley of California is a broad, gently sloping valley that drains into the largest estuary on the West Coast, the Sacramento–San Joaquin Delta (Delta). Lower-lying lands along the valley's two major rivers, the Sacramento River and the San Joaquin River, were floodplains that were regularly inundated for long periods during large seasonal flood events before land reclamation. Catastrophic floods in the Central Valley have been documented since the mid-1800s Gold Rush era. In the late 1800s, hydraulic mining in the Sierra Nevada Mountains sent large amounts of sediment downstream, choking the channels of rivers and increasing flooding by raising channel beds above their natural levels and surrounding lands. The current flood management system in California's Central Valley has evolved through an incremental construction process that began during that era. Landowners began constructing levees along the mainstem Sacramento and San Joaquin Rivers to convert these marshy bottomlands to agriculturally productive land.

A clamshell dredge uses river-bottom material to form unengineered levees in the Central Valley, circa 1910–1930.

The original purpose of the Central Valley flood management system was to reduce seasonal flooding on rural-agricultural lands to support agricultural development while maintaining navigable channels for commerce. The flood system was not originally designed to provide a high level of protection to the urban areas that have since developed over time. Much of the levee system was constructed using soils dredged from the adjacent river that were often poorly compacted over permeable foundations. Levees were located close to the river to flush hydraulic mining debris left from the Gold Rush era in the Sacramento River Basin. Levees were not protected from seepage through or under the levee. There was no agreement among landowners for a comprehensive flood system with uniform levee standards or channel capacities for the rivers.

In the early 1900s, both Congress and the California Legislature adopted the "Jackson Plan" for the Sacramento River Basin. The Jackson Plan was a comprehensive plan for flood protection for the Sacramento Valley that included a system of levees along existing streams, supplemented by weirs and bypasses to convey excess flood flows. Between the 1950s and 1970s, the federal and State governments constructed a leveed conveyance system along the mainstem San Joaquin River that included bypasses. In addition, beginning in the 1940s, upstream reservoirs were built, and piecemeal levee improvements were constructed largely in urban areas. However, much of the flood management system constructed many decades ago is largely the same system we are living with today. Since the time of the Jackson Plan, the flood management system has evolved to serve multiple needs of modern society, but without many modern engineering upgrades, such as levee seepage improvements.

Although the Central Valley flood management system has prevented billions of dollars in flood damages since its construction, substantial improvements are required so that the system meets modern needs. In addition, societal values and expectations for the flood management system have changed over time, and many challenges must be overcome to provide a more sustainable flood system into the twenty-first century:

- Urban growth and development in areas protected by the flood system have increased flood risk and have created the need for levels of protection higher than that provided by levees originally intended to protect rural-agricultural areas. This growth is expected to continue over the long-term future; population within the SPFC Planning Area is projected to increase by 70% over the next 50 years (DWR, 2014). Modern engineering evaluations have shown that many flood facilities face an unacceptably high chance of failure.

- The construction of levees, revetment, reservoirs, and other factors have reduced riverine and floodplain habitats and natural ecosystem processes, contributing to the decline of native species.

- There is an increased need from societal and regulatory perspectives to more effectively manage Central Valley rivers and floodplains for multiple purposes, including water supply, ecosystem restoration, recreation, and public education. Managing for multiple purposes includes the challenge of securing adequate funding to comply with increasingly stringent environmental regulations.

- The flood management system has experienced much larger floods than the events leading to its original design in the early twentieth century. Hydrologic variability and uncertainty are increasing with climate change, which is likely to result in more severe flooding over time.

Societal values and expectations for the flood management system have changed over time, emphasizing the need for a multi-benefit approach.

Photo: River Partners

- Operations and maintenance of existing flood facilities are becoming increasingly difficult to implement throughout the flood management system due in part to regulatory and funding constraints, and a backlog of deferred maintenance continues to grow.

More than 1 million people live or work in the Central Valley floodplains, which also hosts some of the most productive agricultural land in the nation. In some areas of the Central Valley, flood risk has been significantly reduced. However, in many areas, people, property and sensitive ecosystems are still at unacceptably high risk from catastrophic flooding. In addition, future floods are expected to cause more damage due to sea-level rise, climate change, subsidence, and future population growth and development within floodplains. Over time, these future drivers threaten to erode the reductions in flood risk achieved to date. Therefore, although significant progress has been made, much remains to be done.

The costs of inaction could result in catastrophic consequences, including loss of life, lost jobs, ruined infrastructure (including highways, businesses, hospitals, and homes), and closed businesses that could impact all Californians if a major flood disaster were to occur. Regional agriculture-based economies could also be devastated, causing serious impacts to the State economy and disrupting national and international food supplies. After flooding occurs, businesses, homes, schools, and other important structures must be vacated for proper rehabilitation, causing economic and other impacts on families and communities. Communities and livelihoods could further suffer the long-term impacts of plummeting home values, higher flood insurance, and the huge costs of rebuilding. Sustainably investing in flood management now will be a small fraction of the cost of recovering from a major flood disaster later.

1.2 About this CVFPP Update

The 2017 CVFPP Update is the first 5-year update of the 2012 CVFPP. The update's primary focus is to refine the State Systemwide Investment Approach (SSIA) formulated in 2012 to achieve the CVFPP goals (see respective boxes). The SSIA provided a road map for Central Valley flood risk management and is now being refined based on new information, physical changes to the flood system, and policy updates over the past 5 years.

Central Valley Flood Protection Plan Goals

CVFPP Primary Goal

- **Improve flood risk management.** Reduce the chance of flooding, and damages once flooding occurs, and improve public safety, preparedness, and emergency response through the following:
  - Identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC.
  - Formulating standards, criteria, and guidelines to facilitate implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin river basins and the Delta.

CVFPP Supporting Goals

- **Improve operations and maintenance.** Reduce systemwide maintenance and repair requirements by modifying the flood management systems in ways that are compatible with natural processes, and adjust, coordinate, and streamline regulatory and institutional standards, funding, and practices for operations and maintenance, including significant repairs.
- **Promote ecosystem functions.** Integrate the recovery and restoration of key physical processes, self-sustaining ecological functions, native habitats, and species into flood management system improvements.
- **Improve institutional support.** Develop stable institutional structures, coordination protocols, and financial frameworks that enable effective and adaptive integrated flood management (designs, operations and maintenance, permitting, preparedness, response, recovery, and land use and development planning).
- **Promote multi-benefit projects.** Describe flood management projects and actions that also contribute to broader integrated water management objectives identified through other programs.

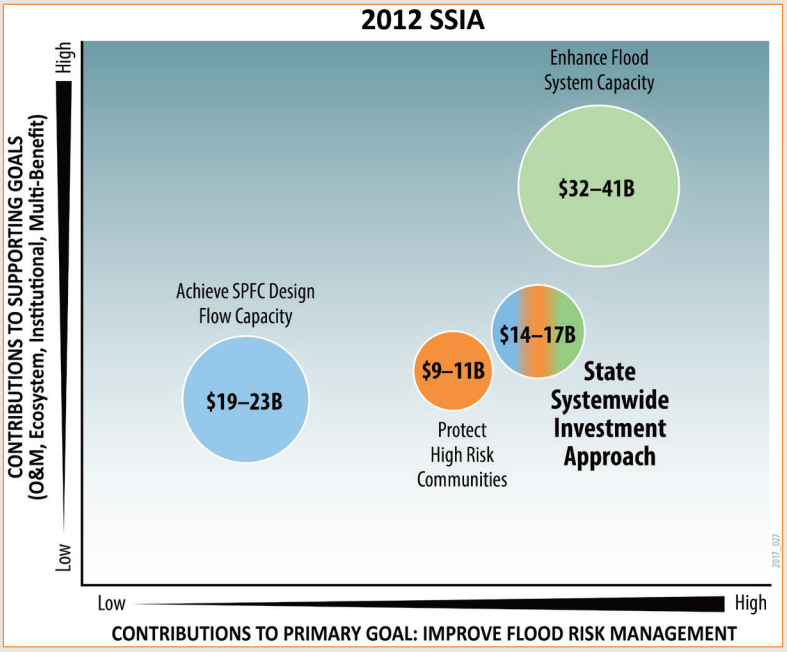
Note: These goals are as adopted by the Central Valley Flood Protection Board in 2012 (DWR, 2012).

The 2017 CVFPP Update describes implementation progress and recommends refinements to programmatic investments and policies needed to implement the CVFPP over the next 30 years. Building on the foundation established in the 2012 CVFPP, the 2017 CVFPP Update accomplishes the following:

- Refines the SSIA through programmatic actions and strategies that reflect local, State, and federal planning efforts
- Refines capital and ongoing costs, funding, and implementation phasing of the SSIA
- Identifies long-standing policy issues that challenge CVFPP implementation and provides recommendations to resolve them
- Establishes an outcome-based planning framework with measurable objectives and tracks progress toward achieving them over time

2012 CVFPP State Systemwide Investment Approach

The 2012 CVFPP proposed the SSIA for sustainable, integrated flood management in areas protected by SPFC facilities (as defined in California Water Code Section 9110(f)). The SSIA is an assembly of the most promising, cost-efficient, and implementable elements of the three preliminary approaches studied in the 2012 CVFPP (see chart at right). In addition, some preliminary approaches only partially achieved the CVFPP goals, while others met the CVFPP goals but were determined to be too expensive. The SSIA was formulated as a balance among many competing needs to achieve a plan that was reasonable and cost-effective. Unlike previous plans, the SSIA reflects the State's strategy for modernizing the SPFC by improving levee integrity and expanding flood system capacity through multi-benefit projects that meet the CVFPP goals. This approach includes a diverse array of actions to improve flood protection for urban areas, small communities, and rural-agricultural areas. The SSIA included 200-year level of protection for urban and urbanizing areas, 100-year level of protection for small communities, rural-agricultural levee improvements, weir and bypass expansions, flood structure improvements, and ecosystem restoration. It also encouraged further exploring actions such as floodplain transitory storage, groundwater recharge opportunities, reservoir management, and residual risk management.



This update was prepared during a severe multi-year drought. Consequently, the attention of water managers over the past 5 years has been largely focused on responding to this historic drought emergency. Nevertheless, as California's climate of extremes inevitably swings from drought to flood, it remains critically important that the CVFPP continues to advance long-term flood protection and prepare for future flood events. The drought has caused groundwater levels to decline (especially in the San Joaquin River Basin), resulting in land subsidence that has further stressed the flood management system. The drought has also placed renewed focus on opportunities to enhance water supply associated with flood management system improvements.

CVFPP implementation progress has been steady, but more work remains to be done to advance the vision for flood management established in 2012. In addition to on-the-ground implementation progress achieved so far, interagency collaboration has begun to address flood management policy issues highlighted in 2012, and the CVFPP planning process has advanced significantly to refine the SSIA and needed flood management improvements. Guided by the Central Valley Flood Protection Act of 2008 and necessary alignment with significant statewide plans, this process reflects a greater emphasis on comprehensive activities that can achieve lasting and measurable outcomes rather than incremental, single-purpose flood management investments. The CVFPP update planning process has also brought together many stakeholders with interests related to flood management in the Central Valley. Overall, this has contributed to a more robust understanding of the current flood system and further identification of opportunities for flood management improvements. Some efforts focused on rigorous technical analysis to refine a broad array of management actions consistent with the adopted plan, and other efforts addressed the need for more effective implementation, such as development of an investment strategy and funding plan.

More Work Remains to Implement the CVFPP

- About 1.3 million people at risk in SPFC floodplains
- About $80 billion of infrastructure and assets at risk
- More work to achieve urban level of flood protection by 2025 for urban areas protected by the SPFC
- Continued challenges in areas that have deferred maintenance and have not had the benefit of recent repairs or improvements
- Habitat degradation in many areas of the floodplain continue to stress ecological processes and sensitive native species

Further, refinements reflect additional information from the previous 5 years, including:

- CVFPP alignment with recent statewide plans (Section 1.2.1); California Water Action Plan, issued by the Governor in 2014 and updated in 2016; California Water Plan Update (2013) by DWR, with progress underway for the 2018 update; Statewide Flood Management Planning, *California's Flood Future: Recommendations for Managing the State's Flood Risk* (2013) by DWR, articulating the State's higher-level priorities in flood management statewide (SPFC and non-SPFC); CVFPP implementation progress since 2012, through on-the-ground projects and efforts to address flood management policy issues related to the SPFC (Section 1.2.2)
- Study results and potential plan refinements informed by State partners and stakeholder input (Chapters 2 and 3)
- Significant advancements in the best available science, including climate change science (Chapter 2)
- Significant new developments, including external events, policies, or other drivers affecting CVFPP implementation (changing conditions) (Section 1.3, Chapters 3 and 4)
- Relative efficiency of recent State investments in flood management, based on the ability to monitor and track desired outcomes over time (Chapters 2 and 4)

This 2017 CVFPP Update continues implementation of key concepts from 2012 and recommends refinements or changes only where necessary for planning context, continuity, and convenience. Otherwise, the reader is encouraged to refer to the 2012 CVFPP for background information throughout the life of this long-term planning effort.

1.2.1 Alignment of the CVFPP with Statewide Plans

Since 2012, three significant statewide plans have been completed: The *California Water Action Plan* (CWAP; 2014 and 2016 Update), the *California Water Plan Update 2013*, and *California's Flood Future: Recommendations for Managing the State's Flood Risk* (2013). These documents underscore a deep commitment to the principles of integrated water management (IWM), and the 2017 CVFPP Update aligns with these statewide efforts.

An IWM approach uses a collection of tools, plans, and actions to achieve efficient and sustainable solutions for water management challenges facing California. It reinforces the interrelation of different water management components with the understanding that changes in the management of one component will affect the others. IWM promotes system flexibility and resiliency to accommodate changing conditions such as regional preferences, ecosystem needs, climate change, flood or drought events, and funding capabilities. Within the constraints of society and economic productivity on floodplains, IWM acknowledges the importance and function of flooding as a natural part of the ecosystem and helps people understand the natural and beneficial functions of floodplains. An IWM approach requires alignment and cooperation among public agencies, tribal entities, land owners, interest-based groups, and other stakeholders. It is not a one-time activity, but rather an ongoing process.

In 2014, Governor Jerry Brown declared a drought emergency and issued the CWAP, which the 2017 CVFPP Update and other DWR programs must support. The CWAP emphasizes operational and regulatory efficiency as well as sustainable and integrated funding opportunities. With regard to flood management specifically, the CWAP describes actions for increasing flood protection and the need for flood management projects to employ an integrated approach at a regional scale to achieve benefits. Table 1-1 shows how the CVFPP contributes to the actions set forth by the Governor.

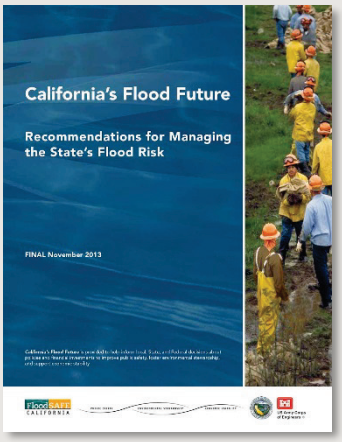
The *California Water Plan Update 2013* focused on three themes: integrated water management, government agency alignment, and investment in innovation and infrastructure. These themes are reflected in the flood management policy issues discussed in this 2017 CVFPP Update.

California's Flood Future offered several recommendations for improved statewide flood risk management (see box, California's Flood Future: Recommendations for Managing the State's Flood Risk). Ongoing work as part of DWR's Statewide Flood Management Planning includes building upon the *California's Flood Future*'s recommendations to provide a new approach to water and flood management, to address the issues facing the water management system, and to identify a sound investment strategy.

Table 1-1. CVFPP Support of the California Water Action Plan

California Water Action Plan Actions		CVFPP Contributions to Actions
Action 1.	Make conservation a California way of life	**CWAP Action 2:** The CVFPP and supporting documents (mentioned below) identify multi-benefit portfolios of investment that include integrated water management actions across local, regional, and State entities (Chapter 3). **CWAP Action 4:** The CVFPP Conservation Strategy (Conservation Strategy) identifies measurable ecosystem restoration objectives, and the 2017 refined SSIA investment portfolio includes ecosystem improvements (Chapters 2, 3, and 4). **CWAP Action 6:** Sacramento and San Joaquin Basin-Wide Feasibility Studies (BWFSs) identify improvements related to floodwater storage along with management actions to improve groundwater recharge (Chapters 2 and 3). **CWAP Action 8:** Increasing flood protection corresponds to the primary goal of the CVFPP (Chapter 1). **CWAP Action 9:** The Conservation Strategy addresses regulatory issues and efficiency. The Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum (OMRR&R TM) addresses flood operations, regulatory needs, and efficiency (Chapters 2 and 3). **CWAP Action 10:** The CVFPP Investment Strategy addresses sustainable funding needs and strategies (Chapters 2 and 4).
Action 2.	Increase regional self-reliance and integrated water management across all levels of government	
Action 3.	Achieve the co-equal goals for the Delta	
Action 4.	Protect and restore important ecosystems	
Action 5.	Manage and prepare for dry periods	
Action 6.	Expand water storage capacity and improve groundwater management	
Action 7.	Provide safe water for all communities	
Action 8.	Increase flood protection	
Action 9.	Increase operational and regulatory efficiency	
Action 10.	Identify sustainable and integrated financing opportunities	

California's Flood Future: Recommendations for Managing the State's Flood Risk



In 2013, *California's Flood Future* provided the first comprehensive look at statewide exposure to flood risk and outlined seven recommendations for improved statewide flood risk management. Developed through a partnership between DWR and USACE, it included cooperation and information provided by more than 140 local agencies throughout California, as well as State and federal agencies.

California's Future Report found that more than seven million people and $580 billion in assets (crops, buildings, and public infrastructure) are exposed to the hazards of flooding in California. The State's significant flood risk, variable flood conditions, and California's diverse geography require regional flood management approaches. The report's recommendations are directed to all local, State, and federal agencies with responsibility for land use planning, flood management, water resources, environmental habitat and ecosystem restoration, cultural and recreation resources, agriculture, and public safety. The recommendations are intended to guide discussions and encourage collaboration between public agencies, elected officials, and key stakeholders to achieve necessary policy reforms and program results. The recommendations are organized under the categories *Tools*, *Plans*, and *Actions*.

Tools

- **Risk assessments.** Conduct regional flood risk assessments to better understand statewide flood risk.
- **Flood risk awareness.** Increase public and policymaker awareness about flood risks to facilitate informed decisions.
- **Flood readiness.** Increase support for flood emergency preparedness, response, and recovery programs to reduce flood impacts.

Plans

- **Land use planning.** Encourage land use planning practices that reduce the consequences of flooding.
- **Regional, systemwide, and statewide planning.** Implement flood management from regional, systemwide, and statewide perspectives to provide multiple benefits.

Actions

- **Increase agency collaboration.** Increase collaboration among public agencies to improve flood management planning, policies, and investments.
- **Establish funding investment priorities.** Establish sufficient and stable funding mechanisms to reduce flood risk.

California's Flood Future identified the immediate need for more than $50 billion to complete flood management improvements and projects statewide (the needs identified in the 2012 CVFPP are included in this total). Further, it estimated that significant additional funding—approximately $100 billion in additional capital investment—is needed for flood management improvements and projects. DWR has built upon the work in *California's Flood Future* by initiating a new phase of work, which includes developing *Investing in California's Flood Future: An Outcome-Driven Approach to Flood Management*. This new report will expand understanding related to all the recommendations from *California's Flood Future*, while focusing on the last recommendation—establish sufficient and stable funding mechanisms to reduce flood risk—and how public understanding of risk awareness, water and related resource management planning, and regulatory and environmental compliance processes affect funding for flood management.

1.2.2 CVFPP Implementation Progress

Implementation of some flood improvements began in 2007, when bond funding provided a down payment toward SPFC improvements and extensive evaluations of SPFC facilities that were later included in the CVFPP. Since 2007, approximately 220 miles of urban and 100 miles of non-urban SPFC levees have been repaired, rehabilitated, or improved. From 2007 through 2012, on-the-ground construction began solving some critical levee problems, and management of the flood system began to improve.

Since adoption of the CVFPP in June 2012, flood management planning has progressed at the federal, State, and regional/local levels (see Chapter 2), and the implementation pace has been steady, enabled by the continued influx of bond funding for capital projects and recent general fund allocations targeted at addressing deferred maintenance. The State has continued investing in projects that are consistent with the SSIA, feasible, and ready to move forward, to the extent funding has been available. Table 1-2 shows the State's investment in Central Valley flood management from 2007 through 2016 by flood management program. This investment includes funding from Propositions 1E and 84 and from the general fund. Since passage of Propositions 1E and 84, significant progress has been made in implementing levee improvements and reducing flood risk, especially in urban areas.

Table 1-2. State Investments in Flood Management (2007–2016)

Program	Investment ($M)
Flood Management Planning	$375
Floodplain Risk Management	$170
Flood Risk Reduction Projects	$1,475
Flood System Operations and Maintenance	$180
Flood Emergency Response	$240
Total	**$2,440**

Note: Investments include expenditures and allocated funds for the SPFC as of October 2016, and do not include additional non-SPFC investments. Table reflects State investments only (not federal and local contributions).

Since 2012, three flood management improvement projects have been added to the SPFC in the *2017 State Plan of Flood Control Descriptive Document Update*, and implementation has progressed for multiple physical elements of the system (see box, SPFC System Updates).

Repairs, rehabilitation, and improvements (some ongoing) to the SPFC facilities include the following projects and efforts since 2012:

- Feather River West Levee Project
- Marysville Ring Levee Project
- Natomas Levee Improvement Program
- American River Common Features Project
- West Sacramento Levee Repair and Improvement Projects
- South Sacramento County Streams Group Project
- Mid-Valley Area Project
- Modernized Supervisory Control and Data Acquisition (SCADA) systems and controls for San Joaquin River hydraulic structures
- Six critical levee repairs (e.g., seepage repairs at Reclamation Districts 404 and 17).

The State also participated in the Folsom Dam Joint Federal Project (JFP), with construction of a new emergency spillway now underway that will provide benefits to the SPFC and will improve flood protection for the City of Sacramento along the American River. In addition to on-the-ground construction, forecast-coordinated operations (F-CO) has been implemented on the Yuba and Feather Rivers and is being initiated for reservoirs in the San Joaquin River Basin. Forecast-informed operations (F-IO) is advancing for reservoirs on the Yuba, Feather, and American Rivers to allow release of water in advance of major storm events. Multiple actions have been implemented to improve flood emergency preparedness and response, such as installation of new gaging stations and development of the Flood Emergency Response Information Exchange (FERIX) to better provide information to flood responders and provide funding for improved flood preparedness at the State and local levels.

SPFC System Updates

The *State Plan of Flood Control Descriptive Document* (DWR, 2010) includes a *detailed inventory and description* of the levees, weirs, bypass channels, pumps, dams, and other structures included in the SPFC. The SPFC Descriptive Document Update, as of 2017, includes the following additional projects in the SPFC:

- East levee Yolo Bypass (Mellin Levee)
- Lower Feather River Setback Levee at Star Bend
- Natomas Cross Canal South Levee Project

The *Flood Control System Status Report* (DWR, 2011) describes the *physical condition* of SPFC facilities. The 2017 Flood System Status Report includes a refined physical conditions baseline for levee, channel, and flood control structures and documentation of recent implementation progress.

Recent progress in CVFPP implementation includes repair, rehabilitation, and improvement of about 220 miles of urban SPFC levees (out of 300 miles) and about 100 miles of non-urban SPFC levees (out of 1,300 miles).

Interagency collaboration has begun to address the flood management policy issues highlighted in the CVFPP related to levee vegetation management and floodplain management in agricultural areas protected by the SPFC. CVFPB Resolution No. 2012-25 directed DWR to further develop the Levee Vegetation Management Strategy (LVMS) into a more comprehensive approach, and further directed that the approach be adaptive and responsive to the results of ongoing and future research regarding vegetation on levees, knowledge gained from levee performance during high-water events, and the need to conserve critical riparian habitat. DWR prepared an updated LVMS that is included as Appendix D to the CVFPP Conservation Strategy. Many of the approaches described in the

2012 LVMS are already being implemented, and others continue to be developed. DWR is further developing and refining levee vegetation management practices by utilizing the research findings that came out of the California Levee Vegetation Research Program (CLVRP). This partnership of policy makers, levee managers, and researchers in federal, State, and local agencies are working together to use the latest research and field expertise to inform levee management policies, improve maintenance practices, and reduce flood risk. A CLVRP work group is developing guidance that will provide DWR's levee maintainers with a structured, science-based process to manage levee vegetation on a risk-prioritized basis. DWR is also engaging with USACE during their legislatively mandated review and refinement of federal levee vegetation policy, striving to achieve compatibility between State and federal policies.

Programmatic Planning at Different Scales

The CVFPP is a strategic, long-range plan, and its updates describe a programmatic vision for flood system improvements over time and across the Central Valley at different scales. Policy issue recommendations are targeted to realize improvements in flood management across scales.

Systemwide or large-scale. Encompassing multiple regions and/or land use types up to the full extent of the flood management system in the Central Valley.

Regional-scale or medium-scale. The general scale of the regions defined through Regional Flood Management Planning (see Chapter 2) according to delineation by hydrologic and administrative boundaries.

Small-scale. A local area of limited geographic extent.

The Agricultural Floodplain Ordinance Task Force was also initiated following adoption of the CVFPP as collaboration between local and regional partners in the Sacramento River Basin. Through three work groups focused on different topics, this task force is developing a set of recommendations to improve Federal Emergency Management Agency (FEMA) and National Flood Insurance Program (NFIP) administration of rural-agricultural areas in the Central Valley. Recommendations were finalized in late 2016 to support the 2017 CVFPP Update.

1.3 Flood Management-Related Policy Issues Affecting Implementation of the CVFPP

Throughout this 2017 CVFPP Update, eight policy issues related to flood management are discussed, along with recommendations to address them and enable full implementation of the CVFPP across different scales (see box, Programmatic Planning at Different Scales). These issues were identified primarily through partner and stakeholder engagement on the CVFPP and major supporting efforts, and through coordination with CVFPP implementation programs, and are meant to clarify and supplement the policy issues identified in 2012. Each basic issue is introduced here, and subsequent chapters expand on them. Chapter 2 provides additional description and discusses stakeholder perspectives. Chapter 3 characterizes the issues as they relate to management actions, which in turn informs specific recommendations to address the issues as presented in Chapter 4.

Land use and Floodplain Management

Ongoing and planned development in the floodplain[1] continues to intensify flood risk.

Residual Risk Management

Flood risk can be reduced, but never eliminated. Commitment to enhanced resilience and public awareness falls short in many areas.

Hydraulic and Ecosystem Baselines and Program Phasing

Current regulatory practices hinder the ability to obtain credit for benefits of improvements made early in a long-term program in order to offset impacts that may occur later in the program, complicating phased system-scale implementation of CVFPP multi-benefit-improvements.

Operations and Maintenance of the Flood System

Underfunding and complex, time-consuming permits lead to a backlog of deferred maintenance and greater risk to life and property.

Multi-benefit Projects

Ineffective institutional frameworks have hindered implementation of multi-benefit actions.

Governance and Institutional Support

Overlapping authorities and conflicting mandates can complicate flood system improvements and maintenance, and are partially the result of existing governance structures, which are inadequate to support the broad range of actions included in the CVFPP.

Coordination with Federal Agencies

Federal agencies share responsibility for flood management, but complicated coordination, policies, funding, and approvals slow progress.

Funding

Insufficient and unstable flood management funding has led to delayed investment and greater risk to life and property.

[1] Floodplain is defined as an area adjacent to a stream or river that experiences occasional or periodic flooding. (DWR, 2012)

1.4 The Need for Sustainable Funding of Flood System Investments

In 2012, the SSIA identified $14 to $17 billion in needed flood system investments over 20 to 25 years. Based on the results of subsequent studies recommended in 2012 and completed for this update, the 2017 CVFPP Update provides an updated estimate of investments totaling $17 to $21 billion needed over the next 30 years. This update also includes an investment strategy that describes a portfolio of flood management actions intended to advance the goals of the CVFPP, and a funding plan that describes how these management actions could be funded. The CVFPP also establishes a basis for further developing the means to monitor and track outcomes that demonstrate the value of State investments and improve efficiency of these investments over time.

Expectations for managing the flood system for multiple benefits are far greater today than in the past.

Expectations for managing the flood system for multiple objectives are far greater today than they have been in the past; the desire for a multi-benefit flood system managed with sustainability in mind has increased with time. Flood system managers are increasingly tasked with managing the flood system to reduce flood risk while simultaneously providing ecosystem and other benefits. Measures that enhance flood system resilience can offer a means to reduce risk, promote multiple other benefits, and advance the ultimate goal of sustainability. However, managing a sustainable flood system that provides multiple benefits in perpetuity is not only difficult to achieve within today's regulatory framework, but it is also expensive. California's historical funding patterns have consistently funded water supply and water quality—water management functions that affect people daily—much more robustly than flood management and aquatic ecosystem restoration (Figure 1-1).

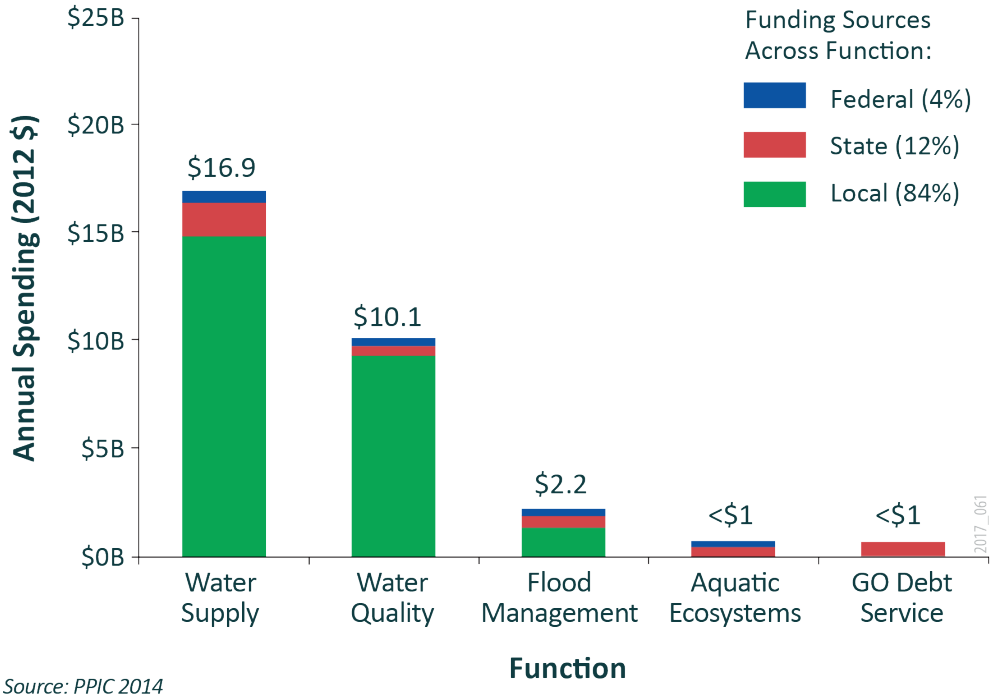


Figure 1-1. Water Management Sector Spending by Function

Yearly water-related spending in California by funding source, 2008 through 2011 (2012 $)

Source: PPIC 2014

In contrast to other water management functions, the benefits of flood risk management are realized only as a result of infrequent and otherwise devastating flood events. This results in the public's perception of risk waning as non-flood years pass. Nevertheless, the risk has increased over time. With future population growth in the Central Valley and a lack of sufficient and sustained investments in the flood management system, the risk to life and property will continue to increase.

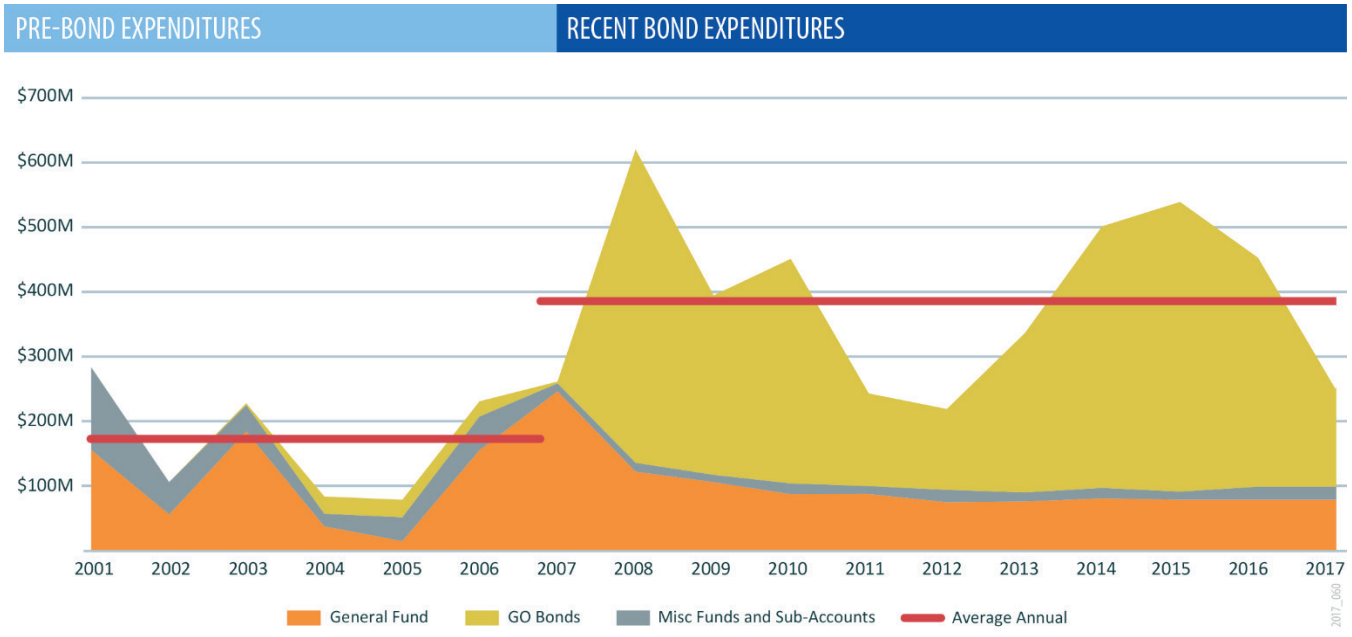
Flood risk poses a threat to public safety, and the State is obligated to be a responsible steward of public monies spent in California. At the same time, flood disasters have proven increasingly costly, both in California and across the country. These realties underscore the State's fundamental interest in advancing proactive investments in the flood system.

In recent years, implementation of flood system improvements has been enabled by funding from general obligation bonds (Figure 1-2). However, bond funding by nature is short-lived, and this temporary boost is coming to an end. Considering a range of possible funding and financial scenarios, current funding mechanisms at historical spending levels (State General Fund, USACE, and local funds) could provide $4 to $5 billion toward CVFPP implementation over the next 30 years (see Chapter 4). When compared to the $17 to $21 billion required for full implementation—which includes providing for multiple benefits, where feasible—it is clear that current funding is starkly insufficient to meet public expectations for meaningful flood risk management in the Central Valley. Substantially more funding and greater efficiency are required.

Current funding is starkly insufficient to meet public expectations for meaningful flood risk management in the Central Valley.

To achieve sustainable funding for flood system investments, changes in funding and project implementation approaches are required, as well as unprecedented funding commitments from current funding mechanisms at all levels of government (see Chapter 4).

Figure 1-2. Recent Trends in Statewide Flood Management Expenditures



1.5 What Is in This Update?

The following chapter overviews highlight key ideas and discussions in this update of the CVFPP.

- **Chapter 1, Updating the Central Valley Flood Protection Plan:** Introduces the 2017 CVFPP Update, describes implementation progress and what has changed since 2012, identifies policy issues relevant to the CVFPP, and introduces the need for sustainable funding of flood system improvements.

- **Chapter 2, Refining the State Systemwide Investment Approach:** Describes the planning process and studies used to develop the 2017 CVFPP Update with a refined SSIA, including robust stakeholder communications and engagement and perspectives on flood management policy issues.

- **Chapter 3, Strategies to Improve System Management:** Describes refinements to the SSIA considering the progress of recent implementation and planning efforts, lays out management action categories at the systemwide, urban, rural, and small communities levels along with their potential to provide outcomes to achieve the CVFPP goals, and discusses the necessary policy and financial conditions for effectively implementing the CVFPP.

- **Chapter 4, Funding and Implementing the 2017 Refined SSIA Portfolio:** Provides a summary of refined SSIA investment costs, funding, financing, and timing of delivery through DWR implementation programs. This chapter also summarizes the need to support monitoring and tracking of the outcomes from CVFPP implementation and demonstration of return on investment to California taxpayers. Finally, the chapter concludes with the plan for moving forward and a summary of key flood management policy recommendations for continuing implementation of the CVFPP.

The 2017 CVFPP Update adopted by the CVFPB comprises this updated plan document, the *2017 State Plan of Flood Control Descriptive Document Update*, and the *2017 Flood System Status Report* to meet the CVFPP content requirements of the Central Valley Flood Protection Act of 2008. In addition, the CVFPB has adopted the *2016 CVFPP Conservation Strategy*. More information relating to the adoption of these documents can be found in CVFPB Resolution No. 2017-10 (Appendix A). The 2017 CVFPP Update also contains information that has been integrated into the plan from a variety of supporting documents that were each created to inform and provide content for this update. These supporting efforts are available on the CVFPB and DWR websites, and are described in the Appendix B, Legislative Reference and Reader's Guide.

The CVFPP provides the framework for understanding how diverse local, State, and federal interests fit into a systemwide flood management approach.

Refining the State Systemwide Investment Approach

Chapter 2

The approach for developing the 2017 CVFPP Update over the last 5 years focused on refining the SSIA through several technical studies, regional plans, and flood management system document updates completed since 2012, all supported with robust and ongoing communications and engagement with partners and stakeholders. This update process brings together technical and policy-level information to refine the SSIA and its associated cost estimates, funding, and phasing over the next 30 years. The resulting 2017 refined SSIA portfolio provides a comprehensive set of management actions and investments needed to manage flood waters for the SPFC and produce desired outcomes in the Central Valley.

2.1 2017 Central Valley Flood Protection Plan Update Development

State participation and investment in water resources management in California is driven largely by societal values for the people of California, including public health and safety, a stable economy, sustainable vital ecosystems, and opportunities for enriching experiences, in alignment with the *California Water Action Plan*, *California Water Plan*, and *California's Flood Future*. All DWR water management programs—the CVFPP included—play specific roles in helping the State support these societal values. The relationship between the CVFPP's goals and societal values for water management is shown in Figure 2-1. Demonstrating the CVFPP's contribution to supporting these values is important for securing increased investment in, and sustainable funding for, SPFC improvements.

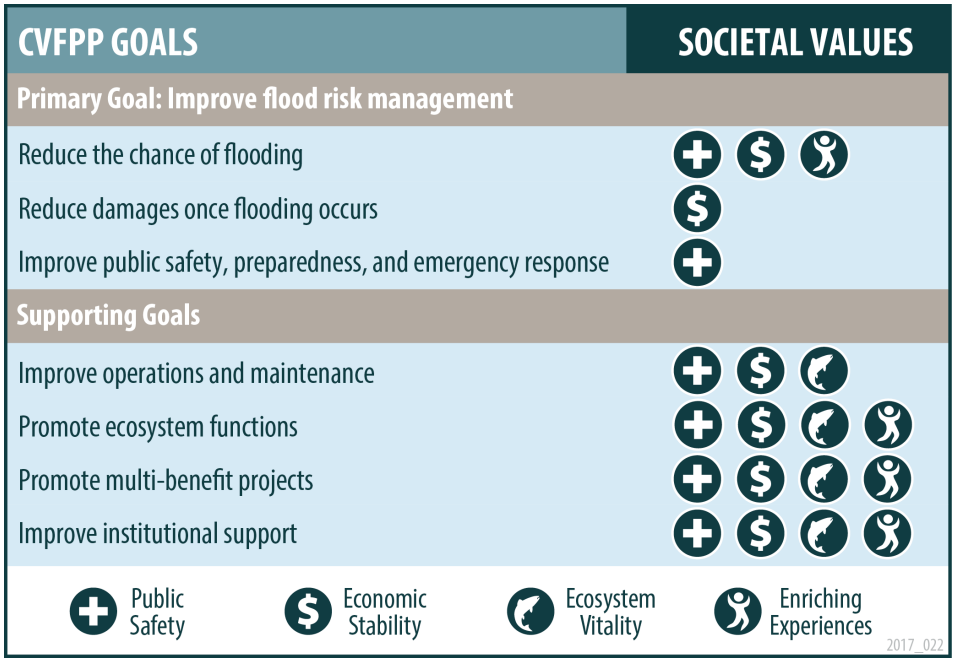
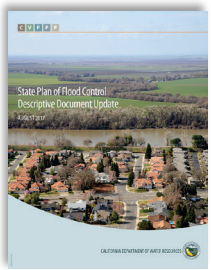


Figure 2-1. Societal Values Supported by Each CVFPP Primary and Supporting Goal

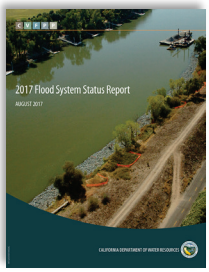
2.1.1 CVFPP Planning Progress

Beyond the implementation progress described in Chapter 1, planning has advanced since 2012 to support this update. The CVFPP planning process brought together many partners, stakeholders, and flood-management-related efforts in the Central Valley to converge on a common, outcome-driven vision that guides State investments. Some efforts focused on rigorous technical analysis to refine a broad array of management actions consistent with the plan, while others addressed the need for more effective implementation, such as developing an investment strategy for identifying funding needs and mechanisms. Brief overviews of many of these supporting planning efforts follow. Further description of how these efforts meet the requirements of the Central Valley Flood Protection Act of 2008 and support and inform development of the CVFPP is included in the Appendix B, Legislative Reference and Reader's Guide.



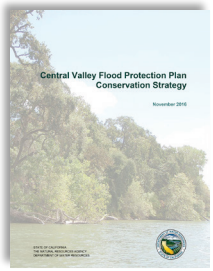
2017 State Plan of Flood Control Descriptive Document Update

The 2010 State Plan of Flood Control Descriptive Document (SPFC Descriptive Document) was the first inventory of the SPFC compiled in a single report. It identified and describes SPFC components (facilities, lands, programs, plans, conditions, modes of O&M) in accordance with the requirements of the Central Valley Flood Protection Act of 2008. In 2017, it was updated based on recent documentation and implementation progress to inform preparation of the 2017 CVFPP Update.



2017 Flood System Status Report

The 2017 Flood System Status Report (FSSR) describes the current physical condition of SPFC facilities as of 2016 at a systemwide level as an update to the Flood Control System Status Report (FCSSR) developed in 2011, pursuant to requirements of the Central Valley Flood Protection Act of 2008. The 2017 FSSR supports development of the 2017 CVFPP Update and guides future inspection, evaluation, reconstruction, and improvement of SPFC facilities.



2016 CVFPP Conservation Strategy

The 2016 CVFPP Conservation Strategy is a non-regulatory document that provides measurable ecological objectives and long-term approaches for improving riverine and floodplain ecosystems through multi-benefit projects that include ecosystem restoration and improvements, and operations, maintenance, repair, rehabilitation, and replacement (OMRR&R). The Conservation Strategy provides a wealth of data and information to support 2017 CVFPP Update development by guiding the integration and improvement of ecosystem functions associated with flood-risk-reduction actions, and providing the basis for recommending conservation actions for the SPFC. The Conservation Strategy's measurable ecological objectives will guide and support monitoring and tracking of contributions to the CVFPP's supporting goal of promoting ecosystem functions over time. The Conservation Strategy is discussed further in Section 2.1.2.

CVFPP Supplemental Program Environmental Impact Report

Prepared in compliance with the California Environmental Quality Act (CEQA), the Supplemental PEIR analyzes the refined SSIA at a program level for the 2017 CVFPP Update. The Supplemental PEIR describes the likely impacts and benefits of the refined SSIA and ways to avoid, reduce, or mitigate any adverse effects.

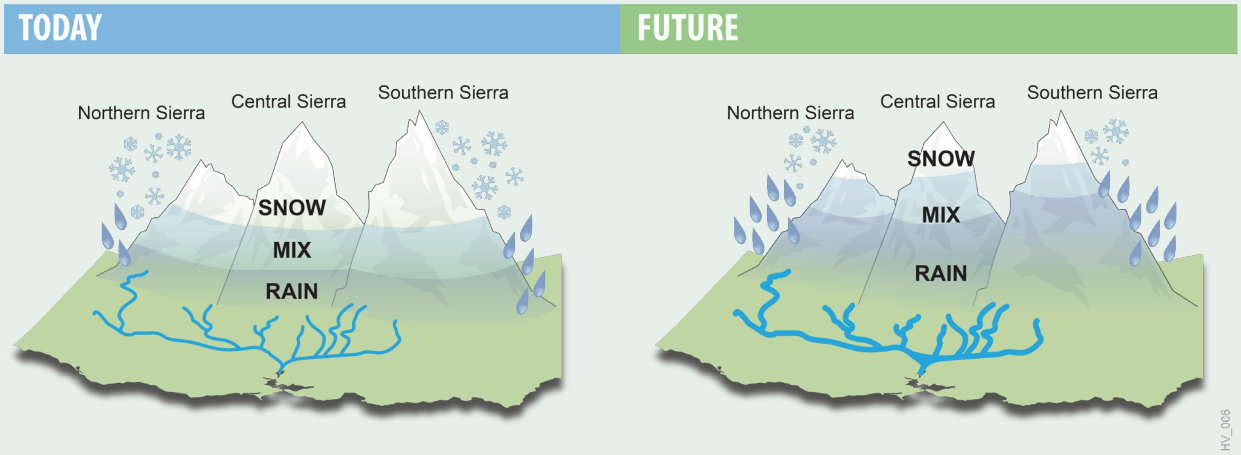
Draft Sacramento River and San Joaquin River Basin-Wide Feasibility Studies

Two BWFSs were completed to refine the scale and location of large-scale system improvements identified in the 2012 CVFPP for each basin. The BWFSs identify system improvements that can be further developed in ongoing or new federal cost-share feasibility studies, and inform the 2017 CVFPP Update and its funding plan (part of the CVFPP Investment Strategy TM). Section 2.1.2 describes the scope of each BWFS. The BWFSs provide a substantially more detailed description of potential systemwide improvements than was available for the 2012 CVFPP.

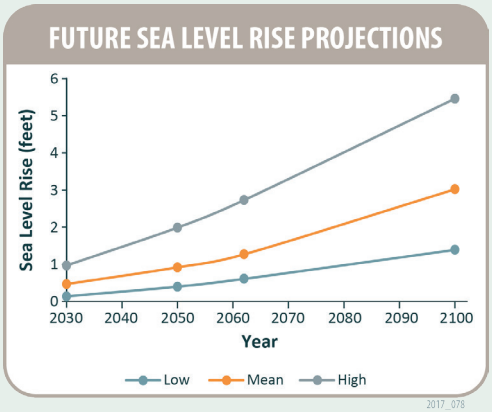
Climate Change Considerations for CVFPP

In accordance with State[1] and federal[2] policy and technical guidance, the 2017 CVFPP Update draws upon the latest climate science and understanding to assess the effects of sea-level rise and the hydrological impacts in the Central Valley. These analyses use the CMIP5[3] climate model data, which are the basis for the IPCC AR5[4] report. Analyses provide estimates of potential changes in unregulated flows throughout the Central Valley based on refined hydrologic modeling using the Variable Infiltration Capacity (VIC) hydrological model.[5] These climate projections informed the technical analyses used for the 2017 CVFPP Update (described in Chapter 3). The climate change analyses provided these key findings:

- Projections of increased warming are consistent for the entire planning area.
- Extreme precipitation—the driver for most flood events—is likely to intensify, even with projections of overall drier conditions.
- Changes in flood magnitudes and frequencies are projected to vary from north to south in the Central Valley. Watershed characteristics strongly influence the hydrological response to climate change, with the high-elevation San Joaquin watersheds showing the largest percentage increases in flood volumes due to a reduction in precipitation falling as snow and more rapid snowpack melting.



Future sea level rise projections would impact flood water levels throughout the San Francisco Bay-Delta and the lower San Joaquin and Sacramento River watersheds. The 2017 CVFPP Update modeling draws upon the National Research Council reported sea level rise projections in 2030, 2050, and 2100 (NRC, 2012). Analyses of potential future conditions for the Delta and lower reaches of the San Joaquin and Sacramento river basins used the mean sea level rise projection for 2067 at the Golden Gate Bridge, which was calculated based on these projections, as shown in the chart.



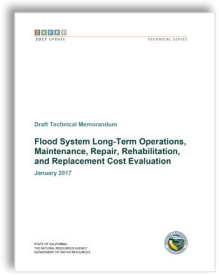
[1] Governor Brown's Executive Order B-30-15 and AB 1482 require State agencies to account for climate change in project planning and investment decisions.
[2] Executive Order 13690 applies to Federal actions such as Federal grants used for repair and rehabilitation after a disaster.
[3] Coupled Model Intercomparison Project Phase 5 (CMIP5) (Taylor et al., 2012)
[4] Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC, 2013)
[5] Variable Infiltration Capacity (VIC) Hydrological Model (Liang et al., 1994, 1996; Nijssen et al., 1997)

Regional Flood Management Plans

DWR funded six regionally led Regional Flood Management Plans (RFMPs) that describe local and regional flood management priorities, challenges, and potential funding mechanisms along with site-specific improvement needs. These plans provide valuable perspectives from regional and local flood managers that help inform and align CVFPP investment strategies and implementation. The RFMPs also provided a platform for meaningful engagement among DWR and local and regional flood planners across the Sacramento River and San Joaquin River basins. The RFMPs are discussed further in Section 2.1.2.

Draft CVFPP Investment Strategy Technical Memorandum

The Investment Strategy TM considers the complete portfolio of actions in the 2017 CVFPP Update and proposes phased investment consistent with the refined SSIA. New and existing State, local, and federal funding mechanisms are examined in the development of multiple scenarios that vary in range of timing and level of funding needed to implement the SSIA over 30 years. The Investment Strategy TM provides recommendations to the State, federal, and local partners to guide successful implementation of the CVFPP.



Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum

An interagency work group developed an estimated full cost of long-term OMRR&R of SPFC facilities. This document represents the first effort to gather a systemwide view of OMRR&R needs across multiple maintaining agencies, including DWR and local maintaining agencies (LMAs). It documents existing practices, challenges, and key issues related to OMRR&R of the SPFC, and it describes the existing annual funding shortfall of approximately $100 million for proper OMRR&R of the SPFC.

Draft CVFPP Climate Change Analyses

Using the latest climate science and understanding, these analyses identify and evaluate potential future climatic and sea level rise changes in the Central Valley. The climate change analyses inform quantitative estimates of performance of the CVFPP over time (described in Chapter 3) and provide flood management system managers with important information on potential effects of climate change. See the box titled *Climate Change Considerations for CVFPP* for additional description of these analyses.

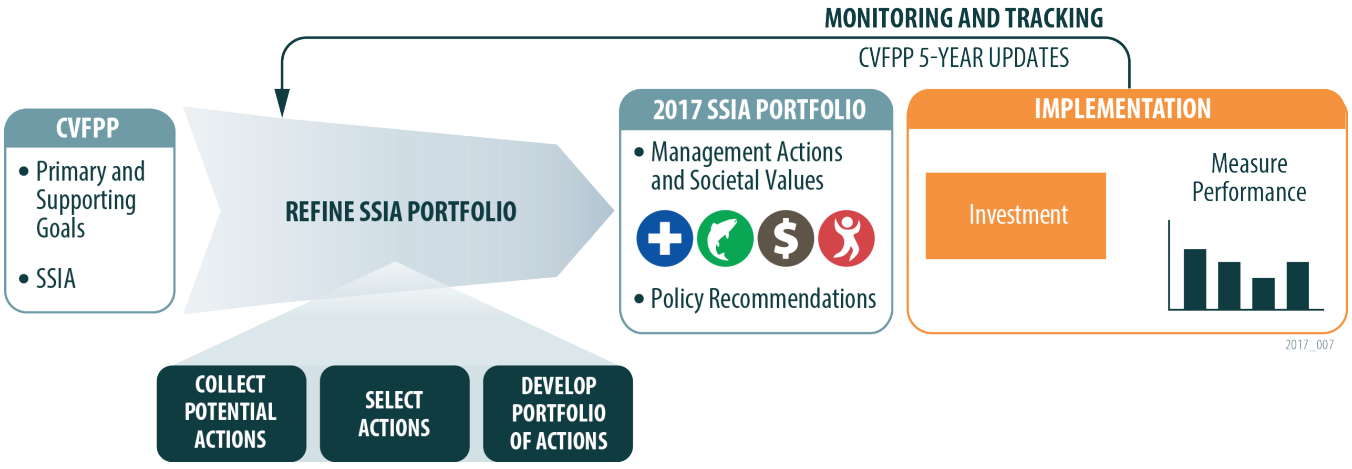
2.1.2 Refining Flood Management Solutions

Development of the 2017 refined SSIA portfolio included frequent communications, collaboration with partners and stakeholders, and planning to update and refine many potential CVFPP management actions into a diverse selection of actions that are consistent with the SSIA. The essential development steps of the 2017 CVFPP Update shown in Figure 2-2 can serve as a template for future CVFPP updates. The planning process is iterative, with continuous work and engagement among State, federal, and local agency partners and with other stakeholders as the CVFPP is developed and implemented through DWR's flood management programs.

For the 2017 CVFPP Update, potential management actions originally identified in the 2012 CVFPP were updated and refined by the following efforts over the past 5 years:

- The State refined and updated **large-scale management actions** in the San Joaquin River and the Sacramento River BWFSs.
- USACE led State-federal feasibility studies for the **medium- or regional-scale actions** in the urban areas protected by the SPFC.
- Regional stakeholder groups refined and updated **small- and medium-scale actions** (and provided the regional perspective on refinement of large-scale actions) through their six RFMPs.
- The CVFPP Conservation Strategy provided the **guidance, data, and tools for multi-benefit planning to promote ecosystem functions** associated with flood risk management projects. The Draft Conservation Strategy informed development of the BWFSs (see Chapter 3) and began to inform development of the RFMPs after it was released. It also identified ecological metrics for measuring, monitoring, and tracking contributions to the CVFPP supporting goal to promote ecosystem functions.

Figure 2-2. The 2017 Central Valley Flood Protection Plan Update Development Process



These sources of information were used to assemble a collection of potential CVFPP management actions. The collection was then checked for consistency with the SSIA and used to develop a 2017 refined SSIA portfolio. The development process also involved analyzing and describing the quantitative and qualitative outcomes, priorities, phasing, and funding of the 2017 refined SSIA portfolio. The following discussion elaborates on the **process of refining the SSIA** for that portfolio, and Chapters 3 and 4 elaborate on the **contents of the portfolio, investment, and implementation**.

Collection of Potential Management Actions

The SSIA envisioned a broad suite of actions that provide multiple benefits to the SPFC. The BWFSs, State-federal feasibility studies, and RFMPs resulted in a collection of potential CVFPP management actions. The BWFSs and RFMPs also included ecosystem restoration or enhancement actions that were guided by the Conservation Strategy. The following discussion describes the purpose and scope of these efforts to refine the SSIA in 2017.

Draft Basin-Wide Feasibility Studies

CVFPB Resolution 2012-25 prescribed development of the Sacramento River BWFS and the San Joaquin River BWFS to refine the scale and location of system improvements identified in each basin. DWR led the two BWFSs and prepared reports for each basin that evaluate actions with the potential to benefit large areas of the flood management system that encompass multiple regions and land use types (e.g., urban, rural, and small communities).

The Draft Sacramento River BWFS primarily evaluates multi-benefit options for improving the Sacramento River bypass system, including potential expansion of the Yolo Bypass, Sacramento Bypass, and Sutter Bypass, as well as the potential for creating a new Feather River bypass. It includes detailed evaluations of various combinations of levee setbacks, weir expansions, new bypass channels, and flood storage opportunities, with integrated ecosystem restoration or enhancement actions to refine the scale and locations of systemwide improvements identified in the 2012 CVFPP.

The Draft San Joaquin River BWFS evaluates potential systemwide multi-benefit improvements, including expansion of Paradise Cut; reservoir management strategies, including conjunctive use, increasing objective release, and operational changes (FI-O, and FC-O); and large-scale conveyance (Cross Valley Canal, conveyance to O'Neil Forebay). Because of the unique characteristics of the San Joaquin River Basin with lower peak flood flows than the Sacramento River Basin, the San Joaquin River BWFS also evaluated large-scale regional management actions such as levee improvements in Stockton, levee and hydraulic structure improvements around Firebaugh, and transitory storage at the Three Amigos and Dos Rios/Hidden Valley Ranch sites.

The specific management actions identified and analyzed by DWR as part of the BWFS were included in the collection of potential CVFPP management actions. The BWFS results and refinements are presented in Chapter 3, and the cost estimates, priorities, and implementation phasing are included in Chapter 4.

Multi-Benefit Projects

Multi-benefit projects are designed to reduce flood risk and enhance fish and wildlife habitat, as well as create additional public benefits such as sustaining agricultural production, improving water quality and water supply reliability, increasing groundwater recharge, supporting commercial fisheries, and providing public recreation and educational opportunities, or any combination thereof.

Stakeholder engagement played an important role in developing recommendations to move forward on potential multi-benefit projects in both BWFSs (see box definition). Engagement focused on discussions about the formulation process, including input data, technical study methods, and results. DWR regularly briefed the CVFPB, USACE, and stakeholders in the six regional planning areas, including members of the agricultural and environmental communities.

State-Federal Feasibility Studies

State-federal feasibility studies and their approval by the USACE Civil Works Review Board (Review Board) play a major role in securing funding for federal projects. During the last 5 years, USACE has undertaken several feasibility studies primarily in urban areas protected by the SPFC and completed the American River Common Features and the West Sacramento River General Re-Evaluation Report (GRR) feasibility studies. These two feasibility studies were reviewed by the Review Board in December 2015, and the Review Board recommended USACE support for the projects. Chief's Reports on these two projects are being prepared by USACE. The Chief's Report is the formal tool for USACE to communicate its recommendations to Congress for project construction authorization and eventual appropriations.

A third feasibility study is being completed for the Stockton urban area and is scheduled to be submitted to the Review Board in November 2017. These three projects are all moving closer to providing 200-year protection for major urban areas in the Central Valley.

Regional Flood Management Planning

DWR launched and funded a regionally led effort to help local agencies develop comprehensive plans that describe local flood management priorities, challenges, and potential funding mechanisms, and define site-specific improvement needs. (Regional boundaries are shown in Map 2-1.) Six RFMPs were completed by 2015 and subsequently reviewed by DWR for development of the 2017 CVFPP Update. Each RFMP addressed infrastructure performance, OMRR&R, emergency management, governance, environmental compliance, regional priorities, and funding.

Together, the six RFMPs identified over 500 management actions totaling an approximate cost of $14 billion. Despite being constrained to using existing information without new analyses or investigations, the RFMPs represent the most comprehensive thinking about local flood management challenges and opportunities and illustrate a breadth of potential flood management investments across the Central Valley.

Not all management actions identified in the RFMPs are consistent with the goals and policies of the CVFPP. However, DWR considered all collected RFMP information when developing the 2017 refined SSIA portfolio. The cost estimates, timelines, and other details provided by RFMPs helped DWR forecast investment need and articulate priorities in specific geographic areas.

Throughout the 2017 CVFPP Update planning period, DWR met regularly with RFMP representatives to discuss and refine local flood management actions and share technical information and updates about DWR-led CVFPP supporting efforts, including the BWFS and Conservation Strategy. These discussions formed the backbone of a Central Valley–wide discussion regarding how both State- and locally-led efforts will contribute to the improvement and long-term success of CVFPP implementation.

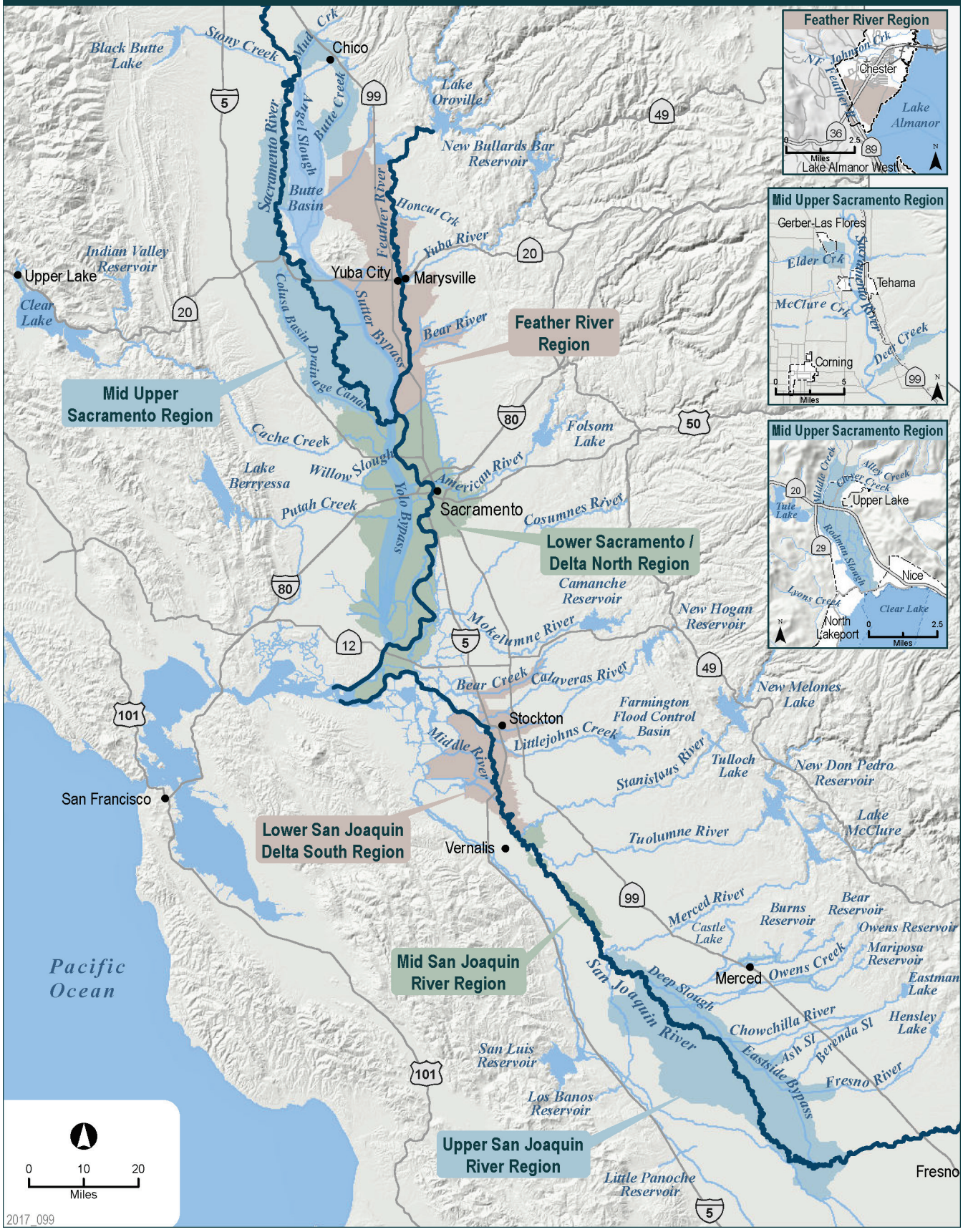
Collecting Management Actions through Regional Planning

Regional flood management planning represents an unprecedented partnership and level of engagement among the State and local and regional flood planning entities across the Sacramento River and San Joaquin River basins. In addition to providing funding for the effort, DWR has been working closely with the six regions since adoption of the 2012 CVFPP and will continue this interaction following adoption of the 2017 CVFPP Update. The CVFPB has also been instrumental in engaging a broad range of stakeholders in the RFMP process through monthly Coordinating Committee meetings.

2016 CVFPP Conservation Strategy

The 2016 Conservation Strategy supported and informed development of the 2017 CVFPP Update by guiding the integration and improvement of ecosystem functions associated with flood-risk-reduction actions and by providing the basis for conservation action recommendations for the SPFC. It provides specific, measurable objectives and long-term approaches for improving riverine and floodplain ecosystems through multi-benefit projects that include ecosystem restoration or enhancements and could assist with improving the environmental permitting process. Application of the Conservation Strategy during plan formulation demonstrates potential to provide ecological benefits associated with flood management system improvements.

Map 2-1. Flood Management Planning Regions in the Central Valley



Through the BWFSs, ecosystem restoration concepts for larger-scale flood management system features (such as the Yolo Bypass and Paradise Cut) have been developed, representing the application of the Conservation Strategy and its measurable objectives in those areas. After the draft became available, the Conservation Strategy began to inform RFMP development and continues to guide DWR's prioritization of multi-benefit projects. The Conservation Strategy will continue to inform future phases of RFMP development as funding and other resources allow. Assuming the availability of funds, DWR, in coordination with regional partners, will evaluate the extent to which habitat projects included in the RFMPs contribute to ecological objectives of the CVFPP.

Selection of CVFPP Management Actions

After potential CVFPP management actions were identified and collected, they were assessed using a set of basic criteria. The primary criterion was consistency with the SSIA, for which all actions identified in the six RFMPs and two BWFSs were assessed as part of the 2017 CVFPP Update. In addition, the BWFSs assessed potential management actions for consistency with planning constraints and their potential to meet CVFPP goals and objectives.

The assessment process resulted in a selection of actions organized by basin and region, with potential projects characterized by scale and anticipated implementation timeline. Any actions not selected for the 2017 CVFPP Update, including multi-benefit projects recommended by the RFMPs, may be further developed or refined for consideration in future CVFPP updates. For more details on the selection of CVFPP Management Actions, please refer to the draft CVFPP Investment Strategy TM.

A Refined SSIA Portfolio

The 2017 refined SSIA portfolio comprises management actions each organized by one of four areas of interest (systemwide, urban, rural, and small community) that align with existing DWR flood management implementation programs. Each portfolio was assessed for how its management actions support the four broader societal values.

As mentioned in Chapter 1, the 2017 refined SSIA portfolio represents the updated programmatic vision for the SPFC, and is not a funding decision, permitting decision, or endorsement of specific projects. Chapter 3 presents the 2017 refined SSIA portfolio of actions, along with a description of related flood management policy issues affecting implementation of those actions.

Implementation of the SSIA Portfolio

Implementation of the CVFPP as a whole will be achieved in coordination with federal, State, and local agencies and programs. The State will implement projects with our partners as funding is secured and as projects mature from planning to design, permitting, and construction. DWR has five major programs with specialized roles in CVFPP implementation. These programs are discussed further in Chapter 4 to highlight their roles in project implementation.

- Flood Management Planning
- Floodplain Risk Management
- Flood Risk Reduction Projects
- Flood System Operations and Maintenance
- Flood Emergency Response

The 2017 refined SSIA portfolio demonstrates that investment in flood management improvements across all areas of interest should be increased with a changing distribution among them over time compared to existing investments. Figure 2-3 shows that under the existing investment distribution, urban and regional improvements currently receive the greatest levels of flood management investment. Under the desired (updated) investment distribution, urban and regional improvements would continue to receive the greatest investment, but rural, small community, and systemwide investments would ramp up relatively more over the next 30 years as those urban and regional improvements are completed to result in a more resilient flood management system (Figure 2-3). Considerations for implementing the 2017 refined SSIA portfolio, including the funding plan, are the focus of Chapter 4.

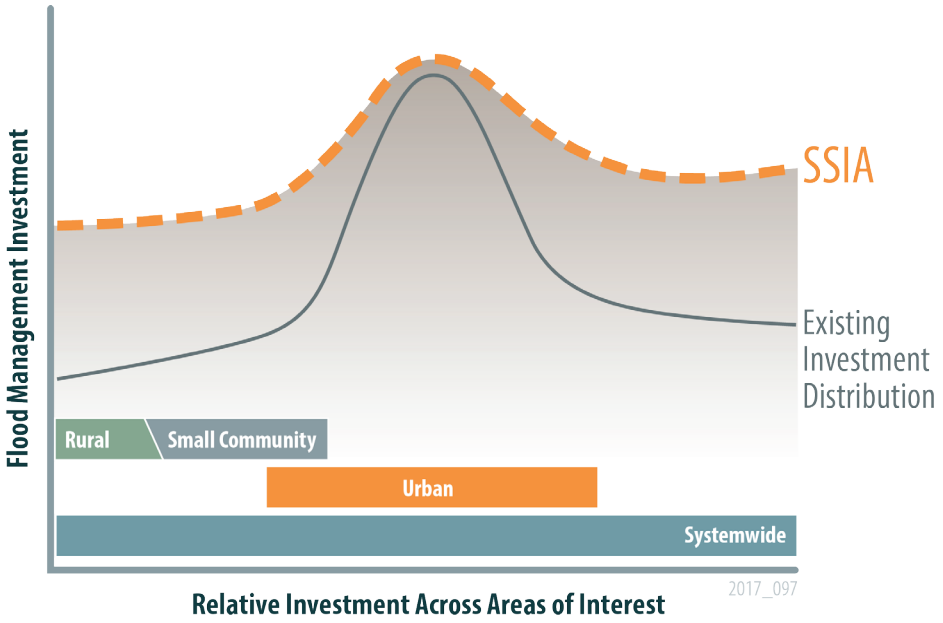


Figure 2-3. Current and Desired Investment Distribution Among Implementation Areas of Interest

Flood Risk Objectives

The objective flood protection targets associated with urban areas were specified by the Legislature as 200-year level of protection (0.5% probability of flooding per year or less for urban areas). For small communities, 100-year protection (1% probability of flooding per year or less) is an unofficial target established by Congress' 1968 National Flood Insurance Act, under which communities that voluntarily participate in the National Flood Insurance Program are no longer subjected to mandatory flood insurance.

While the Legislature or FEMA did not require a specific level of protection for rural-agricultural levees, DWR recommends an approach without numerical targets to repair distressed levees as needed to sustain existing land uses or consider levee setbacks to provide multiple benefits associated with different land uses.

CVFPP investments are prioritized based on flood risk and life safety, when funding is available. Therefore, levee improvements included in the CVFPP contain an emphasis on addressing seepage where life safety is a concern in urban areas and small communities, as seepage is a primary cause of failure. This is a major change from historical flood protection plans such as the Jackson Plan, which emphasized channel capacities and levee geometry. Still, without specific numerical targets for rural areas, much effort remains to repair distressed levee sites in rural areas, and to develop and implement more robust emergency response to reduce flood risk. The CVFPP recognizes that the risk of flooding can never be eliminated, and investments in residual risk management remain a critical part of the State's approach to achieving the primary goal consistent with the Central Valley Flood Protection Act of 2008.

Flood risk objectives associated with system-scale actions such as those studied in the BWFSs also contribute to improved flood protection in rural areas. These include improving the flood conveyance capacity and reducing flood stages in the flood management system while improving flood system resiliency and facilitating adaptation to future climate and land use changes. System-scale actions are also formulated to meet ecosystem and related multi-benefit objectives.

Accountability Through Performance Tracking of Outcomes

The CVFPP shifts focus away from discrete, disconnected actions and toward intended outcomes with strategic and systemwide effect. This offers greater value for State investment over time in three important ways:

- **Funding:** An improved framework for setting intent, articulating dependencies between management actions and outcomes, and tracking effectiveness provides a way to more clearly demonstrate the value of flood management to California taxpayers, and has the potential to lead to stable funding for flood management.
- **Effectiveness:** Setting clear intent, and then tracking results over time, improves our ability to course-correct. This ultimately makes the system more effective as assumptions are tested and actions based on observed relationships and results are improved.
- **Local-State Partnerships:** When flood system funding is linked to intended outcomes, the State interest is communicated to stakeholders. This offers stakeholders the opportunity to apply local expertise and perspectives for more successful partnerships when applying for funding/cost shares.

As management actions are implemented, progress toward achieving the CVFPP goals can be measured. Performance tracking of outcomes associated with the CVFPP is aligned with the following societal values:

- Provide public health and safety
- Support ecosystem vitality
- Support a stable economy
- Provide opportunities for enriching experiences (other benefits)

Achieved outcomes must be tracked, measured, and compared to intended outcomes. Performance tracking is what allows the planning cycle to continually inform a new collection of potential CVFPP management actions. Information gained through performance tracking will provide opportunities to make adjustments for continued evolution toward ever greater flood management effectiveness and continued evolution toward a more resilient flood system that delivers broad, sustained benefits over time. Performance tracking also provides a system of accountability and a method for demonstrating return on investment for the California taxpayer.

For the CVFPP, specific outcomes contributing to the ultimate goal of sustainability have been formulated in the context of achieving the CVFPP primary and supporting goals. The outcomes are intended to be actionable, measurable, and attainable within the life of the CVFPP. Measurable objectives were developed for some outcomes that more specifically describe the extent to which they are being attained. These descriptions can support project formulation, funding and management decisions, and serve as yardsticks for measuring progress in implementation. These objectives are intended to serve as a framework for evaluating progress over time and are not mandated performance criteria.

Contributions to measurable objectives over time can be guided by numerical targets applicable at regional and systemwide scales. As part of achieving the CVFPP primary goal of improving flood risk management, the CVFPP referenced existing targets for 100-year level of flood protection for small communities and 200-year level of protection for urban areas (see also Table 3-2, Refinements to Physical and Operational Elements in the State Systemwide Investment Approach). The 100-year level of flood protection for small communities serves as the nationwide de facto standard for communities that choose to participate in the NFIP as established in 1968. The 200-year level of protection for urban areas was established for urban communities in the Central Valley Flood Protection Act of 2008, which also directed development of the CVFPP. This plan serves to estimate the costs and implementation approach to achieve the 2008 legislative objective. The CVFPP does not include a specific level of protection for rural-agricultural areas, leaving more flexibility to improve the system over time for multiple benefits in a cost-efficient manner commensurate with the value of assets at risk.

Development of Measurable Ecological Objectives

As part of achieving the CVFPP supporting goals, the Draft CVFPP Conservation Strategy developed non-regulatory measurable objectives to serve as a framework for evaluating progress toward recovery of native species over time. Measurable objectives were developed considering data such as historical and existing vegetation, and potential opportunities identified by DWR and local/regional partners. Attainment of these objectives depends on future funding and on contributing actions by the multiple organizations implementing flood projects and operating and maintaining the SPFC. The process for developing these objectives and monitoring and tracking performance is challenging, and relies on an adaptive management approach to learn from project outcomes, adjust future projects, and improve the process over time.

As part of achieving the CVFPP supporting goals, the CVFPP Conservation Strategy includes specific metrics to measure contribution to conservation goals and non-regulatory numerical targets at regional (according to Conservation Planning Areas) and systemwide scales for the CVFPP to contribute to recovery of native species (Draft CVFPP Conservation Strategy Appendix L). These metrics are to be used to support future planning, tracking, and reporting of ecosystem vitality outcomes. In conjunction with 5-year updates to the CVFPP, these targets are iterative in nature and may be updated and reevaluated and revised as necessary, based on improvements to scientific understanding and further evaluation of opportunities for multi-benefit flood management projects, and future collaboration with regional partners. The ecological measurable objectives will be updated as part of the 2022 CVFPP Update to reflect the projects identified in the RFMPs and through further collaboration with the RFMPs. Contributions to other multi-benefit outcomes for the CVFPP (such as recreation and water supply) are not guided by numerical targets. Monitoring and tracking of all outcomes related to the CVFPP is a challenging process, and relies on adaptive management by DWR and our partner agencies to improve the process over time in support of future plan updates.

It is important that CVFPP updates describe progress toward achieving the CVFPP primary and supporting goals over time, and also show how meeting those goals can contribute to broader societal values. Central Valley flood management is primarily intended to contribute to these goals by helping to minimize lives lost from flooding and contribute to the economic stability of local communities, the region, and the State. At the same time, the CVFPP is expected to provide opportunities for ecosystem and other multi-benefits associated with flood system improvements (such as recreation and other enriching experiences). Characterizing management actions' ability to contribute to these outcomes of broader public interest is key to raising State funds for implementation.

Characterizing management actions' ability to contribute to these outcomes of broader public interest is key to raising State and federal funds for implementation.

Example performance tracking metrics for flood-specific outcomes that contribute toward sustainability are organized by the four broader societal values and presented in Table 2-1. For each category, the measure of overall improvement comes from the realization of the outcomes that contribute to it. This demonstrates the manner in which the State's highest priority societal values are translated into flood-specific outcomes that may be measured and tracked. Table 2-1 describes metrics using currently available data and information (source listed in the right column) along with metrics that would require additional work to develop, monitor, and track. These example performance metrics will be revised and refined, where necessary, through a transparent process in order to ensure they are consistent with the best available science and stakeholder input. Table 2-2 provides guidance for further development of metrics for outcome-based performance tracking for the CVFPP in future updates. These metrics are intended to be used for monitoring and tracking at a program-level for the CVFPP, and are rolled up from more detailed estimates developed as part of the BWFSs and other planning studies (see examples in Chapter 3, Section 3.1.6). In future CVFPP updates, refined performance metrics may be used to measure, track, and report progress toward achieving flood-specific outcomes.

Table 2-1. Example Performance Tracking Metrics and Data Sources for the CVFPP

Flood-specific Outcome Categories	Example Tracking Metrics	Data Source
Public Safety Outcomes		
Minimize number of people within the floodplain	■ Number of lives exposed to flooding as defined by the number of people residing or working in SPFC floodplains	DWR/IWM
Reduce human vulnerability when flooding occurs	■ Percentage of exposed population evacuated prior to inundation	DWR/DFM and Cal OES
	■ Maximum time (hours) required to retrieve/rescue those unable to evacuate	FEMA/Counties
Increase system performance in populous areas	■ Miles of levee repaired or improved	DWR/DFM
	■ Number of structures repaired or rehabilitated	DWR/DFM
	■ Frequency of "Danger Stage" exceeded near populated areas	DWR/DFM
	■ Reduced peak flood stage (feet)	DWR/DFM
Ecosystem Vitality Outcomes		
Reduce stressors on riverine and floodplain ecosystems	■ Number of priority fish passage barriers improved/removed	DWR, CalFish – Passage Assessment Database
	■ Acres of non-native plant species removed	DWR, Reclamation, Cal-IPC, various local agencies
Improve riverine and floodplain habitats and ecosystems	■ Miles of natural bank and shaded riverine aquatic (SRA) improved/increased	DWR
	■ Change in acres of floodplain inundation and meander potential	DWR
	■ Change in acres of riparian and wetland habitats	DWR
	■ Number of multi-purpose projects including actions that contribute to Conservation Strategy goals	TBD
Increase and maintain the abundance and diversity of floodplain dependent native species	■ Change in number and abundance of native species over time	TBD
Economic Stability Outcomes		
Minimize property and assets within the floodplain	■ Value of property and assets exposed to flooding as defined by those located within SPFC floodplains	TBD
Reduce economic vulnerability when flooding occurs	■ Value of flood damage to floodplain properties and assets	USACE
Increase system performance for economically developed areas	■ Miles of levee repaired or improved	DWR
	■ Number of structures repaired or rehabilitated	DWR
	■ Frequency of "Danger stage" exceeded near economic centers	CDEC
	■ Frequency of levee failures in urban, small community, and rural areas with high value agricultural land	DWR
	■ Reduced peak flood stage (feet)	DWR
Produce or maintain economic benefits on floodplains	■ Value of all economic productivity from floodplain land uses (e.g., floodplain compatible agriculture) ($/year)	TBD
Enriching Experiences Outcomes		
Provide recreational benefits	■ Number of floodplain-related recreational visitor-days per year	TBD
Support societal/ aesthetic values	■ Value of open space ($)	TBD
Provide education and public awareness	■ Number of floodplain-related education visitor-days per year	TBD
Protect significant farmland	■ Long-term preservation of scenic, cultural and historic farmlands (e.g., Williamson Act parcels)	County assessors

Cal-IPC: California Invasive Plant Council
Cal OES: California Office of Emergency Services
CDEC: California Data Exchange Center (DWR)
DWR: Department of Water Resources
DWR DFM: DWR Division of Flood Management
DWR IWM: DWR Division of Integrated Water Management
Reclamation: Bureau of Reclamation, U.S. Department of the Interior
TBD: to be determined.

Table 2-2. Guidance for Continued Development of Outcome-Based Performance Tracking Metrics for the CVFPP

Outcome Categories	Example Tracking Metrics
Public Safety Outcomes	
Measures of overall improved public safety (resulting from combination of flood-specific outcomes)	Number of lives lost or people injured in large flood events (expected annual life loss)
Ecosystem Vitality Outcomes	
Measures of overall improved ecosystem vitality (resulting from combination of flood-specific outcomes)	Change in the quantity and quality of natural habitats over time
Economic Stability Outcomes	
Measures of overall improved economic stability (resulting from combination of flood-specific outcomes)	Total value of annual economic floodplain activity less floodplain management costs less expected annual damage
Enriching Experiences Outcomes	
Measure of overall improved enriching experiences (resulting from combination of flood-specific outcomes)	Percentage of residents who feel they have ample opportunities for recreation, cultural enrichment, and education

2.2 DWR Programs Affected by Flood Management Policy Issues

The eight flood management policy issues introduced in Chapter 1 affect DWR flood management implementation programs in different ways and magnitudes as shown in Table 2-3. Flood project and O&M implementation are affected the most by these issues, with floodplain risk management and flood emergency response affected relatively less. Table 2-4 shows how various CVFPP supporting efforts are contributing toward addressing these policy issues through the Flood Management Planning program. DWR implementation programs are described in greater detail in Chapter 4 (Section 4.3). The information in these tables frames the approach for how the flood management policy issues were identified and organized, and how they may continue to be addressed (with progress tracking) in future updates to the CVFPP.

Table 2-3. DWR Flood Management Programs Affected by Policy Issues

DWR Flood Management Programs	Flood Management Policy Issues							
	 Land Use and Floodplain Management	 Residual Risk Management	 Hydraulic/Ecosystem Baseline and Program Phasing	 Operations and Maintenance of the Flood System	 Multi-Benefit Projects	 Governance and Institutional Support	 Coordination with Federal Agencies	 Funding
Flood Management Planning	●	◡	●	◡	●	●	●	●
Floodplain Risk Management	●	●			◡	●	●	
Flood System O&M	◡	●	◡	●	●	●	◡	●
Rural Levee System Repair			◡	●	◡		◡	●
Flood Emergency Response	◡	●					●	●
Flood Risk Reduction Projects								
Urban Flood Risk Reduction	●	◡	◡	●	◡	●	●	●
Small Community Flood Risk Reduction	●	◡	●	●	●	●	◡	●
System Implementation Program	●	◡	●	●	●	●	●	●
Delta Special Projects	◡		◡	◡	●	◡	◡	●

Key:

● Flood management program is greatly affected by this issue

◡ Flood management program is somewhat affected by this issue

Table 2-4. Effectiveness of CVFPP Supporting Efforts to Address Flood Management Policy Issues

CVFPP Supporting Effort	Flood Management Policy Issues							
	 Land Use and Floodplain Management	 Residual Risk Management	 Hydraulic/Ecosystem Baseline and Program Phasing	 Operations and Maintenance of the Flood System	 Multi-Benefit Projects	 Governance and Institutional Support	 Coordination with Federal Agencies	 Funding
2017 SPFC Descriptive Document Update		●		◡		◡	◡	
2017 FSSR	◡		◡	◡			◡	
2016 CVFPP Conservation Strategy	●		●	●	●	◡	●	
CVFPP Supplemental Program EIR	◡		●					
Draft Basin-wide Feasibility Studies	●		●		●		●	◡
Regional Flood Management Plans	●	●		◡	◡	◡	◡	◡
Draft CVFPP Investment Strategy TM		●	●	●	◡		◡	●
Draft OMRR&R TM		●		●	●	●	●	●
Draft Climate Change Analyses	◡	◡	●	◡	◡			

Key:

● Supporting effort greatly informs overall efforts on this key issue

◡ Supporting effort somewhat informs overall efforts on this key issue

2.3 Key Stakeholder Engagement and Perspectives on Updating and Implementing the CVFPP

The planning efforts informing this 2017 CVFPP Update were prepared in close coordination with State, federal, and regional partners and guided by a multi-year stakeholder engagement process initiated in 2012. This outreach was driven by DWR's commitment to regularly share information about ongoing activities and the overall planning process, and was supported through valuable engagement efforts spearheaded by the CVFPB and regional flood management planners. Valuable information was also obtained from DWR's implementation programs as challenges arose in implementing the broad vision of the CVFPP.

DWR worked closely with the CVFPB throughout the public engagement process to link communications activities and dialogue to the State's CVFPP update approach. Since 2012, the CVFPB has convened regular public meetings that were widely attended by representatives of State, federal, and local agencies, environmental organizations, and agricultural interests and other stakeholders. These regular meetings, referred to as the "Coordinating Committee meetings," have been instrumental in facilitating and maintaining stakeholder communication.

Ongoing discussions with a wide range of stakeholders have yielded important insights about different perspectives on flood management needs, challenges, and opportunities across the Sacramento River and San Joaquin River basins. Many of these perspectives are reflected in the 2017 CVFPP Update recommendations highlighted in Chapter 4; others will continue to be discussed among stakeholders and policymakers as the CVFPP is implemented and refined in future plan updates.

A Sample of Consulted Central Valley Stakeholders and Partners

- Agricultural community (including groups such as the California Farm Bureau Federation, county farm bureaus, and landowners)
- Environmental community (including non-governmental organizations such as American Rivers, CalTrout, Trout Unlimited, and The Nature Conservancy)
- Federal partner agencies
- Tribes
- Resource agencies
- General public
- Local maintaining agencies
- Regional flood management planning leads
- Other State agencies and initiatives

2.3.1 Types of Stakeholder Engagement for Updating the CVFPP

Types of stakeholder engagement completed for the 2017 CVFPP Update included formal and informal briefings, work groups and advisory groups, regional coordination, and other engagement opportunities. Figure 2-4 presents an overview of the type and number of key communications and engagement activities over the past 5 years.

- **Formal and informal briefings.** Monthly briefings were provided to the CVFPB and the public during regular public meetings and to a broader group of engaged stakeholders during monthly meetings of the Coordinating Committee. DWR also met regularly with interest-based groups, focusing discussions on technical work, policy issues, and implementation of the CVFPP. All briefings aimed to promote consistency and coordination of information and collect stakeholder insights about challenges, opportunities, and areas of agreement across the Sacramento River and San Joaquin River basins.

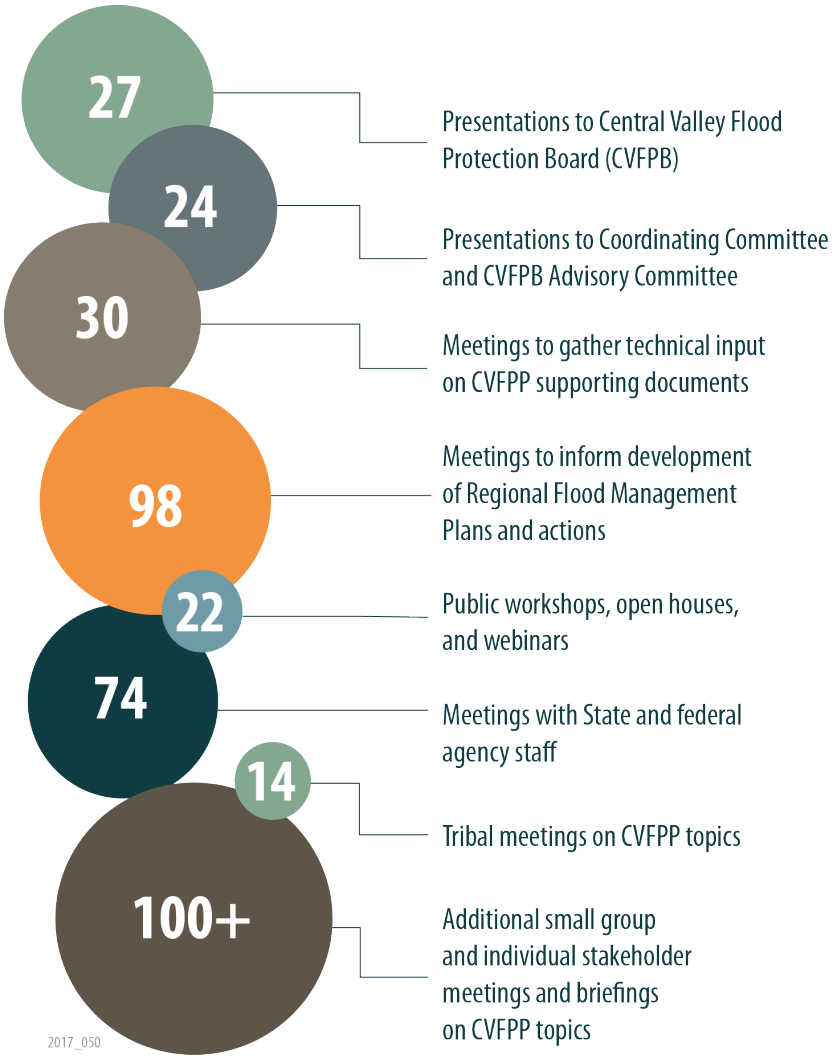


Figure 2-4. Key Communications and Engagement Activities for the CVFPP Update

- **Work groups and advisory groups.** These groups were convened to engage subject matter experts and regional leaders in assisting with developing information and material to inform the 2017 CVFPP Update. Examples include the Conservation Strategy Interagency Advisory Committee, Conservation Strategy Measurable Objectives Technical Advisory Workgroup, CVFPB Conservation Strategy Advisory Committee, and OMRR&R Work Group.
- **Regional coordination.** DWR met frequently with representatives from each of the six regional flood management planning leads during the development of the 2017 CVFPP Update. These discussions were critical to identifying regional needs and priorities and developing a shared vision for flood protection in the Central Valley.

Stakeholder Involvement in the CVFPP Conservation Strategy

DWR has worked closely with a variety of stakeholders over the past 5 years to develop, refine, and improve the CVFPP Conservation Strategy.

In 2011, DWR convened the Conservation Strategy Interagency Advisory Committee (IAC) to engage State and federal natural resource and regulatory agencies in the development of the Conservation Strategy. DWR met with the IAC to gather input from member agencies and to look collectively toward application and implementation of the strategy as a key component of the CVFPP.

In 2014, DWR conducted public workshops on developing measurable objectives and during review of the Conservation Strategy Administrative Draft, stakeholders and resource agencies articulated that measurable objectives could help inform planning and project formulation, create synergies among various efforts, and help track progress toward achieving environmental and flood-related outcomes. In response, DWR convened the Conservation Strategy Measurable Objectives Technical Advisory Workgroup to assist in the development of long-term measurable objectives, to inform multi-benefit project development and refinement, to estimate how specific projects will contribute to desired ecosystem outcomes, and to integrate the objectives into the 2017 CVFPP Update.

In 2015, the CVFPB convened the Conservation Strategy Advisory Committee to advise on Conservation Strategy implementation. The Conservation Strategy Advisory Committee includes environmental and agricultural stakeholders and representatives from DWR, local maintaining agencies, California Department of Fish and Wildlife, United States Fish and Wildlife Service, National Marine Fisheries Service, Delta Stewardship Council, Delta Conservancy, and National Resources Conservation Service. The committee worked to create a common vision of success for Conservation Strategy implementation, and has prepared recommendations to the CVFPB related to the Draft CVFPP Conservation Strategy and overall CVFPP. The Conservation Strategy Advisory Committee submitted its recommendations to the CVFPB in October 2016. The Advisory Committee submitted 24 recommendations to the CVFPB that are reflected in this 2017 CVFPP Update and CVFPP Conservation Strategy, where applicable.

- **Other engagement opportunities.** General public engagement activities, including open houses, public workshops, webinars, conferences, site visits, meetings, email notifications and regular updates to the DWR website, helped to build broad awareness and obtain valuable feedback for 2017 CVFPP Update planning activities.

Tribal Engagement

Areas near water often have archaeological sites as well as ceremonial places and cemeteries important to Native American traditions. The Central Valley and Clear Lake areas were among the most densely populated areas in California prior to European contact, mostly near the banks of Central Valley rivers, including villages, culturally significant activities, and burials. California tribes maintain unique information concerning the location and characteristics of these tribal cultural resources.

The DWR Tribal Engagement Policy strengthens DWR's commitment to improving communication, collaboration, and consultation with California Native American Tribes, (DWR, 2016). Consistent with Executive Order B-10-11, the California Natural Resources Agency Tribal Consultation Policy, and Assembly Bill 52 Native Americans: California Environmental Quality Act, the Tribal Engagement Policy includes the policy principles to achieve early and meaningful tribal engagement with California Native American Tribes.

Informational meetings and consultations with tribes were conducted as part of the 2017 CVFPP update process to understand and evaluate impacts to cultural resources. In March 2016, DWR sent letters to approximately 50 Native American tribes. This letter provided information about the 2017 CVFPP Update and DWR's proposal to develop a Supplemental Program Environmental Impact Report in support of the 2017 CVFPP Update, and it also informed the tribes of the opportunity to consult and coordinate with DWR. Based on the response to DWR's letter, DWR held informational meetings with five different tribes affiliated with project area, and continued consulting with one of these tribes through July 2017.

Future CVFPP updates will look for additional opportunities to more fully integrate tribes, tribal cultural resources, tribal values, and tribal viewpoints. To facilitate this integration into future updates and maintain coordination on project implementation, regular informational meetings will be held with California Native American Tribes to provide updates on existing projects implemented under the CVFPP, provide information on future projects and consultation opportunities, and to exchange information. Some Tribal stakeholders have also expressed interest in considering how tribal cultural resources protection, restoration, and enhancement could be integrated into the multi-benefit project definition.

Moving forward with CVFPP implementation, project funding should consider tribal cultural resources identification, which could include obtaining information from databases maintained by affiliated tribes, and potential mitigation. Some Tribal stakeholders have also expressed interest in comprehensive cultural resources mitigation measures, such as a cultural mitigation fund, a long-term operations and maintenance plan that considers tribal monitoring, and specific protocols for cultural resources surveys, treatment of cultural resources, reburials, and other topics.

2.3.2 Stakeholder and Partner Perspectives and Continuing Conversations on Flood Management Policy Issues

DWR continued work toward characterizing and addressing flood management policy issues over the past 5 years. DWR's discussions with partners and stakeholders helped identify areas where the State and stakeholders largely agree, and other areas that will require continuing conversations or technical analyses to address various needs and perspectives and develop solutions collaboratively. These perspectives, paraphrased from a broad spectrum of stakeholder input since 2012, have been organized and summarized below in the context of the eight flood management policy issues introduced in Chapter 1. Strategies for addressing the eight flood management policy issues are described in Chapter 3, and specific recommendations to address the issues are presented in Chapter 4.

Perspectives on Land Use and Floodplain Management

The Issue: Ongoing and planned development in the floodplain continues to intensify flood risk. Urban development is expected to continue in the Central Valley's floodplains to accommodate population growth. If flood risks are not managed wisely, cumulative flood damages and loss of life will likely increase over time. Structural flood improvements can never fully eliminate the risk of flooding and are also costly to construct and maintain over the long-term. The first line of defense against flood risk should be to avoid or minimize damages through sound land use and floodplain management policies and investments.

Areas of Agreement	Areas for Continuing Conversations
✓ We should manage and protect floodplains wisely.	? Development in floodplains that can realize associated economic benefits remains an interest to some stakeholders, but can be difficult to achieve without intensification of risk.
✓ Ecosystems of river channels, floodplains, and flood basins are among the valley's most important natural resources and often provide critical habitat.	? A variety of interests and priorities exist related to achieving ecosystem benefits while preserving agriculture and associated rural economies.
✓ Agricultural lands have economic, environmental, and cultural value, and impacts to farmland and local agricultural economies should be minimized.	
✓ The CVFPP should affirm a dedication to agricultural land and water supply stewardship and regional economies.	

Perspectives on Residual Risk Management

The Issue: The SPFC has greatly reduced the frequency of flooding and made possible the vibrant communities and agricultural development of floodplains in the Central Valley. Yet even with the realization of major physical improvements to the flood management system, the risk of flooding can never be completely eliminated. Unanticipated facility failures or extreme flood events may cause flooding. This remaining flood threat is called "residual risk." Commitment to enhanced resilience and public awareness to reduce exposure to residual risk falls short in many areas.

Areas of Agreement	Areas for Continuing Conversations
✓ Funding is needed to enable local agencies to develop or improve emergency response plans, including evacuation plans, for lands protected by the SPFC.	? Additional information and interagency coordination is needed to support potential new programs for State assistance in residual risk management.
✓ Continued investment in flood emergency training at the local, State and federal levels is needed.	
✓ Public education and awareness measures should be further explored for reducing flood risk.	

Perspectives on Hydraulic/ Ecosystem Baseline and Program Phasing

The Issue: The structural improvements proposed as part of the CVFPP (including Yolo Bypass expansion, Paradise Cut, and other large system-scale projects) require implementation in phases over many decades. Current regulatory practices hinder the ability to obtain credit for benefits of improvements made early in a long-term program in order to offset impacts that may occur later in the program, complicating phased system-scale implementation of CVFPP multi-benefit improvements.

Areas of Agreement	Areas for Continuing Conversations
✓ CVFPP implementation should be carried out in phases, beginning with the management actions that will achieve the highest priority outcomes.	? Measurable objectives should recognize the ecological value of wildlife-friendly agriculture.
✓ Measurable flood and ecosystem objectives should be articulated as a basis for monitoring and tracking system performance over time.	? Consistency should be provided between State and federal agency determinations regarding hydraulic and ecosystem baseline conditions, objectives, and regulatory requirements.

Perspectives on Operations and Maintenance of the Flood System

The Issue: Operations, maintenance, and repair activities are critical for long-term, sustainable flood management. A robust and fully funded O&M program is fundamental to the proper function of the SPFC, ensuring public safety and upholding the State's legal assurances to maintain federal flood project features, and enabling the implementation and maintenance of multi-benefit projects. However, O&M has been impaired by two primary constraints:

- O&M activities have been chronically underfunded
- Declining natural resources have led to a regulatory framework in which flood managers often face conflicting mandates.

Areas of Agreement	Areas for Continuing Conversations
✓ Aging infrastructure and decades of deferred maintenance compromise the performance of existing facilities. Further, many facilities predate (and therefore do not meet) modern design standards.	? Channel capacity may be increased through dredging and vegetation removal, but this does not address systemwide geomorphic and ecosystem health trends.
✓ Significant additional funding is needed to properly maintain SPFC facilities.	? Incorporating maintenance of habitat improvements into flood maintenance requirements could introduce further financial and regulatory burden on maintaining agencies.
✓ An improved approach to permitting flood system maintenance is needed.	? Regional programmatic environmental permitting or multiple-objective O&M approaches could result in improved flood system resiliency as well as ecosystem improvement. Ecosystem uplift could reduce regulatory burden for flood system maintenance over time.
✓ A prioritized list of maintenance requirements that support habitat stewardship with a funding and regulatory path forward is needed.	? A revised hydraulic baseline is needed for any improvements that increase conveyance capacity to make sure those increases are sustained over the long-term future
✓ The flood management system should be managed as a dynamic whole that will evolve over time, and should include considerations for infrastructure and habitat while maintaining access to reliable water supplies and sustainable local economies to support broad public values.	

Perspectives on Multi-Benefit Projects

The Issue: Many policy and institutional barriers have hindered the implementation of multi-benefit actions. Limited funding resources are currently available to support the development of multi-benefit projects. Conflicting flood management, resource management, and environmental regulatory frameworks hinder the implementation, operations, and maintenance of multi-benefit projects. Furthermore, modifications to SPFC facilities can be extremely difficult and costly to permit, even for obsolete flood management infrastructure that can be safely repurposed for other uses. Differences between federal and State levee and channel vegetation policies also create conflicting mandates.

Areas of Agreement	Areas for Continuing Conversations
✓ Historical flood management practices and single-purpose projects are insufficient to address degraded ecosystems. ✓ Achievement of multi-benefit objectives can be challenged by inconsistencies between federal, state and local agency regulatory mandates.	? Some stakeholders expressed concern that an emphasis on multi-benefit projects could carry unintended consequences such as increased costs to local flood agencies and landowners and conversion of productive agricultural land to floodplain habitat. Although the general premise of multi-benefit projects is understood, a clearly-defined term is needed to avoid misunderstandings or unintended policy implications. ? The best approach to integrating and prioritizing the primary and supporting goals of the Central Valley Flood Protection Act of 2008 remain a central point of discussion among DWR and stakeholders. ? The description of conservation opportunities should be clarified by defining the flood system footprint used to determine these opportunities. ? Some stakeholders are concerned that prioritizing multi-benefit projects will unfairly limit investment in effective single-purpose flood risk management projects. ? New funding sources and mechanisms may be needed to support multi-benefit project components. ? The cost to implement, maintain, and monitor planned habitat restoration should not be the sole responsibility of LMAs, because habitat improvements provide benefits to the State and nation.

Perspectives on Governance and Institutional Support

The Issue: Overlapping authorities and conflicting mandates that sometimes occur can complicate flood system improvements and maintenance and are partially the result of existing governance structures, which are inadequate to support the broad range of actions included in the CVFPP. Central Valley flood management is affected by a complex framework of public agencies (over 300 in the Sacramento Basin and over 200 in the San Joaquin Basin).

Areas of Agreement	Areas for Continuing Conversations
✓ Incremental adoption of policies and regulations has had unintended consequences on preceding policies and regulations, and these must be reconciled.	? DWR may fund an additional RFMP phase following adoption of the 2017 CVFPP Update.
✓ Clarity is needed on roles, responsibilities and authorities between agencies and across levels of government.	? Many local and regional agencies are not structured or resourced to implement or maintain multi-benefit flood improvements.
✓ Linking State and federal funding programs to elements of local and regional plans and projects that align with the CVFPP will produce more value to taxpayers and lead to a broadly supported plan.	? State funding should be provided to regional flood management planners to formulate projects that integrate and reconcile ecological objectives and regional priorities, support public safety and multi-benefit objectives as informed by the CVFPP Conservation Strategy, quantify individual and collective contribution of RFMP projects toward meeting ecological objectives, and support planning and implementation of multi-benefit flood projects in areas protected by the SPFC, including disadvantaged communities.
✓ The RFMPs have helped strengthen regional governance and fostered a shared vision for local and regional flood protection.	
✓ Enhanced regional governance can empower groups of local agencies to more effectively pool and leverage funding and resources.	

Perspectives on Coordination with Federal Agencies

The Issue: Flood management in California is a shared responsibility among State, federal, and local agencies. Effective partnerships with federal agencies are essential to achieve funding and regulatory objectives. Successful coordination with federal agencies is critical to efficiently and effectively implementing the CVFPP and managing the flood system over the long-term future.

Areas of Agreement	Areas for Continuing Conversations
✓ Effective partnerships with federal agencies are essential to achieving the vision of the CVFPP.	? Although many stakeholders support pursuing programmatic permitting to improve efficiency and reduce costs, future discussions with State and federal agencies are needed to develop implementable approaches.
✓ There should be consistency between State and federal regulatory requirements.	? Some local flood managers are supportive of the State having a contingency plan in the event that adequate federal funding is not available to support CVFPP implementation.
✓ Additional guidance is needed for a path forward for LMAs considering removal, abandonment, or modification of project purposes for SPFC facilities, in close coordination with USACE and other affected federal and State agencies.	? Continued efforts are required to align changes in USACE designation of federal flood project facilities with the SPFC.
	? A process is needed to resolve policy or mandate discrepancies between State and federal agencies.

Perspectives on Funding

The Issue: Insufficient and unstable flood management funding has led to delayed investment and greater risk to life and property. Continued implementation of the CVFPP will decline unless new State, federal, and local funding becomes available. Full implementation of the SSIA over the next 30 years will require a combination of significant changes in how the State and its partners fund and implement projects as along with unprecedented levels of expenditures using mechanisms currently available.

Areas of Agreement

- ✓ The flood system has degraded over time in part due to insufficient and unstable funding.
- ✓ Uncertain funding and fragmented flood management responsibilities have resulted in the lack of a long-term vision and a comprehensive implementation program to address longstanding flood management challenges.
- ✓ Unstable funding can be attributed in part to the public's perception of flood risk that is much greater immediately after major flood events, then fades as non-flood years pass.
- ✓ Investments should be equitable and commensurate with the relative level of flood risk that different communities face, consistent with local and regional needs and priorities.
- ✓ Investments should be tracked over time to offer transparency and demonstrate the value that the State attains for its flood management investments over time.
- ✓ The CVFPP Update should describe the need for improved cost sharing by: including language that specifies applicable cost share funding sources going forward, including increased cost share by the State (primarily), the federal government, and other existing and future funding programs; specifying the necessity and intention for State cost share to be available through project planning, implementation, and O&M; and including language that recognizes the need for additional funding and increased cost share by the State for project planning and implementation in areas with disadvantaged communities.
- ✓ Increased State cost share should be considered to promote implementation of multi-benefit projects, similar to DWR's Flood Corridor Program and Delta Special Projects Program.

Areas for Continuing Conversations

- ? Some stakeholders expressed frustration with perceived imbalances in the State's focus of flood planning and investment, including prioritizing the Sacramento River Basin over the San Joaquin River Basin, and investing in urban areas more than rural areas and small communities.
- ? Some rural and agricultural interests support development of a rural levee standard to help ensure that rural interests receive equitable attention and resources.
- ? Some stakeholders expressed concern that the cost burden on rural, local flood management and maintenance entities is too high and in many cases, cannot be met. In addition, many local rural agencies feel they cannot further raise assessments any more to secure needed additional funding.
- ? Some stakeholders expressed concern that it is too difficult to secure federal cost share for projects in non-urban areas.

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A comprehensive set of interrelated activities and projects is needed to improve management of the State federal flood protection system.

Strategies to Improve System Management

Chapter 3

The 2017 refined SSIA portfolio consists of interrelated management actions working together systemwide that will achieve the CVFPP goals and result in a more resilient flood management system. Chapter 3 takes a deeper look at what makes up this portfolio, the expected outcomes for each societal value resulting from the implementation of these management actions, and policy and financial conditions necessary for making CVFPP implementation possible and effective (Figure 3-1).

The following discussion steps through management action categories under four areas of interest that align with DWR implementation programs, including the type of investment (capital or ongoing) needed for each type of action. These management actions are necessary for achieving CVFPP goals, and they inform State decision-making for investing in CVFPP implementation. Policy and financial issues that will constrain or enable implementation of these actions must be addressed if CVFPP goals are to be achieved. Discussion of the drivers, trends, and interdependencies of these issues provides a basis for formulating recommendations meant to drive more effective implementation of the CVFPP in the future.

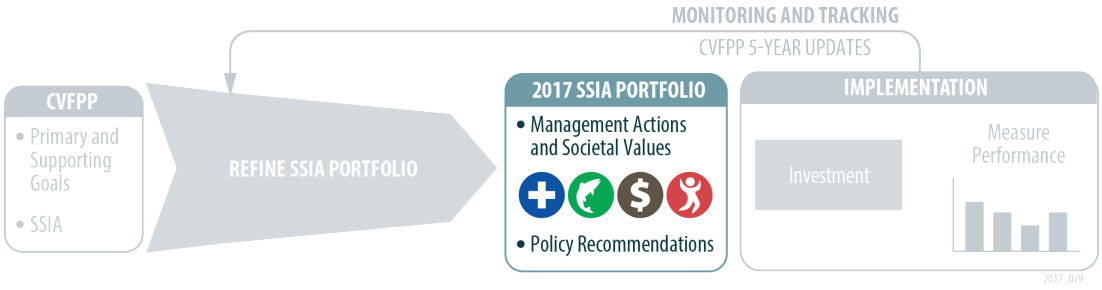


Figure 3-1. A Deeper Look at Management Actions, Outcomes, and Policy Issues

3.1 Management Actions Included in the 2017 Refined SSIA Portfolio

The SSIA presented in the 2012 CVFPP has been refined based on new information provided by multiple efforts described in Chapter 2 completed since 2012: six RFMPs, both BWFSs, the OMRR&R Workgroup, related technical studies (such as climate change analyses), along with the CVFPP Conservation Strategy and CVFPP Investment Strategy. Other supporting efforts included updating the 2017 SPFC Descriptive Document and 2017 FSSR.

The following discussion looks at overall refinements to the SSIA and contributions to CVFPP goals at the strategic level, and then elaborates on management action categories and expected outcomes to provide for each of the four areas of interest (systemwide, urban, rural, and small communities). The refined SSIA portfolio includes descriptions of systemwide actions to be implemented alongside updated descriptions of urban, small community, and rural management actions to provide a reasonable and balanced vision of improvements for the SPFC.

3.1.1 SSIA Refinements

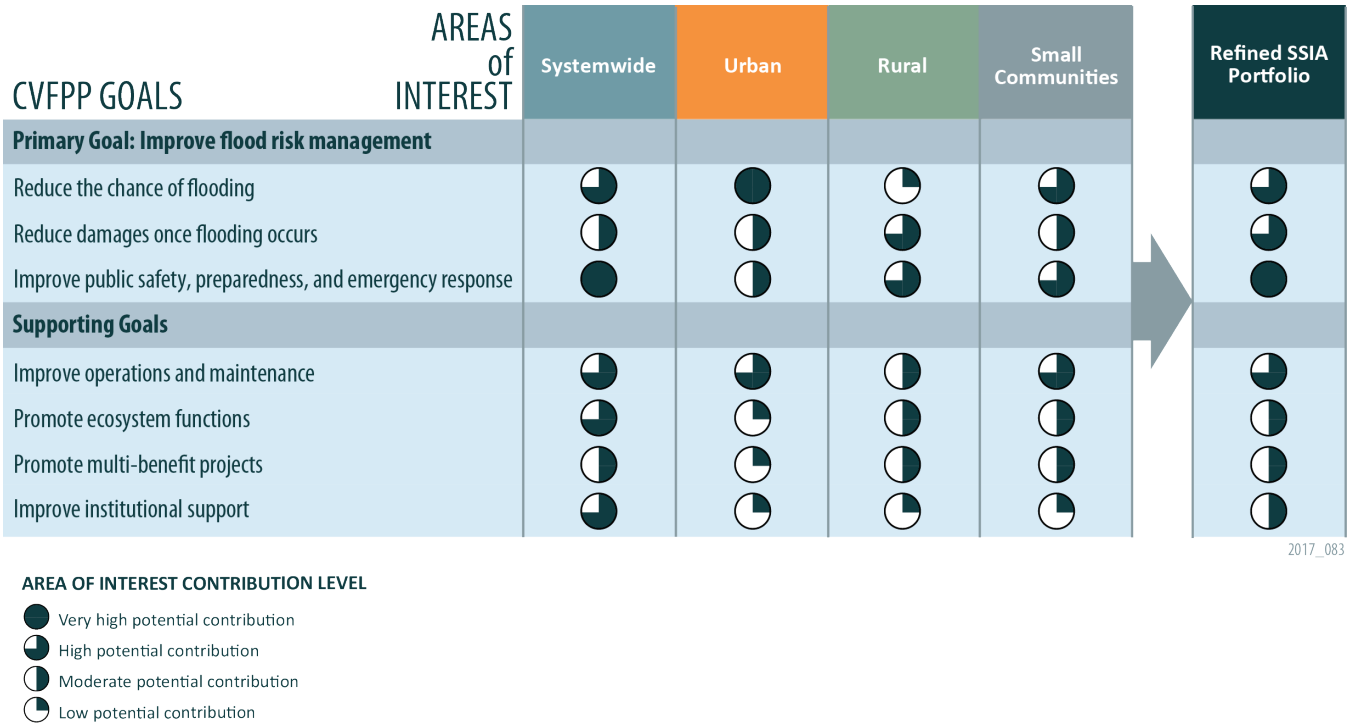
Management actions included in the 2017 refined SSIA portfolio have been organized in a framework that supports implementation of the CVFPP Investment Strategy, aligns with existing flood management programs, and supports future monitoring and tracking for accountability of investments, outcomes, and achievement of CVFPP goals. This framework will help guide and facilitate CVFPP implementation over time. Table 3-1 shows the grouping of management action categories by capital or ongoing investment types, and by areas of interest (systemwide, urban, rural, and small communities). The relationship of the four areas of interest to DWR's flood management programs is described in Chapter 4.

Figure 3-2 shows how the management actions embodied in each area of interest are expected to contribute to the CVFPP goals, and how the comprehensive 2017 refined SSIA portfolio reflects a combination of the contributions from actions in each area of interest.

Table 3-1. Management Action Categories by Investment Type and Area of Interest

Capital Investment	Ongoing Investment
Systemwide Actions	
■ Yolo Bypass multi-benefit improvements ■ Feather River—Sutter Bypass multi-benefit improvements ■ Paradise Cut multi-benefit improvements ■ Reservoir and floodplain storage	■ State operations, planning, and performance tracking ■ Emergency management ■ Reservoir operations ■ Routine maintenance
Urban Actions	
■ Levee improvements ■ Other infrastructure and multi-benefit improvements	■ Risk awareness, floodproofing, and land use planning ■ Studies and analysis
Rural Actions	
■ Levee repair and infrastructure improvements ■ Small-scale levee setbacks and floodplain storage ■ Land acquisitions and easements ■ Habitat restoration/reconnection	■ Risk awareness, floodproofing, and land use planning ■ Studies and analysis
Small Communities Actions	
■ Levee repair and infrastructure improvements ■ Levee setbacks, land acquisitions, and habitat restoration	■ Risk awareness, floodproofing, and land use planning ■ Studies and analysis

Figure 3-2. Contribution of Areas of Interest Toward CVFPP Goals in the 2017 Refined SSIA Portfolio



The characterization of flood management elements described in the 2012 SSIA has also been refined through subsequent studies, planning, and recognition of implementation progress in the past 5 years. Previously described as "key physical and operational flood management elements," these concepts have been organized into the "management action categories" of the 2017 CVFPP Update. On the next few pages, Table 3-2 provides 2012 concepts on the left side and 2017 refinements to those concepts on the right side.

Maps 3-1 and 3-2 show the general locations of capital investment actions included in the 2017 refined SSIA portfolio in the Sacramento River and San Joaquin River Basins. The portfolio reflects an integrated approach that includes the following:

- Systemwide actions, including larger-scale multi-benefit actions studied in the Sacramento River and San Joaquin River BWFS with application of the CVFPP Conservation Strategy.
- Levee and other infrastructure improvements to provide 200-year level of protection to urban areas to preserve urban development opportunities within specific boundaries without inducing broader urban development in SPFC floodplains that increases aggregate economic and life safety risk.
- Levee and other infrastructure improvements to provide 100-year level of protection to small communities within specific boundaries to preserve small community development opportunities within specific boundaries without providing urban level of protection and encouraging broader urban development in SPFC floodplains.
- Other capital investment actions identified by the six RFMPs and DWR. The figures show the number of management actions identified through these efforts for each category of management actions.
- Habitat restoration, habitat reconnection, and multi-benefit improvement actions (that include proposed systemwide improvements to the Yolo Bypass and Paradise Cut), groundwater recharge actions, and additional actions that may be included in the development of projects in urban, rural, and small community areas of interest. The habitat restoration, habitat reconnection, and multi-benefit improvement actions were guided by the CVFPP Conservation Strategy.

Table 3-2. Refinements to Physical and Operational Elements in the State Systemwide Investment Approach

2012 SSIA		2017 Refined SSIA	
Flood Management Element	**Project Location or Required Components**	**Management Action Categories**	**Summary of Refinements**
Systemwide: Bypasses			
New Bypass Construction and Existing Bypass Expansion	■ Yolo Bypass Expansion ■ Sacramento Bypass Expansion	Yolo Bypass multi-benefit improvements	■ Approximately 1.5-mile expansion of Fremont Weir and expansion of Yolo Bypass in multiple locations with levee setbacks where feasible, including consideration of the use of Sacramento Deep Water Ship Channel to convey flood flows. Recommendations include incorporation of ecosystem and multi-benefit features ■ Approximately 1,500-foot expansion of Sacramento Weir and Bypass, including incorporation of ecosystem and multi-benefit features
	■ Lower San Joaquin River Bypass (Paradise Cut Expansion)	Paradise Cut multi-benefit improvements	■ Approximately 1,000-foot-long weir and associated levee setbacks with incorporation of ecosystem and multi-benefit features
	■ Feather River Bypass ■ Sutter Bypass Expansion	Feather River–Sutter Bypass multi-benefit improvements	■ An array of multi-benefit actions to be determined through future study in close coordination with local and regional partners after Yolo Bypass improvements are implemented
Operational Changes	■ Weir and bypass operational changes	Yolo Bypass multi-benefit improvements, Paradise Cut multi-benefit improvements, Feather River–Sutter Bypass multi-benefit improvements	■ Potential operational changes have been developed for Yolo Bypass and Paradise Cut associated with bypass expansions
Systemwide: Reservoir Storage and Operations			
Forecast-Coordinated Operations (F-CO)/ Forecast-Informed Operations (F-IO)	■ Fifteen reservoirs within Sacramento River Basin and San Joaquin River Basin	Reservoir operations	■ Study of potential changes to Calaveras River and Tuolumne River reservoir operations
New Reservoir Storage	■ Folsom Dam Raise included in SSIA as an already authorized project	Reservoir and floodplain storage	■ Folsom Dam Raise continues to be supported by State ■ Further study and refinement of reservoir and floodplain-related storage actions in Calaveras and Tuolumne River watersheds
Transitory Storage	■ No specific projects in SSIA but to be considered on a willing-seller basis, where new flood storage could be safely isolated from adjacent areas	Reservoir and floodplain storage	■ Four sites identified by RFMPs at Dos Rios, Three Amigos, Oroville Wildlife Area, and Conaway Ranch
Conjunctive Use and Groundwater Recharge	■ Encourages exploring recharge opportunities in the San Joaquin River Basin	Reservoir and floodplain storage	■ Multiple benefit opportunities identified at Madera Ranch and Western Madera County to reduce future subsidence and provide water supply benefits

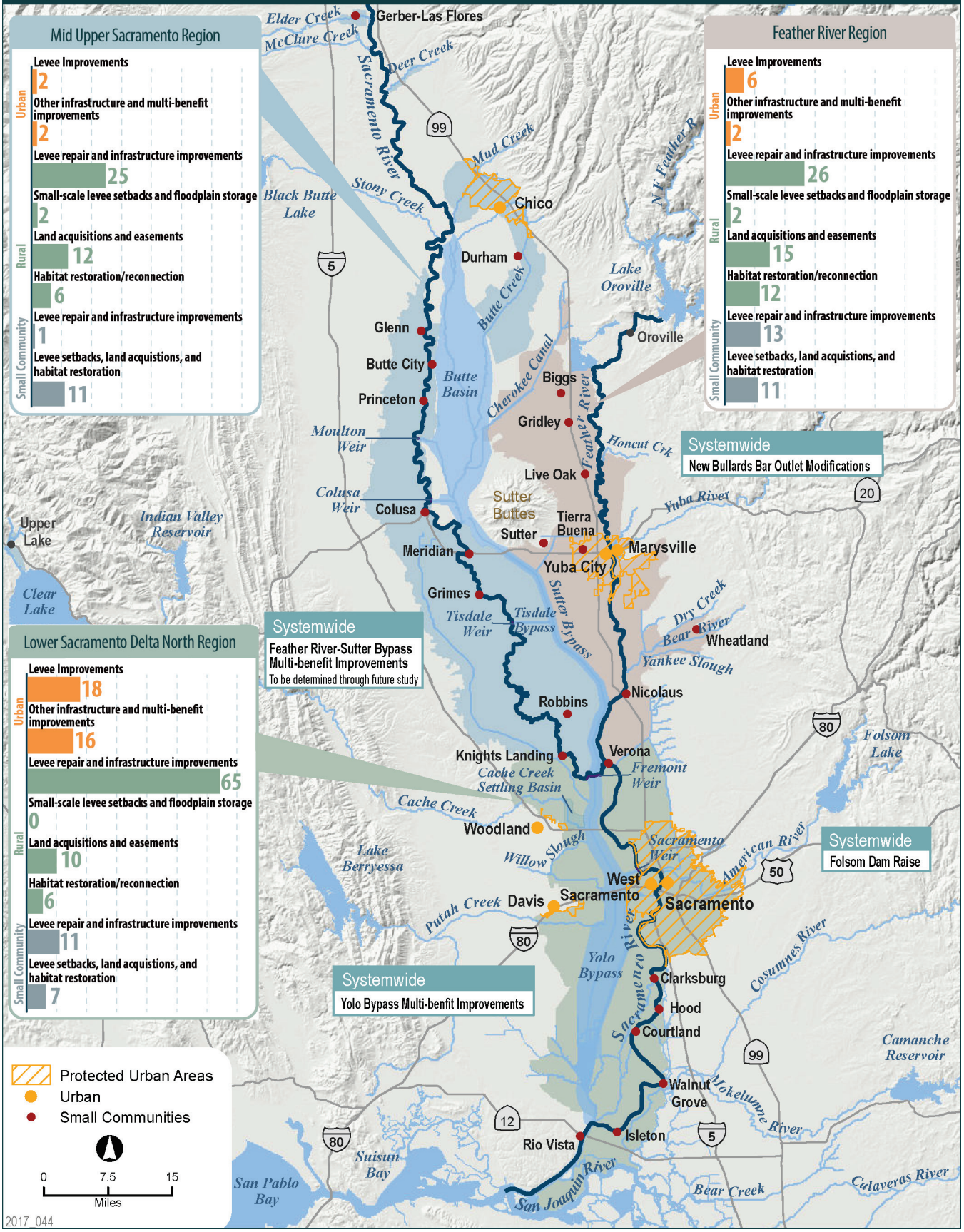
Table 3-2. Refinements to Physical and Operational Elements in the State Systemwide Investment Approach

2012 SSIA		2017 Refined SSIA	
Flood Management Element	Project Location or Required Components	Management Action Categories	Summary of Refinements
Systemwide: Flood Structure Improvements			
Major structures	■ Intake structure for new Feather River Bypass ■ Upgrade and modification of Colusa and Tisdale Weirs	Feather River–Sutter Bypass multi-benefit improvements	■ Future study of an array of multi-benefit options, in close coordination with local and regional partners after Yolo Bypass improvements are implemented. ■ Upgrade and modification of Colusa and Tisdale Weirs
	■ Butte Basin small weir structures	Levee repair and infrastructure improvements (Rural)	■ Butte Basin small weir structures
	■ Sacramento Weir widening and automation ■ Fremont Weir widening and improvement	Yolo Bypass multi-benefit improvements	■ Approximately 1,500-foot expansion of Sacramento Weir (includes consideration of automation) ■ Approximately 1.5-mile expansion of Fremont Weir that would also accommodate fish passage improvements being planned by other programs
	■ Gate structures and/or weir at Paradise Cut	Paradise Cut multi-benefit improvements	■ Approximately 1,000-foot-long weir at Paradise Cut
	■ Upgrade of structures in Upper San Joaquin bypasses ■ Other pumping plants and small weirs	Levee repair and infrastructure improvements (Rural)	■ Completion of upgrade of structures
	■ Low level reservoir outlets at New Bullards Bar Dam	Reservoir and floodplain storage	■ Approximately 20,000 cfs lower level outlet at New Bullards Bar Dam
System Erosion and Bypass Sediment Removal Project	■ Cache Creek Settling Basin sediment management ■ Sacramento system sediment remediation downstream from weirs	Yolo Bypass multi-benefit improvements	■ Improvements to Cache Creek Settling Basin sediment management and sediment remediation downstream from weirs associated with ecosystem improvements in Yolo and Sacramento bypasses
Urban: Capital Improvements			
Target 200-year Level of Protection	Selected projects developed by local agencies, State, federal partners	Levee improvements; other infrastructure and multi-benefit improvements	■ Urban improvements updated considering implementation progress for State-federal projects during last 5 years and recommendations of RFMPs
Non-SPFC Urban Levee Improvements	Includes approximately 120 miles of non-SPFC levees that are closely associated with SPFC urban levees. Performance of these non-SPFC levees may affect the performance of SPFC levees		
Rural: Capital Improvements			
Site-Specific Rural-Agricultural Repairs	Based on levee inspections and other identified critical levee integrity needs	Levee repair and infrastructure improvements	■ Needed repairs identified by RFMPs and DWR's flood project inspections, including potential levee repairs on the Eastside Bypass to replace capacity lost due to local subsidence

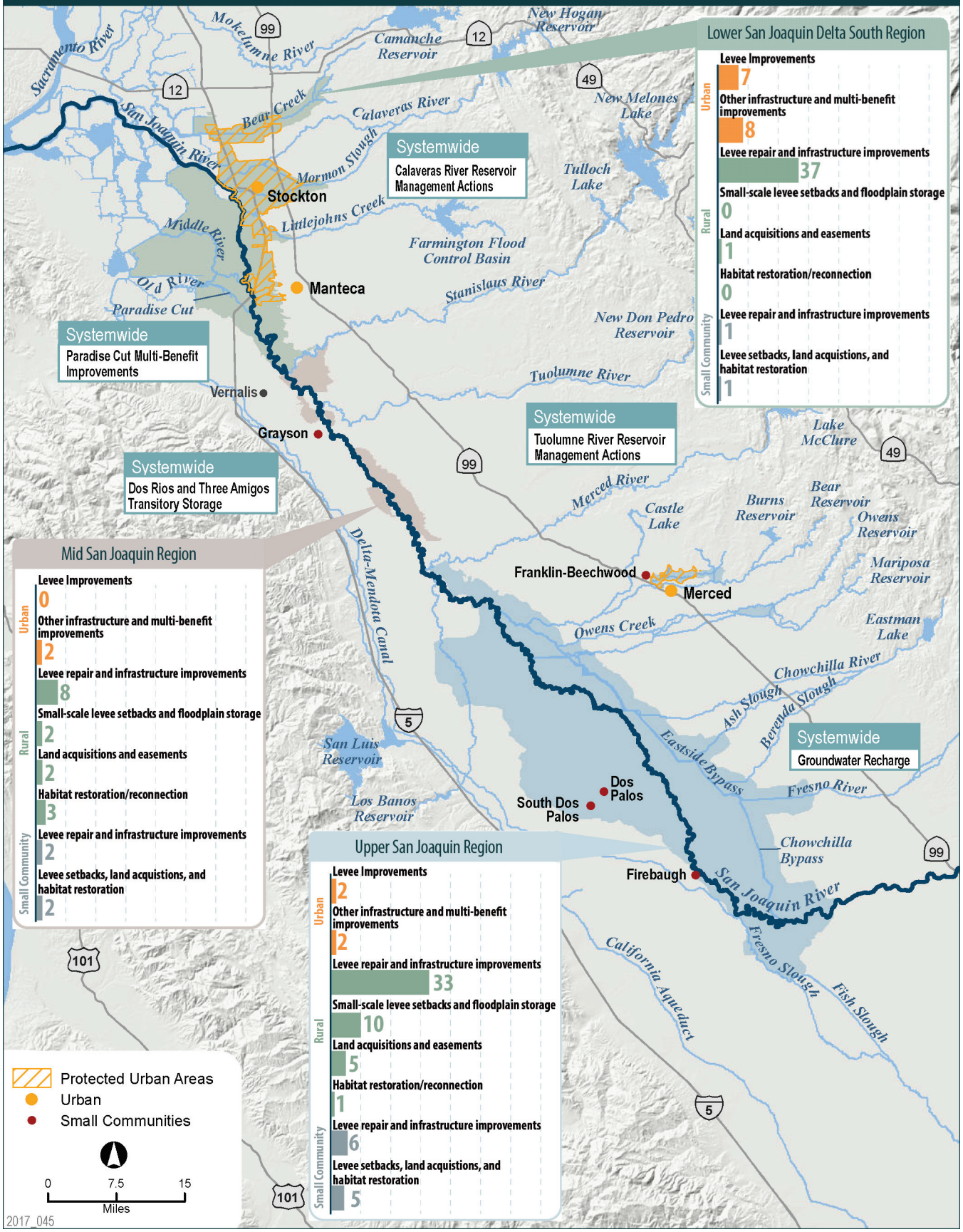
Table 3-2. Refinements to Physical and Operational Elements in the State Systemwide Investment Approach

2012 SSIA		2017 Refined SSIA	
Flood Management Element	**Project Location or Required Components**	**Management Action Categories**	**Summary of Refinements**
Rural: Ecosystem Restoration			
Fish Passage Improvements	■ Tisdale Bypass and Colusa Bypass fish passage ■ Fremont Weir fish passage improvements ■ Deer Creek	Habitat restoration/ reconnection	■ Fremont Weir fish passage improvements being completed by Bi-Ops Program (Reclamation/DWR) ■ Fish passage improvements at Tisdale Bypass, Colusa Bypass, and Deer Creek ■ Ecosystem restoration and enhancement opportunities studied and recommended by Sacramento River and San Joaquin River BWFS and RFMPs for areas within Yolo Bypass, Paradise Cut, and selected levee setback locations in the Sacramento and San Joaquin River basins.
Ecosystem Restoration and Enhancement	■ For areas within new or expanded bypasses, contributing to or incorporated with flood risk reduction projects		
River Meandering and Other Ecosystem Restoration Activities	■ At selected levee setback locations in Sacramento River and San Joaquin River basins		
Small Communities: Capital Improvements			
Target 100-year Level of Protection	■ Small communities protected by the SPFC	Levee repair and infrastructure improvements; levee setbacks, land acquisitions, and habitat restoration	■ Small communities' improvements to be studied and implemented through Small Communities Flood Risk Reduction program considering recommendations of RFMPs and San Joaquin River BWFS
Residual Risk Management			
Enhanced Flood Emergency Response	■ All-weather roads on levee crown ■ Flood information collection and sharing ■ Local flood emergency response planning ■ Forecasting and notification ■ Rural post-flood recovery assistance program	Emergency management (systemwide)	■ Enhanced flood emergency response refined through RFMPs and DWR study of improved flood warning and response times
Enhanced Operations and Maintenance	■ Identify and repair after-event erosion ■ Developing and implementing enhanced O&M programs and regional O&M organizations ■ Sacramento channel and levee management, and bank protection	Routine maintenance (systemwide)	■ Enhanced operations and maintenance refined by OMRR&R Work Group and Multi-Objective O&M case studies
Floodplain Management	■ Raising and waterproofing structures and building berms ■ Purchasing and relocating homes in floodplains ■ Land use and floodplain management	Risk awareness, floodproofing, and land use planning (urban, rural and small communities)	■ Enhanced floodplain management refined through RFMPs and cost estimates for floodplain management
	■ Agricultural and conservation easements and acquisitions	Land acquisitions and easements (rural)	■ Agricultural and conservation easements refined through RFMPs and DWR cost estimates for easements and acquisitions. These include potential flowage easements in the vicinity of the Eastside Bypass to replace capacity caused by local subsidence.

Map 3-1. Number of Capital Investment Actions for the Sacramento River Basin



Map 3-2. Number of Capital Investment Actions for the San Joaquin River Basin



3.1.2 Systemwide Actions That Bolster Resiliency

Proposed systemwide capital investment actions were studied and recommended through the Sacramento River BWFS and San Joaquin River BWFS. In the Sacramento Basin, these include Yolo Bypass multi-benefit improvements and potential systemwide improvements for the Feather River–Sutter Bypass system. In the San Joaquin Basin, these include Paradise Cut multi-benefit improvements, and reservoir and floodplain storage actions. Additional reservoir and floodplain storage actions were also identified in both basins as part of the RFMP process. Figure 3-3 shows the outcomes expected from the proposed systemwide actions as they aligned with societal values. These actions have the potential to greatly bolster overall systemwide resiliency in a way that complements smaller-scale urban, rural, and small community actions.

Figure 3-3. Expected Outcomes from Systemwide Actions

SYSTEMWIDE ACTIONS \ SOCIETAL VALUES	Public Safety	Ecosystem Vitality	Economic Stability	Enriching Experiences
CAPITAL INVESTMENT ACTIONS				
Yolo Bypass multi-benefit improvements	◕	◕	◕	◑
Feather River–Sutter Bypass multi-benefit improvements	◕	◑	◕	◔
Paradise Cut multi-benefit improvements	◕	◕	◕	◑
Reservoir and floodplain storage	◕	◑	◕	◑
ONGOING INVESTMENT ACTIONS				
State operations, planning, and performance tracking	◑	◑	◑	◑
Emergency management	◕	◔	◕	◑
Reservoir operations	◕	◔	◕	◔
Routine maintenance	◕	◔	◕	◔

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OUTCOME CONTRIBUTION LEVEL

- ● Very high potential contribution
- ◕ High potential contribution
- ◑ Moderate potential contribution
- ◔ Low potential contribution

Enhancing Resilience and Supporting Sustainability

Today's flood managers have embraced a *flood risk management* approach as an alternative to the traditional *flood engineering* approach. This shift is a recognition that past flood system improvements often had the unintended effect of increasing risk exposure (e.g., reducing the *probability* of flooding through infrastructure improvements, but greatly increasing the *consequences* of flooding resulting from urban intensification). For instance, levees have been improved in locations that were then converted from rural-agricultural to urban land uses. It also became apparent that the engineering approach was unsustainable. Flood managers today are tasked with not just flood control, but reducing flood risk while promoting ecosystem and other benefits in an effort to support sustainability. Measures to enhance resilience offer a means to reduce risk, promote benefits, and advance the ultimate goal of sustainably managing floodwaters.

Risk management includes a shared understanding that absolute flood protection is impossible; no matter what flood risk management actions are implemented, some level of residual risk remains. Therefore, it is also important to enhance resilience.

Periodic flooding can have beneficial effects in certain areas, such as lands dedicated to supporting floodplain habitats and certain types of agriculture. For example, floods can benefit water supply, agriculture, and habitat creation. In addition, management actions that may be used to promote groundwater recharge, the movement of sediment and nutrients, and riverine and riparian habitat will contribute to enhanced resilience. As these benefits are realized over time, they contribute to sustainability.

The 2017 refined SSIA portfolio includes residual risk management actions considered for their ability to enhance resilience, depending on the scale and area of interest (systemwide, urban, rural, or small community). Management actions that limit exposure and reduce vulnerability represent the most reliable ways to enhance resilience. These actions—such as communicating risk widely through flood risk awareness campaigns, or promoting the wise use of floodplains via agricultural easements—typically do not preclude other actions from being implemented later, thereby preserving the system's adaptive capacity. Such actions contribute to flood system sustainability and flexibility to accommodate future uncertainty.

> *Resilience* is the ability of a system or community to recover from a shock, such as an extreme flood, or to successfully adapt to adversity or changing conditions, such as climate change, in a timely manner.

> *Residual risk* is the risk that remains in the floodplain after a proposed flood risk management project is implemented. Residual risk includes the consequence of capacity exceedance as well as consideration of project performance.

Yolo Bypass Multi-benefit Improvements

The Sacramento River BWFS developed a recommended option for Yolo Bypass (Map 3-3) and recommended the following major elements for the bypass:

- **Fremont Weir.** Expansion of the Fremont Weir about 1.5 miles, with associated ecosystem and multi-benefit improvements.
- **Elkhorn Basin.** Expansion of the upper portion of the Yolo Bypass with levee setbacks in the Elkhorn Basin and associated ecosystem and multi-benefit improvements. The Lower Elkhorn Basin alignment shown in Map 3-3 represents the current range of project alternatives identified through implementation activities as of October 2016.

- **Sacramento Weir and Bypass.** Expansion of the Sacramento Weir about 1,500 feet with a corresponding expansion of the Sacramento Bypass and associated ecosystem and multi-benefit improvements.

- **Cache Creek Settling Basin.** Measures to extend the useful life of the Cache Creek Settling Basin and address concerns regarding mercury in its sediment.

- **Lower Yolo Bypass expansion.** Expansion of capacity of the Lower Yolo Bypass, considering potential enlargement of the Sacramento Deep Water Ship Channel to convey flood flows and improvements to the west side (combination of fix-in-place and levee setbacks, where feasible), with associated ecosystem and multi-benefit improvements. Further study of west side expansion could include transitory storage concepts in the vicinity of Conaway Ranch that provide multiple benefits.

- **Ecosystem and multi-benefit improvements.** Integration of additional ecosystem and multi-benefit actions (e.g., recreation and public education) in the existing Yolo Bypass footprint, where feasible.

Yolo Bypass expansion would increase the overall capacity of the Sacramento River flood management system to convey large flood events benefiting urban, small community, and rural-agricultural areas. Peak flood stages would be reduced by up to 2 feet along the main-stem upper and lower Sacramento River, American River, Yolo Bypass, Sutter Bypass, and Feather River (see Map 3-4). Yolo Bypass multi-benefit improvements could also create opportunities for increased upland, riparian, and wetland habitat acreage guided by the Conservation Strategy (by more than 3,000 additional acres), including inundated floodplain habitat, to benefit a wide variety of sensitive species. Improvements would also create opportunities for other multi-benefits associated with recreation and open space. The expansion would increase system performance over current conditions to better withstand hydrologic uncertainty, climate change, sea-level rise, and other stressors to provide a wide range of public values in the near term and sustainably over the long-term future.

Lower Elkhorn Basin Levee Setback

DWR is in the process developing a proposed project for a new 7-mile-long setback levee on the east side of the Yolo Bypass in the Lower Elkhorn Basin. This effort represents an important first step toward implementation of a long-term vision for multi-benefit expansion of the Yolo Bypass. The proposed project is being formulated in close coordination with affected landowners, local, State, and federal agency partners. Ongoing project development efforts are striving toward a cost-efficient balance of flood management improvements with agricultural sustainability and ecosystem and recreational improvements by leveraging information and relationships developed through the Sacramento River BWFS and Lower Sacramento River/Delta North RFMP.

Integrating Ecosystem Restoration with Flood Risk Management

The CVFPP includes strategies to integrate and improve ecosystem functions associated with flood risk reduction projects, and to promote the development of multi-benefit projects where feasible. **Restoring ecosystems means restoring the natural processes that create and sustain habitats for fish and wildlife.** The CVFPP Conservation Strategy provides guidance for developing and measuring performance of ecosystem conservation and restoration actions based upon four key goals:

- Improve dynamic hydrologic and geomorphic processes
- Increase and improve riverine and floodplain habitats
- Contribute to the recovery of native species
- Reduce stressors

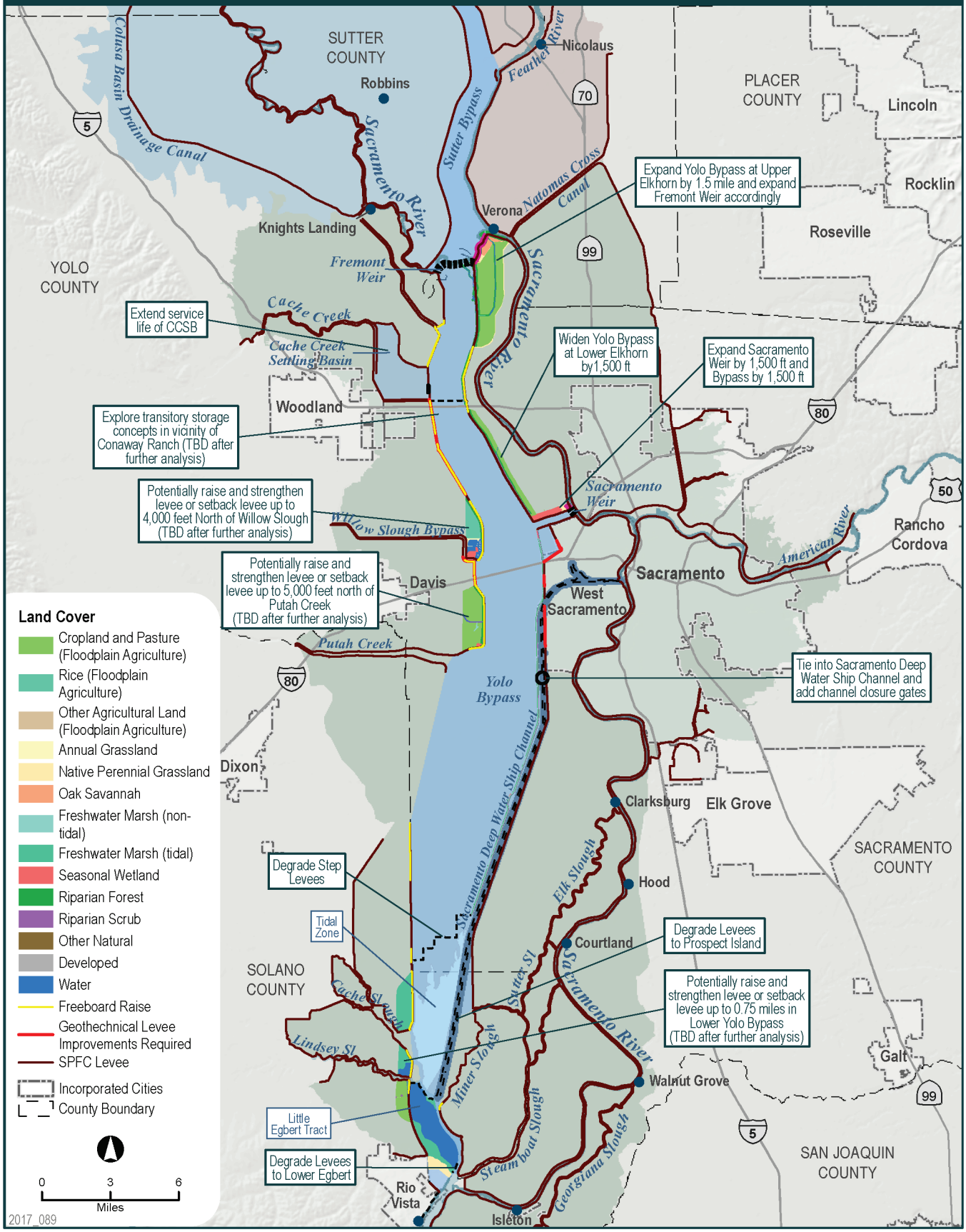
As part of the CVFPP planning process DWR identified and evaluated opportunities for ecosystem improvements during development of the BWFSs. Flood management and ecosystem concepts were developed to balance flood and ecological benefits. Additional refinements will occur as project-level planning proceeds. Other elements needed to create and manage a truly integrated system over time that reliably provides multiple benefits are adequate funding, a regulatory framework that effectively supports long-term integrated management on a system scale, improved agency alignment, and robust governance structures designed to address legal, scientific, and policy matters in an appropriate and timely fashion.

The Sacramento River BWFS recommendations include phasing for implementation. The study acknowledges that substantial additional planning and refinement at the project level is needed before implementing each phase. Refinements to the proposed Yolo Bypass multi-benefit improvements are expected to occur as various phases proceed through project-level planning, full feasibility level analyses, permitting, right-of-way acquisition, design, and construction. Once funding is available, implementation of the Yolo Bypass expansion is expected to take 15 to 20 years. Table 3-3 shows the Yolo Bypass management actions that will seek implementation in the next 5 years, depending on available funding, and which actions are longer-term.

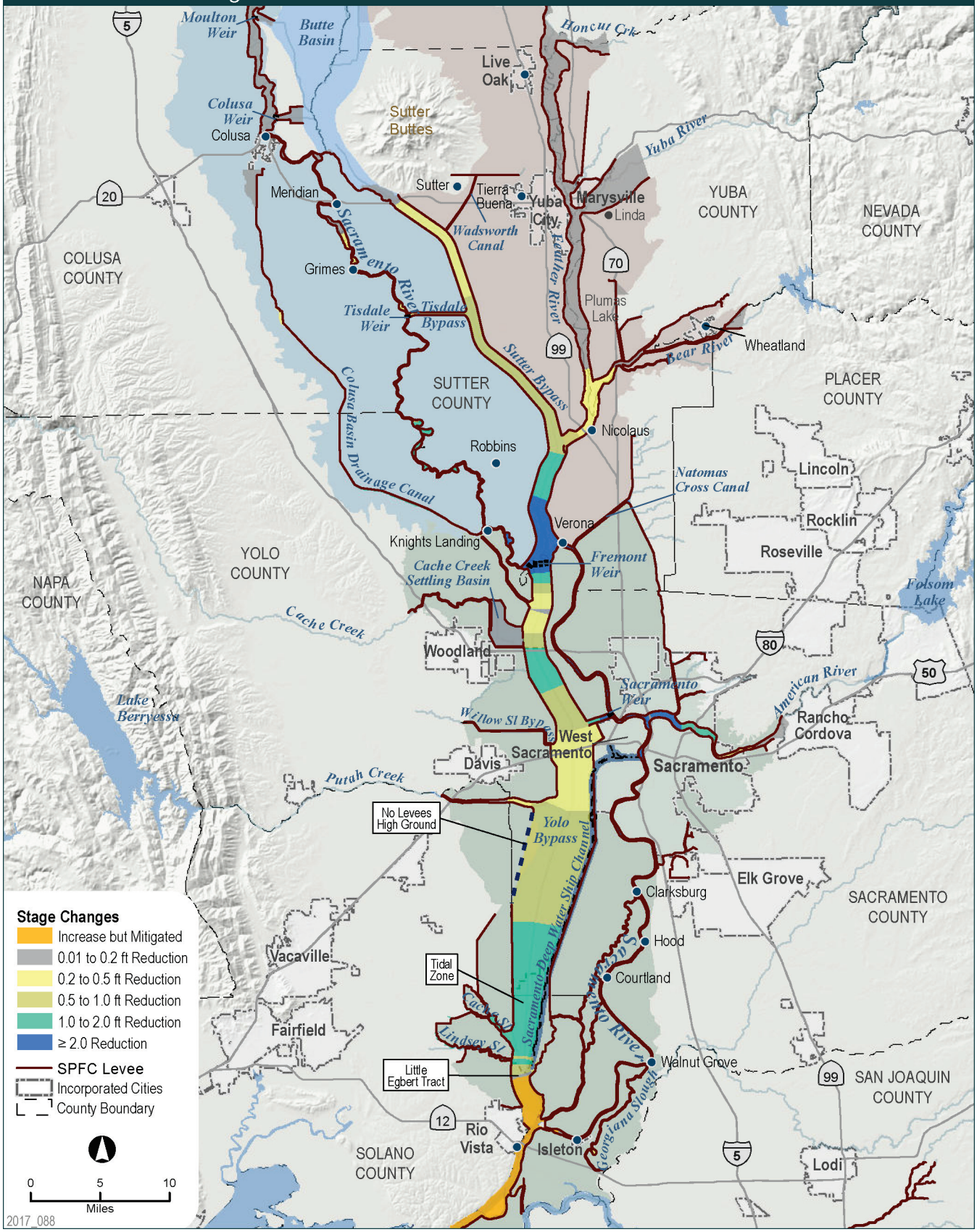
Table 3-3. Yolo Bypass Implementation Activity Anticipated Timing

Next 5 Years	Longer Term
■ Lower Elkhorn levee setback and ecosystem improvements ■ Upper Elkhorn design, permitting, and real estate ■ Sacramento Weir design, permitting, and real estate ■ Sacramento Bypass levee setback and ecosystem improvements ■ Deep Water Ship Channel design, permitting, and real estate ■ Evaluate improvements needed in the Cache Creek Settling Basin ■ Flood and ecosystem improvements in the existing Yolo Bypass footprint (such as Prospect Island and Yolo Bypass Step Levee improvements)	■ Upper Elkhorn levee setback and ecosystem improvements ■ Sacramento Weir expansion ■ Lower Yolo Bypass levee setbacks, levee fix-in-place, and ecosystem improvements ■ Deep Water Ship Channel improvements ■ Cache Creek Settling Basin improvements ■ Fremont Weir expansion

Map 3-3. Yolo Bypass Multi-Benefit Improvements State Recommended Option



Map 3-4. Yolo Bypass Multi-Benefit Improvements Hydraulic Performance for 200 year Event with Climate Change



Upper Elkhorn Basin: A Case Study in Developing Multi-benefit Projects

The following example describes the development process for and opportunities associated with an ecosystem restoration concept for the Fremont Weir and Elkhorn Basin, which was evaluated as a component of the Yolo Bypass expansion in the Sacramento River BWFS. Other BWFS system elements in the San Joaquin and Sacramento River Basins were evaluated in a similar manner for their potential to promote ecosystem functions and multi-benefit projects. As planning proceeds, further opportunities may be developed to promote other multi-benefits associated with Upper Elkhorn Basin, where feasible, including recreational concepts.

Identify multi-benefit opportunities

↓

Develop initial restoration concepts

↓

Vet initial restoration concepts with key stakeholders

↓

Analyze and measure the anticipated results

↓

Refine ecosystem restoration concepts to optimize flood management and ecosystem benefits

↓

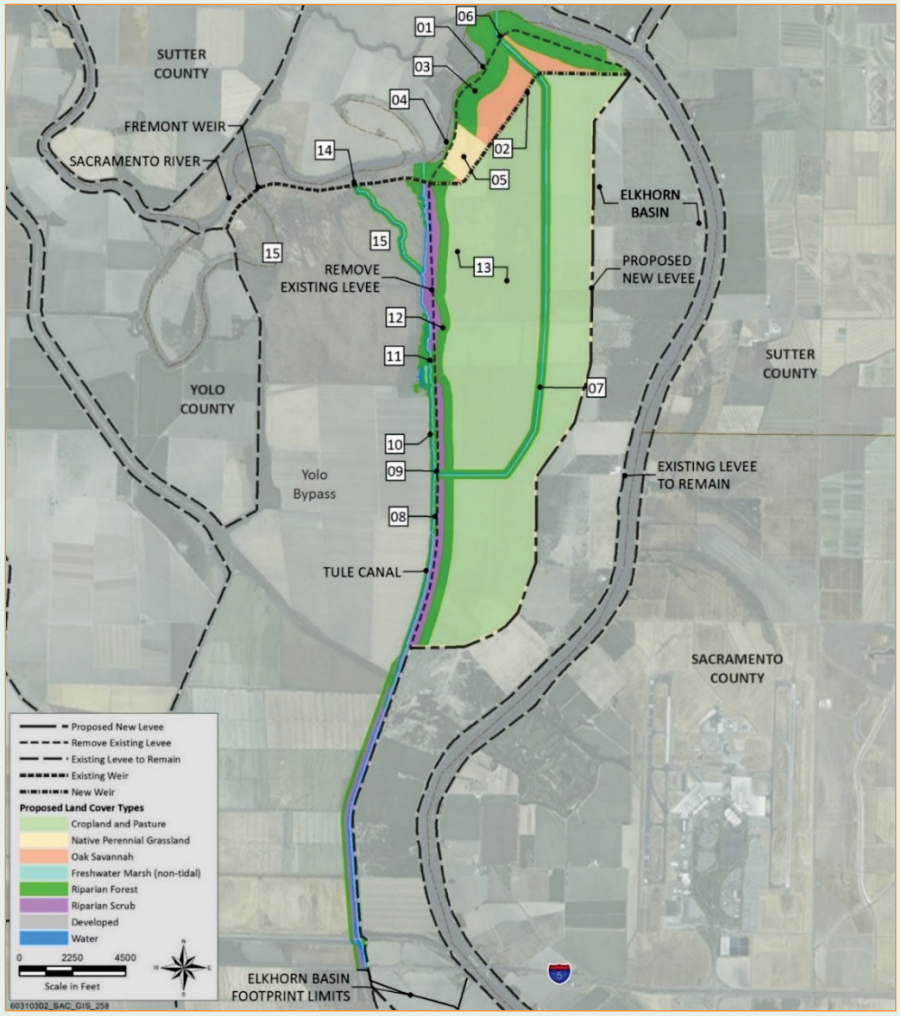
Finalize concepts and perform cost and benefit evaluations

Flood risk management actions and ecosystem restoration opportunities identified in the Upper Elkhorn Basin include the following:

- Modify Fremont Weir and levee configurations to improve flood management and reduce flood risks in the Sacramento region
- Enhance ecosystem processes and habitats by building upon conservation and restoration opportunities proposed by the BiOp fisheries restoration RPAs, Lower Sacramento RFMP, Central Valley Joint Venture, Yolo Bypass Wildlife Area, and other local and regional efforts.
- Improve connectivity and quality of habitat for fish and wildlife species
- Create a continuous habitat corridor along Tule Canal from the Northern Delta to the Sacramento River at the Fremont Weir
- Expand and improve inundated floodplain, riparian, and wetland habitats
- Improve riverine geomorphic processes along the Sacramento River, removing revetment along its banks adjacent to Fremont Weir, and increasing SRA habitat
- Reduce or eliminate fish passage barriers and potential stranding locations
- Remove invasive plant species

Conservation Strategy target species identified as having high restoration potential in the Upper Elkhorn Basin: salmonid, sturgeon, elderberry longhorn beetle, bank swallow, and Swainson's hawk

Potential Ecosystem Restoration Concept for the Upper Elkhorn Basin



This multi-benefit option would lengthen the Fremont Weir and expand the Yolo Bypass to the east to take advantage of the "bathtub" effect of the Elkhorn Basin, providing benefits to target fish species while maximizing agricultural operations within the basin. The numbered callouts provide additional detail for specific features, for example:

4 Remove revetment along the Sacramento River and restore SRA habitat while maintaining existing, as well as, potential bank swallow nesting habitat

7 Construct new channel and riparian corridor (approximately 400 feet wide) through the Elkhorn Basin and connect to Tule Canal

8 Eliminate fish passage barriers and expand the riparian corridor along Tule Canal to be approximately 1,000 feet wide

13 Maintain existing managed wetlands, public use, and agricultural practices within the Bypass; use seasonally as fish rearing habitat

14 Improve the existing fish passage structure in the Fremont Weir to allow passage of salmonids and green sturgeon

This example concept for the Upper Elkhorn Basin is draft in nature, and will change based on collaboration with landowners, stakeholders, and consideration of other factors in later stages of the planning process.

Feather River–Sutter Bypass Multi-benefit Improvements

The Central Valley Flood Protection Board Adoption Resolution 2012-25 (2012 CVFPP, Appendix A) directed that a range of alternatives for the Feather River–Sutter Bypass system be studied. The Sacramento River BWFS analyzed a range of potential system-scale improvements for this system, including different sizes and combinations of the following:

- Cherokee Canal widening and extension[1]
- Wadsworth Canal widening and extension
- Lower Feather River levee setbacks
- Sutter Bypass levee setbacks
- Sutter Bypass fix-in-place levee improvements

However, a recommended option was not selected from among the Feather River–Sutter Bypass options because it is anticipated that flood management improvements in this region would not be implemented until 2030 or later, after Yolo Bypass multi-benefit improvements are completed. Therefore, the 2017 refined SSIA Portfolio includes a range of potential system-scale improvements to the Feather River–Sutter Bypass System that would be further refined through future study to formulate a recommended option in close coordination with local and regional stakeholders. In addition to the above actions, options could include upgrade and modification of Colusa and Tisdale Weirs to divert additional flow from the Sacramento River to the Sutter Bypass, thereby lowering flood stage in the Sacramento River.

DWR intends to continue investing in the rural-agricultural levee system (consistent with the CVFPP goals and objectives) and relying on related implementation programs such as the Small Erosion Repair Program (SERP) and other programs that may be developed, as funding becomes available. Given the anticipated lead time to implement potential systemwide improvements in the Feather River—Sutter Bypass system, DWR intends to make those investment decisions on a case-by-case basis and priority based on current information, which would not be hindered by potential long-term systemwide improvements.

Paradise Cut Multi-benefit Improvements

The 2012 SSIA broadly defined a Paradise Cut bypass expansion as an element to improve flood risk management and provide ecosystem benefits in the San Joaquin River Basin. Since 2012, the San Joaquin River BWFS analyzed potential Paradise Cut options to identify a recommended option (shown on Map 3-5) that includes the following major features:

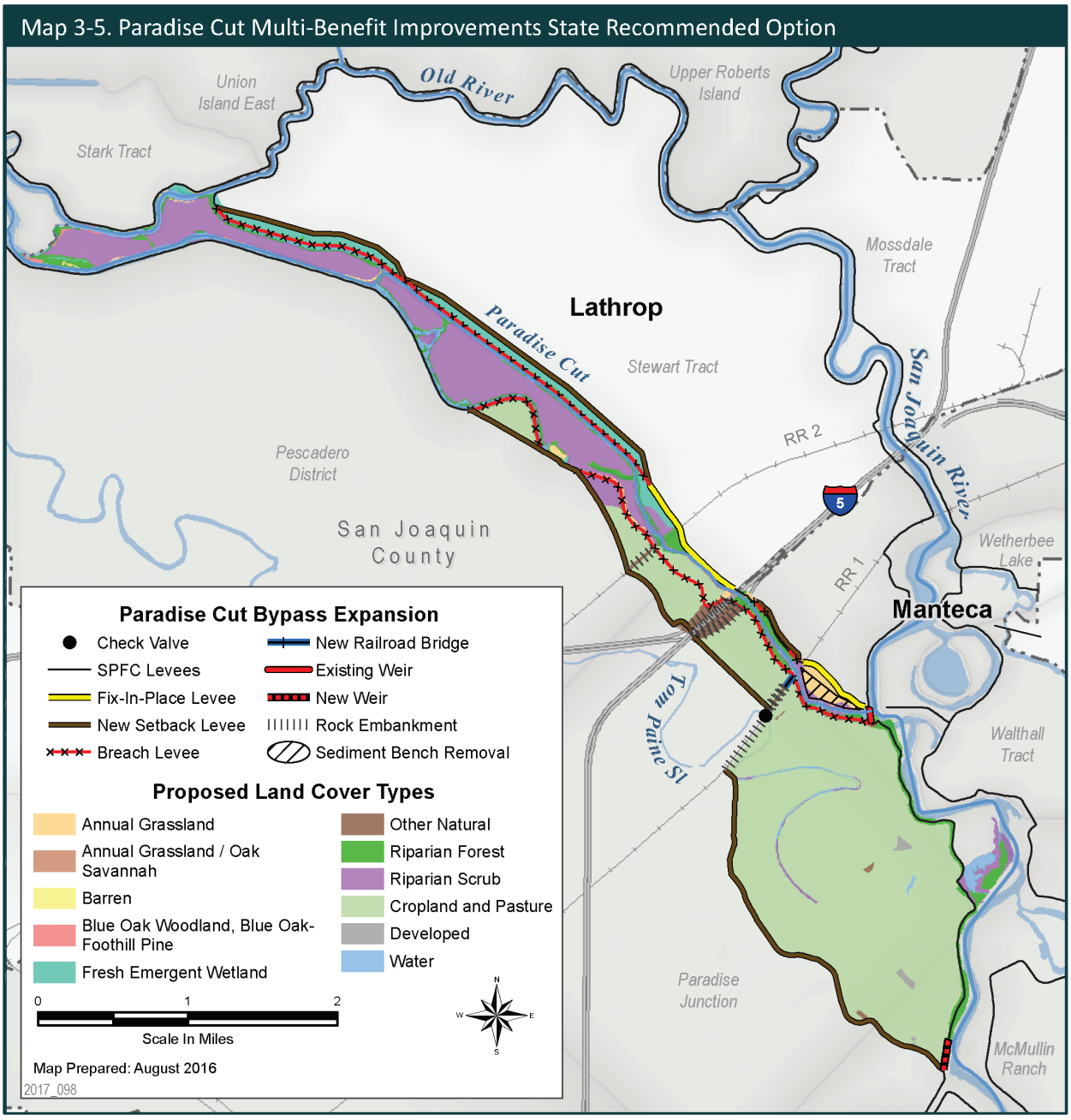
- New 1,000-foot-long weir and associated levee setback
- Shaded riverine aquatic habitat restoration along a decommissioned levee
- Riparian cover for native species
- Revetment to restore geomorphic processes along decommissioned levee
- Restore southern portion of current in-channel bar for floodplain rearing habitat

[1] Restoring Cherokee Canal to its original design capacity was also studied, and is considered to be infeasible. Documentation is included as an appendix to the Sacramento River BWFS.

The proposed Paradise Cut multi-benefit improvements would provide public safety benefits by reducing flood stage more than 2 feet along the San Joaquin River at Mossdale Tract (shown on Map 3-5) and reducing the probability of levee failure in the San Joaquin River downstream of Paradise Cut. Ecosystem improvements consistent with the Conservation Strategy would increase riparian and wetland habitat by about 500 acres and would benefit a wide variety of endangered species.

Key implementation actions for Paradise Cut bypass expansion include acquiring appropriate lands, which is expected to take a few years to complete. A more detailed feasibility study and additional stakeholder engagement will need to be completed to inform the design, permitting, and implementation of the bypass expansion in future phases.

Map 3-5. Paradise Cut Multi-Benefit Improvements State Recommended Option



Reservoir Management Actions

The 2012 SSIA included support for the ongoing Folsom Dam Joint Federal Project and for pursuit of coordinated reservoir operations actions in Central Valley reservoirs.

In the Sacramento River Basin, the 2017 refined SSIA Portfolio continues to include the Folsom Dam Raise and Folsom Dam Joint Federal Project. It also includes New Bullards Bar outlet modification on the Yuba River to increase the release capacity of the reservoir by adding a second gated spillway tunnel to the outlet works of the dam.

In the San Joaquin River Basin, the San Joaquin River BWFS analyzed a range of reservoir flood storage and operations actions. The BWFS analysis found that additional flood storage in the Calaveras River system would significantly reduce stages and corresponding flood risk near downstream urban areas, particularly during large flood events with projected climate change (4-foot reduction in stage during the 200-year with climate change event). This could be achieved through two means: (1) proactively releasing water from existing reservoirs before flood events with enhanced long-term runoff forecasts under F-IO, and/or (2) storing water from existing reservoirs in a groundwater bank through recharge and conjunctive use operations to increase reservoir flood storage while maintaining long-term water supply. In addition, increasing objective release capacity in the Tuolumne River system was found to provide substantial public safety benefits within the watershed and downstream. Therefore, the 2017 refined SSIA Portfolio includes enhancements to flood storage on the Calaveras River and Tuolumne River watersheds to be further refined through future study with reservoir operators and other partners.

Key actions include the following:

- Coordinate and provide project cost-share for completion of Folsom Dam Raise project
- Complete design, environmental documentation and permitting for the project to construct a New Bullards Bar lower outlet
- Evaluate the feasibility of increasing upstream flood storage in New Hogan Lake or elsewhere in the Calaveras River Watershed
- Evaluate reservoir operation actions for New Don Pedro Reservoir in the Tuolumne River Watershed
- Develop a Decision Support System and other tools for reservoir operators to enhance both F-CO and F-IO and conduct operational exercises with reservoir operators that emphasize the coordinated operations of the reservoirs in the Central Valley

Floodplain Storage Actions

The 2012 SSIA did not identify any site-specific floodplain storage actions, but supported pursuit of such storage actions on a willing-seller basis where consistent with local land use plans, all affected landowners support such storage, and the new flood storage area can be safely isolated from adjacent areas. The 2017 refined SSIA portfolio continues to include pursuit of these projects on a willing-seller basis.

The Mid San Joaquin RFMP and San Joaquin River BWFS identified the Dos Rios and Three Amigos transitory storage projects, which are included because of their strong potential for flood and ecosystem benefits. The Dos Rios and Three Amigos projects would provide about 700 acres of new riparian and marsh habitat. An additional site was identified by the Feather River RFMP at the Oroville Wildlife Area. Transitory storage projects such as these can provide significant habitat improvements that contribute toward ecological goals, as well as reducing future risk exposure by protecting land in the floodplain from future development. Key actions include continuing restoration activities at Dos Rios Ranch and Three Amigos Transitory Storage project.

Conjunctive Use and Groundwater Recharge

The 2012 SSIA included support for programs using flood flows for groundwater recharge to improve water management in the San Joaquin River Basin. It did not recommend any specific recharge projects, but recommended exploring recharge opportunities in the basin. The San Joaquin River BWFS and RFMPs found that groundwater recharge could replenish the stressed aquifer in the San Joaquin River flood system to enhance regional water supply and potentially reduce and prevent future subsidence and its potential impacts on flood system capacity. Potential locations have been identified through the San Joaquin River BWFS and RFMPs in Madera County, including a proposed groundwater banking project that would reduce groundwater overdraft in the Red Top and El Nido areas, where the greatest subsidence has occurred in recent years.

Dos Rios Ranch and Three Amigos

Since 2002, River Partners, the U.S. Fish and Wildlife Service (USFWS), DWR, and many other partners have been in the process of developing one of the largest contiguous riparian habitat restoration areas in California by designing levee breaches, constructed wetland basins, elevated refugia for terrestrial species, and vegetation patterns at Dos Rios Ranch and Three Amigos. The result is a landscape-scale working model for multi-benefit flood projects.

Approximately 4,800 acres of flood-prone land are being repurposed to serve as both high-quality floodplain habitat for threatened and endangered species and as transitory storage basins during floods. These actions are consistent with wise use of the floodplains because they provide several valuable outcomes, including:

- Flood risk reduction (nonstructural) by keeping flood-prone lands out of urban development
- Significant ecosystem restoration benefits
- Potential reduction of long-term O&M needs.

Supporting efforts for the 2017 CVFPP Update examined the potential ecological benefits of breaching levees in these areas to increase floodplain inundation, potential flood benefits from downstream stage reduction, and recreational benefits. Projects like these represent an opportunity for farmers, wildlife managers, and other flood management interests to achieve multiple benefits on the same site.

Emergency Management Actions

The 2012 SSIA includes several enhanced emergency flood response actions, including all-weather roads; flood information collection and sharing; local flood emergency response planning, forecasting and notification; and a rural post-flood recovery assistance program.

Floodfight training in the Sutter Basin

For the 2017 CVFPP Update, DWR estimated that most areas in the Central Valley could increase warning and mitigation times by 1 to 2 hours, with some areas improving by up to 7 hours. It is estimated that these improvements in emergency management would improve life safety by about 40% and reduce property damages by about 2% systemwide. Emergency management actions include updating emergency response plans for each local maintaining agency, designing and constructing all-weather access roads, enhancing flood forecasting and notification systems and adding new forecast points, maintaining flood fight supplies, and enhancing F-CO and F-IO for reservoirs in the Central Valley.

The following specific activities are planned for implementation to reduce vulnerability of people and property in high-risk areas:

- Prioritize design and construction of improved all-weather access roads on levee crowns for quick response to flood emergencies
- Enhance flood forecasting and notifications for rural and small communities by assessing and prioritizing needs, identifying additional forecasting points in Sacramento and San Joaquin basins, and providing flood forecasts and notifications for rural agricultural areas
- Continue to maintain strategically located stockpiles of flood fight materials in the Sacramento and San Joaquin Valleys, and three locations in the Delta
- Provide technical and financial assistance to local agencies to help them develop local flood preparedness and response plans for their communities and conduct regional and local flood exercises, and engage local responders to improve flood emergency readiness at the local level
- Develop and train staff on the use of the Flood Emergency Management System for the State-Federal Joint Flood Operations Center to manage, track, and report the flood emergency management and flood fight activities

Routine Maintenance

Routine maintenance includes the following:

- Routine levee and channel maintenance, such as rodent control, vegetation control, encroachments and pipe maintenance, bank erosion and repair, and sediment removal
- Minor structures maintenance, such as stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments

- Major structures maintenance, such as weirs, bypass outflow control structures, outfall gate facilities, and SPFC pumping plants

The activities listed below will be carried out by the State on facilities for which it is responsible under California Water Code (CWC) Sections 8361 and 12878. The State will also consider providing implementation grant funding to partner local agencies to ensure proper operation and maintenance of all SPFC facilities.

- Maintain all-weather levee crown roads for quick response to potential flood threats
- Assist LMAs with fixing sites requiring critical repairs in rural agricultural areas
- Enhance inspection and maintenance of the levees and channels of the SPFC under jurisdiction of the State
- Ensure that sites identified as requiring maintenance actions during spring inspections are properly maintained and repaired by fall, prior to flood season
- Coordinate inspection and timely maintenance of the levees under jurisdictions of the LMAs

Routine vegetation control

- Repair facilities in a timely manner that are the responsibility of the State and that are identified during an inspection as having deficiencies
- Develop strategies for long-term system management and maintenance of the SPFC facilities, such as improving the efficiency of permitting routine maintenance activities and addressing legacy system issues such as encroachment and pipe penetrations

State Operations, Planning, and Performance Tracking

To support the wide variety of investments of the 2017 refined SSIA portfolio, the State must have adequate capacity to administer program activities, continue planning and coordinating with federal agencies, and develop an initial performance tracking system for assessing the effectiveness of these flood investments. A performance tracking system would compare the results of the set intended outcomes of the CVFPP against actual outcomes in the designated timeframe. This would enable flood managers to make better-informed decisions on what types of actions and policies are working most effectively to achieve CVFPP goals (see Chapters 2 and 4). Key actions include development of a performance tracking system for investments and performing updates to the Flood System Status Report (mandated by legislation) and the SPFC Descriptive Document (if needed) that would accompany future CVFPP updates and inform the CVFPB of performance and potential changes to the SPFC.

3.1.3 The Urban Portfolio

The urban portfolio supports improvements to urban (populations greater than 10,000) levees and structures to achieve protection from the 200-year (0.5% annual chance) flood. Urban improvements to levees or floodwalls should continue to follow DWR's Urban Levee Design Criteria, consider incorporating ecosystem restoration in project designs where feasible, be implemented and maintained consistent with the State's vegetation management approach, and be consistent with the wise use of floodplains that is described more fully in Section 3.2.1. This would preserve urban development opportunities within specific boundaries without inducing broader urban development in SPFC floodplains that increases aggregate economic and life safety risk.

DWR will continue to evaluate and participate in projects that contribute to achieving an urban level of flood protection by improving SPFC facilities for the following urban areas in the Central Valley:

- **City of Chico.** Includes SPFC urban levee improvements bordering the City of Chico to provide protection from flooding along local tributaries.
- **Yuba City and City of Marysville.** Includes completion of remaining SPFC urban levee improvements along the Feather and Yuba Rivers through continued implementation efforts with USACE and local partners.
- **Sacramento metropolitan area.** Includes completion of remaining SPFC urban levee improvements along the Sacramento River and American River, Natomas East Main Drainage Canal, and South Sacramento County Streams through continued implementation efforts with USACE and local partners. Also includes improving SPFC urban levees for the City of West Sacramento, along with the Folsom Dam raise and construction of an auxiliary spillway at Folsom Dam as part of the Folsom Dam JFP.
- **Cities of Woodland and Davis.** Includes continued study and completion of SPFC urban levee improvements along Lower Cache Creek through continued implementation efforts with USACE and local partners, including Cache Creek Settling Basin and along Willow Slough Bypass.
- **City of Merced.** Continued support of the Merced County Streams Group effort to identify urban levee improvements and storage opportunities to provide the City of Merced with protection from flooding.
- **Stockton metropolitan area.** Includes urban improvements to SPFC and appurtenant non-SPFC levees and structures with USACE and local partners, including construction of the Smith Canal, Mormon Bypass, and Stockton area levee improvements. Also includes proposed levee improvements with USACE and local partners for Lathrop/Manteca.
- **Other areas.** For urban areas protected by non-SPFC levees, the State may evaluate its interest in participating in levee improvements under other State programs (not under the CVFPP).

In addition to these improvements, the urban portfolio supports a broad array of actions to manage residual flood risk. Although opportunities to improve ecosystem functions in urban areas are more limited compared to small communities and rural-agricultural areas, urban areas should leverage site-specific opportunities to achieve ecosystem and multiple benefits, where feasible. Figure 3-4 displays the expected outcomes expected from the different types of flood management actions in urban areas.

The feasibility studies and construction projects for urban areas include continued implementation of ongoing USACE-authorized projects and completion of State-federal projects recommended by ongoing feasibility studies. These projects and feasibility studies are shown in Table 3-4. Other actions with potential to benefit urban areas are also included in the systemwide portfolio.

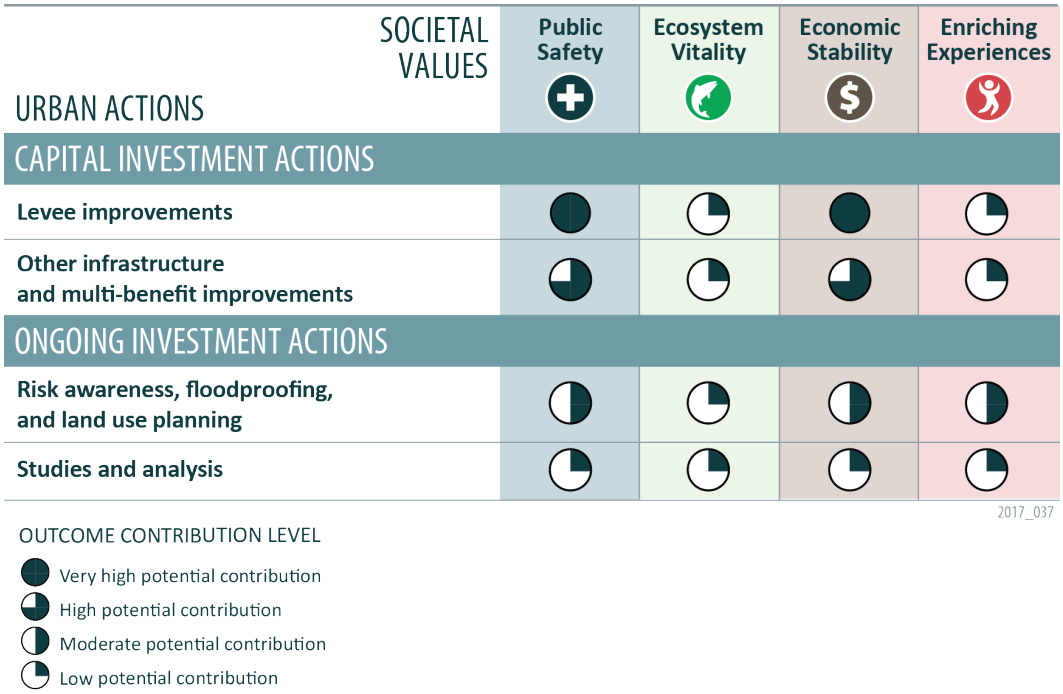


Figure 3-4. Expected Outcomes from Urban Actions

Table 3-4. Key Projects for the Urban Portfolio

Ongoing EIP*and USACE-Authorized Projects	
■ Initiate authorized West Sacramento Area Flood Control Agency (WSAFCA) construction ■ Initiate federal portion of Natomas Basin ARCF construction ■ Initiate Sacramento Bank Protection Phase II Construction (American River) ■ Initiate Stockton area levee construction, including western front levees ■ Complete ARCF 2014 WRDA sites ■ Complete Folsom Dam Joint Federal Project and Dam Raise ■ Complete Marysville Ring Levee improvements	■ Complete SAFCA levee accreditation for the Pocket Area and North Area ■ Complete SBFCA Feather River West Levee ■ Complete SJAFCA Smith Canal construction ■ Complete South Sacramento County Streams construction ■ Complete WSAFCA-approved construction, including Southport Levee Improvements ■ Complete RD 17 Improvements ■ Complete Star Bend Improvements ■ Complete Bear River Improvements
Feasibility Studies with Recommended State-Federal Projects	
■ Cache Creek Settling Basin General Reevaluation Report ■ Merced County Streams General Reevaluation Report ■ Sacramento River General Reevaluation Report ■ West Sacramento General Reevaluation Report	■ Woodland Lower Cache Creek Feasibility Study ■ Yuba River General Reevaluation Report, including study of Yuba Goldfields ■ Lower San Joaquin River Feasibility Study

*DWR's Early Implementation Program (EIP) has become the Urban Flood Risk Reduction (UFRR) Program.

3.1.4 The Rural Portfolio

The rural portfolio supports actions to perform critical repairs for rural levees and hydraulic structures, along with an emphasis on traditionally nonstructural approaches such as land acquisitions and easements and habitat restoration/reconnection actions. The State continues to support maintaining levee crown elevations and providing all-weather access roads to facilitate inspection and floodfighting on rural SPFC levees. Land acquisitions and easements can reduce risk intensification from future population growth and improve the system's ability to attenuate floods. The State intends to enter conversations with willing landowners to achieve these actions where possible. The rural portfolio also includes deferred maintenance actions to address pipe penetrations in SPFC levees, and critical repairs for rural levees to address erosion, seepage, and stability. In addition, repair and rehabilitation of Butte Basin small weir structures, Upper San Joaquin hydraulic structures, and levee repairs and flowage easements to address San Joaquin Basin subsidence are included. Rural flood risk reduction actions that can achieve multiple benefits will be higher priority than other projects. Rural habitat restoration can restore floodplains, improve water quality, and provide habitat for salmonids, migratory birds, and waterfowl while maintaining agricultural production.

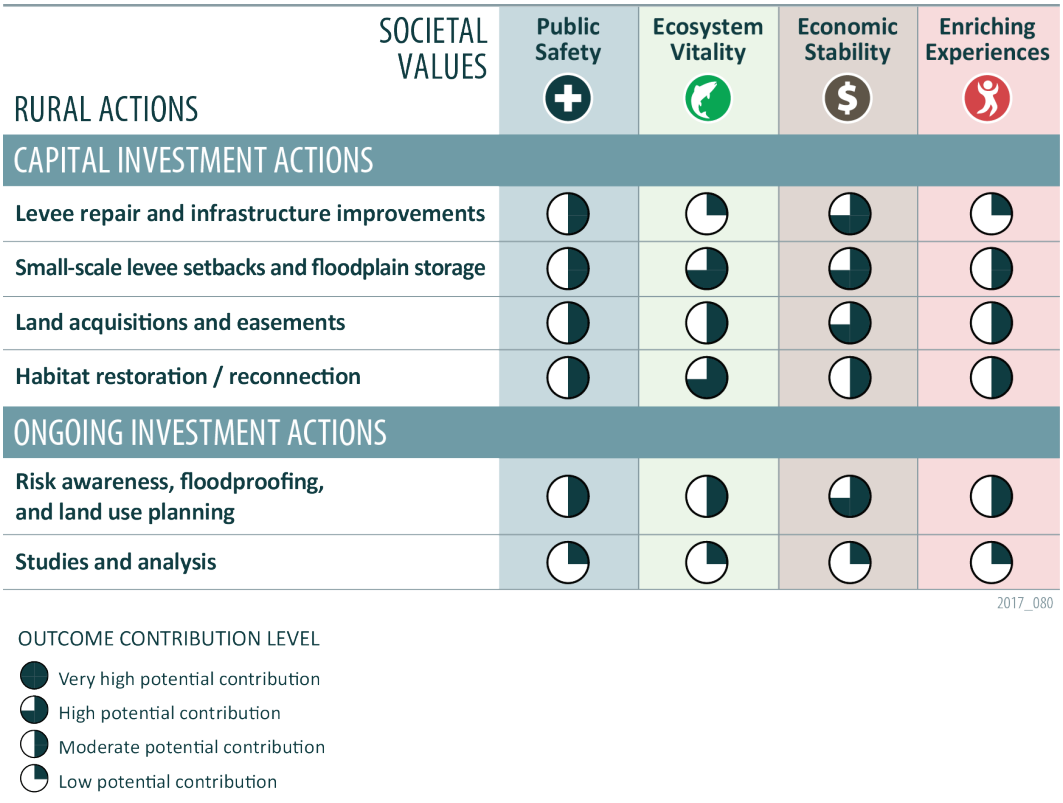


Figure 3-5. Expected Outcomes from Rural Actions

Compared to the urban and small community portfolios, the rural portfolio has the greatest potential to prevent future risk intensification by supporting and enhancing rural and agricultural economies and ecosystem functions in the floodplain. Figure 3-5 displays the expected outcomes expected from different types of management actions in rural areas. Since new or improved levees in rural areas have potential to intensify risk in SPFC floodplains, the 2017 refined SSIA portfolio emphasizes actions to address deferred maintenance, critical repairs, and floodplain management in rural areas consistent with the CVFPP. Other priority actions with potential to benefit rural areas are included in the systemwide portfolio.

3.1.5 The Small Communities Portfolio

The 2017 refined SSIA portfolio supports structural and non-structural actions to protect small communities from 100-year (1% annual chance) flood events. Following adoption of the CVFPP, DWR initiated the Small Communities Flood Risk Reduction (SCFRR) program to help communities having fewer than 10,000 residents protected by the SPFC achieve 100-year protection, where feasible. The SCFRR program currently supports actions for the continued viability of small communities within the SPFC Planning Area to preserve cultural and historical continuity and important social, economic, and public services to rural-agricultural populations, agricultural enterprises, and commercial operations. This would preserve small community development opportunities within specific boundaries without providing urban level of protection and encouraging broader urban development.

Like urban areas, small communities located in floodplains contain a degree of risk to human life, and the density of existing development somewhat limits the types of management actions available within the small community footprints. However, unlike urban areas, the smaller scale of development and openness of the surrounding landscape often allows for a more diverse and resilient approach to flood management that holistically addresses all components of risk and contains more multi-benefit opportunities. Many small communities in the Central Valley are disadvantaged communities with limited resources to plan or implement flood management system repairs, rehabilitation, or improvements without greater assistance from the State and other partners.

Small communities are encouraged to consider a wide variety of actions to reduce flood risk. Nonstructural actions, such as raising/elevating structures and floodproofing should be considered alongside structural improvements. Floodplain management actions, such as floodplain risk awareness campaigns and land use management policies, are particularly effective at risk reduction for small communities. The State also supports considering multi-benefit opportunities that integrate other resources needs, such as the multi-benefit improvements that are being implemented in Hamilton City. Figure 3-6 displays the expected outcomes expected from the different types of flood management opportunities in small communities.

In the context of the overall SSIA portfolio, small community improvements are considered higher priority investment relative to rural-agricultural areas due to the larger number of human lives exposed. Higher priority will be given to small community actions that provide multiple benefits, such as levee setbacks and floodplain management actions. In addition to those included in the small communities portfolio, other actions with potential to benefit small communities are included in the systemwide portfolio.

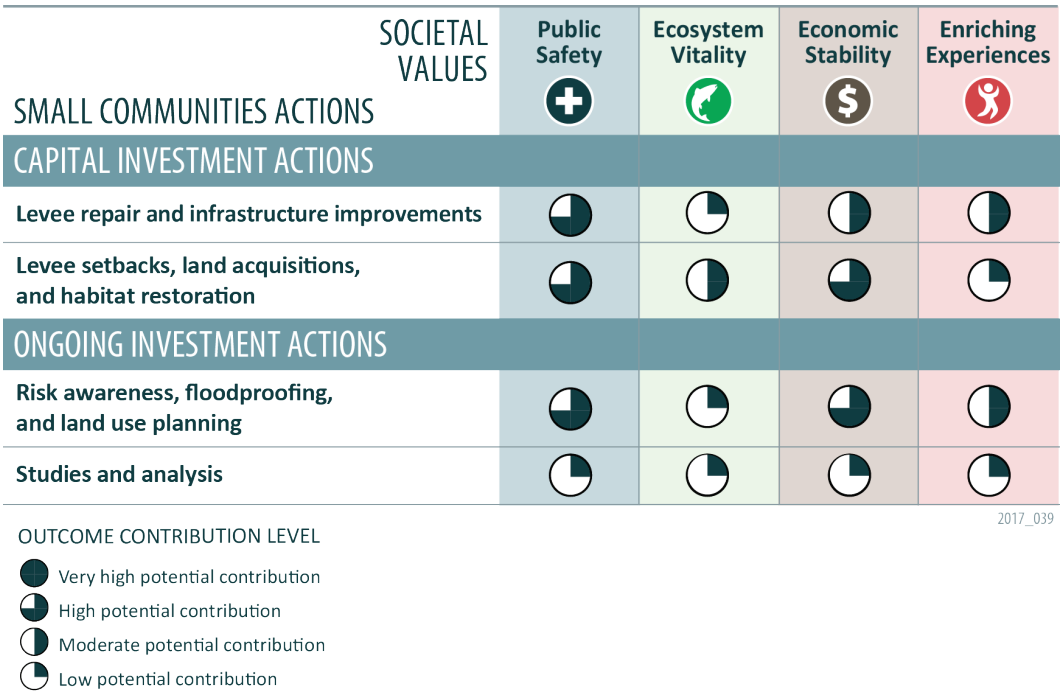


Figure 3-6. Expected Outcomes from Small Communities Actions

3.1.6 Summary of Expected Outcomes from Implementation of the Refined SSIA Portfolio

Implementation of a broad range of management action types is necessary to achieve the goals of the CVFPP. Figure 3-7 shows the relative performance of the 2017 refined SSIA portfolio compared to the 2012 SSIA in terms of contributing to the CVFPP primary and supporting goals. The performance of the 2017 refined SSIA portfolio is enhanced in its contributions to CVFPP primary and supporting goals compared to the SSIA in 2012 based on information integrated from the supporting efforts. An updated cost estimate is provided in Chapter 4. Maps 3-6 and 3-7 show the number of management actions from the SSIA portfolio that are expected to provide each type of outcome within each region. These figures provide a high-level overview of the types of outcomes expected from the SSIA portfolio in each region. Consistent with the CVFPP goals, the greatest number of actions contributes to public safety and economic stability outcomes and a moderate number of actions contributed to ecosystem vitality outcomes. The fewest number of actions are expected to contribute to enriching experience outcomes.

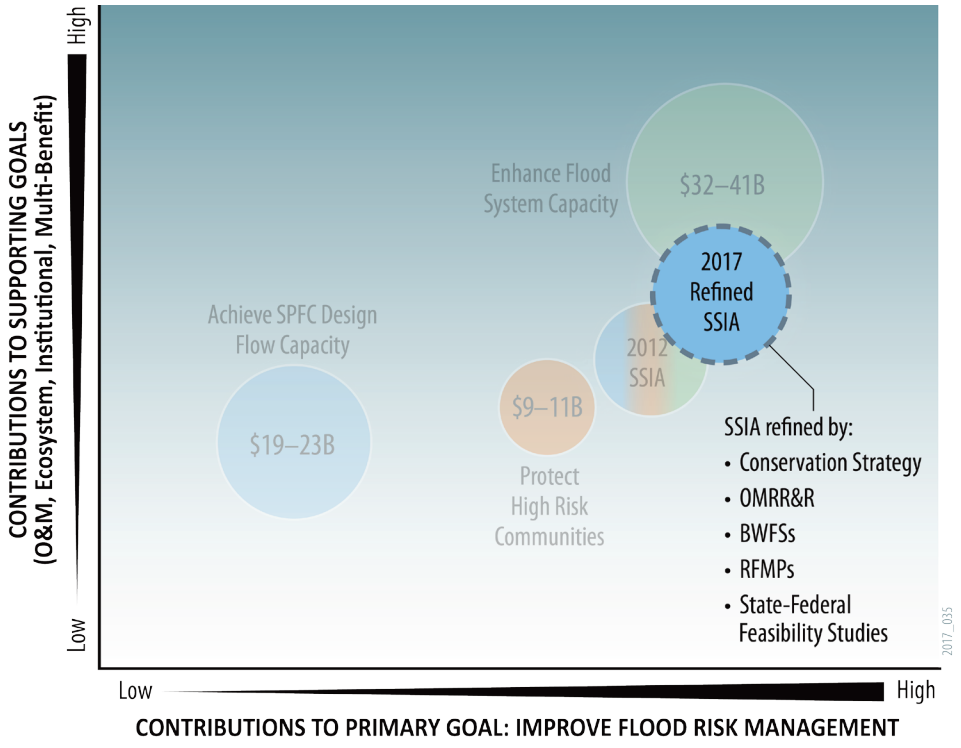
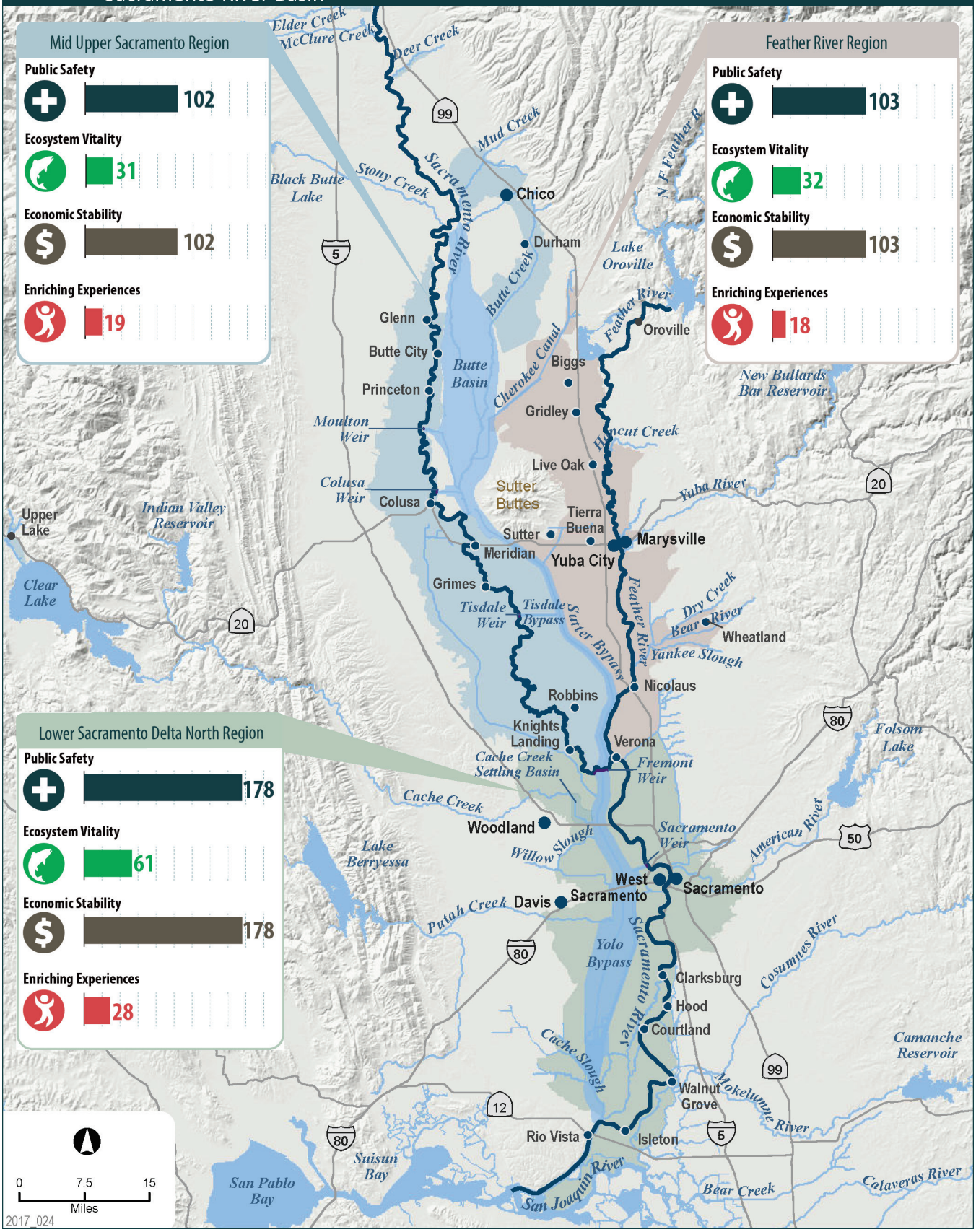
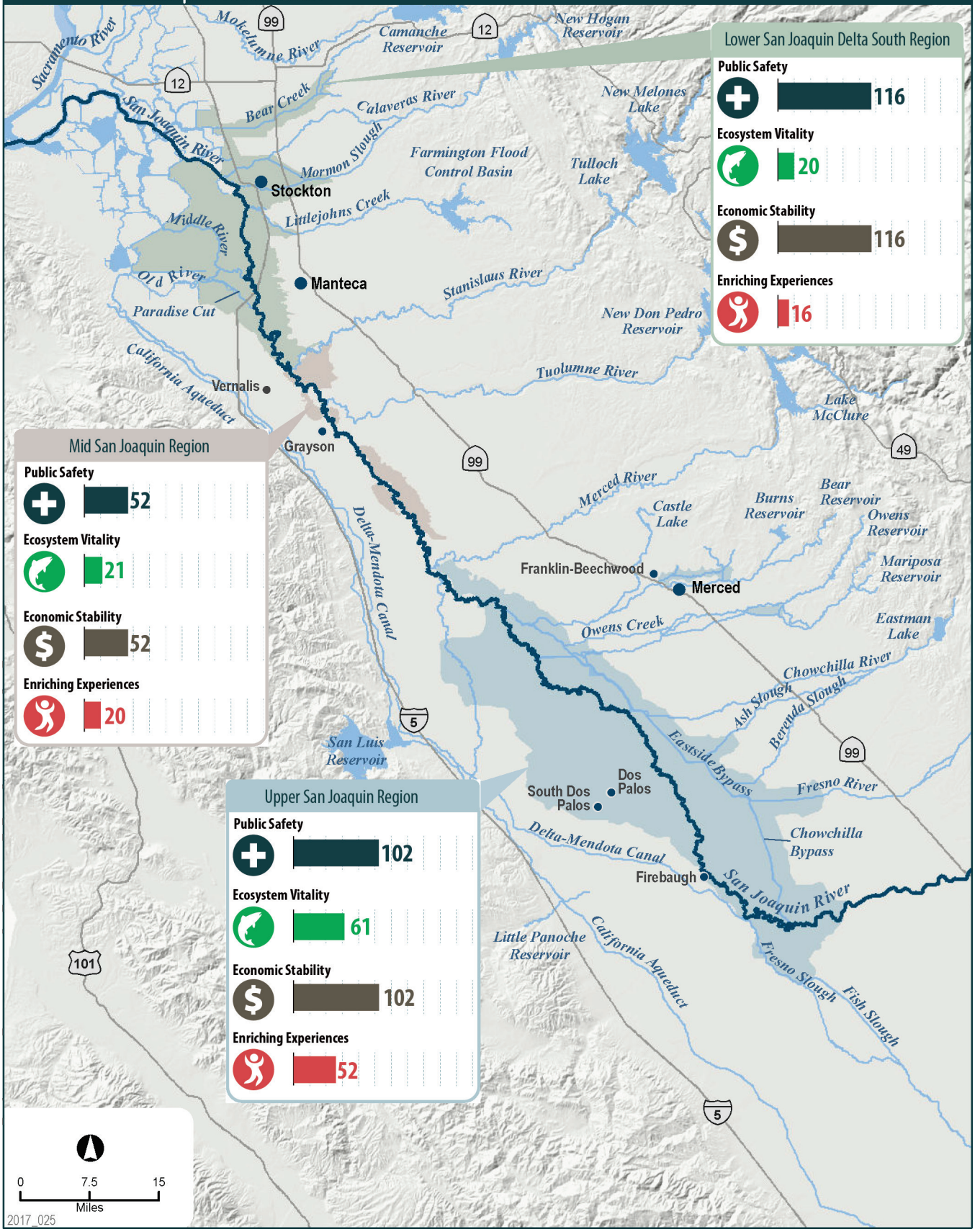


Figure 3-7. Relative Comparison of 2017 Refined SSIA with 2012 SSIA

Map 3-6. Number of Management Actions Contributing to Each Outcome in Each Region in the Sacramento River Basin



Map 3-7. Number of Management Actions Contributing to Each Outcome in Each Region in the San Joaquin River Basin



Limiting Flood Exposure Contributes to Greater Sustainability

As flood managers have embraced a flood risk management approach in recent years, greater emphasis is placed on limiting exposure of life and property. This is primarily in response to continued development in floodplains that puts more people at risk, as well as the rapidly escalating cost of flood damages over time. However, limiting exposure also offers opportunities for ecosystem and other benefits to be realized; for these reasons, limiting risk exposure contributes to greater sustainability.

The greatest benefit of limiting exposure is that it limits flood risk regardless of how well flood system infrastructure performs. Infrastructure is subject to many factors that may degrade its performance during a flood event, especially if it is not properly maintained as it ages. Otherwise, without sufficient and sustained investments in the flood system, the risk to life and property grows.

Although individual projects may differ in their effectiveness based on local circumstances, the following types of management actions tend to have the greatest potential to limit exposure of life and property over time:

- Rural agricultural and conservation easements
- Flood risk awareness campaigns
- Land use planning and policies
- Property acquisitions

Additionally, the following action types may have some potential to limit exposure of life and property over time:

- Levee setbacks
- Bypasses
- Transitory storage

Quantitative Estimates of Expected Contributions to Desired Outcomes

To supplement the high-level overview of outcomes described previously for each area of interest, quantitative estimates have been developed to estimate the expected outcomes from actions in the SSIA portfolio over the next 50 years, considering projected hydrologic uncertainty and climate change. These quantitative estimates are based on technical analysis performed using a subset of actions that included most of the urban levee improvements and systemwide actions described above that were large and well-defined enough to be represented in systemwide models.

A series of scenarios representing different points in time through the 50-year period have been evaluated making use of outputs of the climate change analyses undertaken for the 2017 CVFPP Update, Central Valley Hydrology Study hydrological tools, and the hydraulic modeling tools updated since 2012. Hydraulic modeling accounted for the effects of potential levee breaches based on levee geotechnical conditions.

The following five scenarios were analyzed:

- **2007 Scenario.** This scenario represents an approximation of the performance of the system before the significant improvements made since 2007 with the availability of bond funding. This scenario represents the point in time before implementation of the EIP projects, which are more significant in the Sacramento Basin compared to the San Joaquin Basin. It is important to note that the modeling tools available for the 2017 CVFPP Update have evolved over the past 10 years, so the CVFPP results will not exactly match those that may have been generated during implementation of the EIP projects. However, even with the updated tools, the EIP projects were found to still greatly reduce flood risk.

- **2017 Without Project Scenario.** This scenario includes the existing conditions of flood management systems in the Central Valley, and also includes projects that have been authorized and have funding, or that have started construction or implementation, including:

  - Yuba and Feather River Levee improvements
  - American River and Sacramento River levee improvements
  - Natomas Levee Improvement Program
  - Folsom Dam Joint Federal Project
  - West Sacramento Levee Repair and Improvement Projects
  - American River Common Features Project

- **2017 Enhanced Flood Response and Emergency Management Scenario.** Physically, this scenario is the same as the 2017 Without Project Scenario. It includes non-structural actions only, so there is no change in the flood hazard between the two 2017 scenarios. This scenario is intended to show the benefits from key, non-structural systemwide actions that could be implemented in the short-term, and includes all the projects in the 2017 Without Project Scenario plus the following additional actions:

  - Increased data collection and enhancement of forecasting tools, and expanded use of forecast-based operations to increase reservoir management flexibility and increased forecast lead times

  - Enhancements to emergency preparedness plans and ability to respond in flood emergencies and decreased notification and decision making times

- **2067 Without Project Scenario.** This scenario has all the same features as for the 2017 Without Project Scenario. However, the effects of climate change, sea level rise and population and land use changes at the end of 50 years are included. The climate change and sea level rise effects applied are discussed in Chapter 2. The future growth factors were based on the 2013 California Water Plan 2010–2050 projections of population, commercial and industrial employment, and irrigated crop acreages by Planning Subarea. Growth factors for urban areas were applied only if urban level of protection criteria were assumed to be met under the SSIA, consistent with the Central Valley Flood Protection Act of 2008.

- **2067 With Project Scenario.** This scenario includes all the projects in the 2067 Without Project Scenario plus the following systemwide and larger-scale actions:
  - Yolo Bypass multi-benefit improvements
  - New Bullards Bar Lower Level Outlet
  - Folsom Dam Raise
  - Paradise Cut multi-benefit improvements
  - Stockton levee improvements
  - San Joaquin Basin reservoir actions on the Calaveras and Tuolumne Rivers
  - Dos Rios and Three Amigos transitory storage projects
  - Enhanced flood response and emergency management actions included in the 2017 scenario above

Figure 3-8 shows the expected annual life loss results for each of the five scenarios analyzed. The changes are consistent with the changes in flow and stage described above. Between 2007 and the 2017 Without Project Scenarios, expected annual life loss in the Sacramento River basin is substantially reduced because of implementation of EIP projects. However, the San Joaquin River Basin shows a small increase in life loss between 2007 and 2017 resulting from population growth (most San Joaquin EIP improvements are not reflected in the 2017 scenario). However, both basins show substantial reductions in life loss with implementation of systemwide flood response and emergency management actions.

The results shown indicate projected change over time between the 2007, 2017, and 2067 scenarios (with and without implementation of the SSIA). The results displayed in the figures are given as expected annual life loss. The metric is not a predictor of life loss for a given year, but rather indicates the potential life loss any given year considering the full range of potential flood events and the likelihood of those occurring. The results are informative indices of life risk. However, the results are not forecasts of deaths expected to occur from flood events nor are to be used for emergency planning or other purposes; that would require much more detailed analyses and supporting data than used for this level of analyses.

Life Loss Analysis Methodology

For 2012 CVFPP life loss calculations, the vulnerability of people to flooding was accounted for with a depth-to-percent-mortality function based on the function developed by Jonkman et al. (2009), with data from flood mortality in New Orleans caused by Hurricane Katrina. For the 2017 CVFPP Update, a set of four depth-to-percent-mortality functions from HEC-FIA[1] have been used together with the HEC-FDA[2] flood risk assessment software (both developed by USACE) to enable more-refined calculations at the individual structure level. These functions consider population older or younger than 65, and differentiates between one- and two-story homes. Previous depth-to-percent-mortality relationships averaged these factors as well, because they were applicable for basin average depths. The approach is also applicable to deep floodplain areas.[3]

[1] Deep floodplains are defined as those with greater than 3 feet of flooding during a 200-year flood.
[2] Hydrologic Engineering Center's Flood Impact Analysis
[3] Hydrologic Engineering Center's Flood Damage Analysis

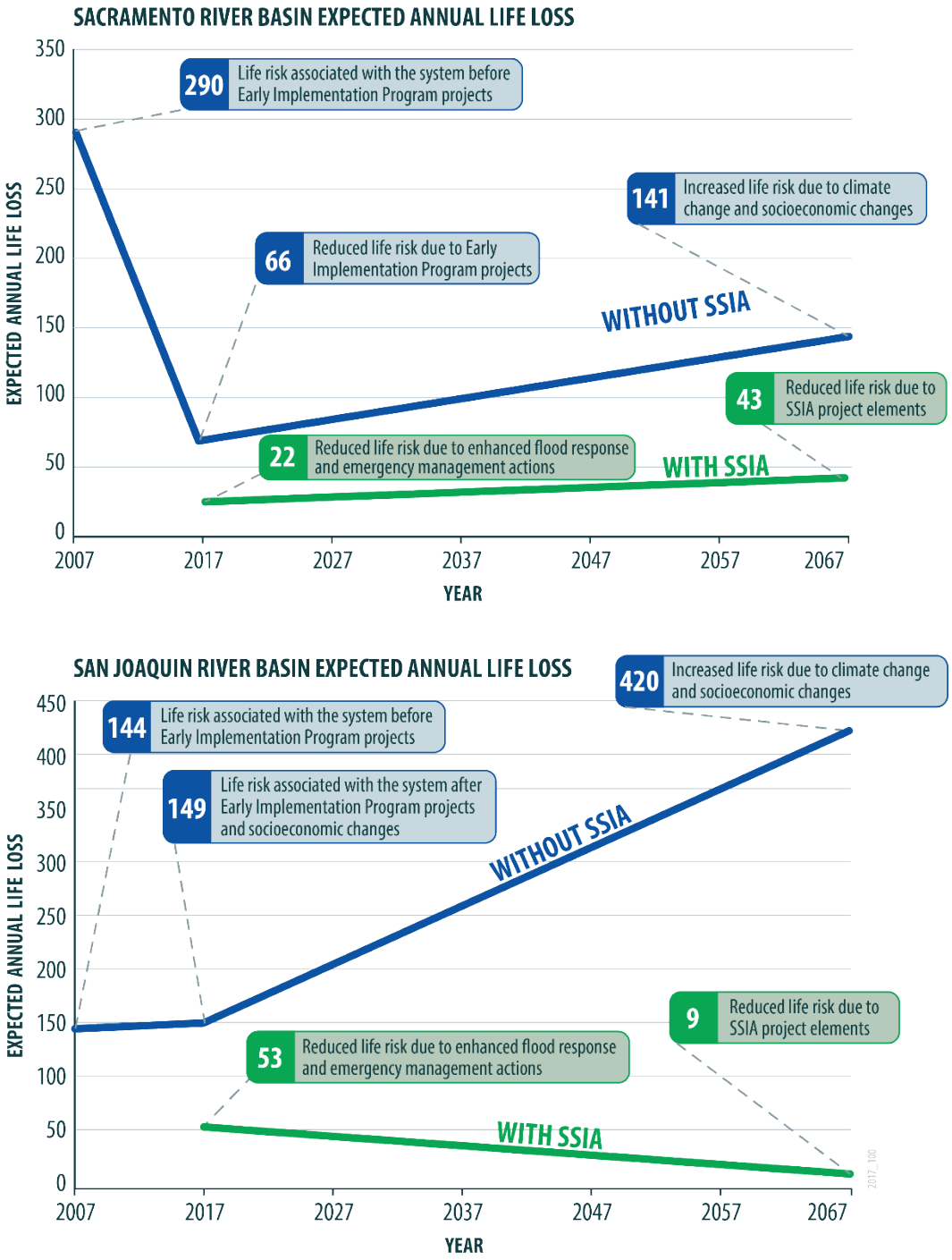


Figure 3-8. Expected Annual Life Loss

- Results indicate the change in expected annual life loss over time between the 2007, 2017, and 2067 scenarios (with and without SSIA).
- The expected annual life loss metric indicates potential life loss in any year across the full range of potential flood events and their likelihood. It is not a predictor of life loss for each given year.
- Results provide an informative metric for life risk. They do not forecast deaths expected from flood events and cannot be used for emergency planning or other purposes.

As with flow and stage changes, expected annual life loss increases in both basins in the Without Project scenarios between 2017 and 2067 because of the effects of climate change and population and land use changes. Substantial improvements occur in both the Sacramento and San Joaquin River Basins in the With Project scenario due to the combination of enhanced flood response and emergency management actions along with the structural improvements included in the 2067 With Project Scenario.

Maps 3-8 and 3-9 show the flow and stage results at key locations in the Sacramento River and San Joaquin River basins for the 2007 and 2017 Scenarios[2] and the 2067 Without Project Scenario and 2067 With Project Scenario for the 2%, 1%, and 0.5% annual chance (50-year, 100-year, 200-year) flood events. Each of these flood events were simulated without climate change for the 2007 and 2017 scenarios and with climate change (including both hydrologic and sea level rise changes) for the 2067 Scenario. In the Sacramento River Basin, the changes in flow and stage between 2007 and 2017 reflect the urban levee improvements that have been implemented since 2007, resulting in fewer levee failures and consequently more flow being passed downstream. By contrast, the results for the San Joaquin River Basin are unchanged between 2007 and 2017 because urban levee improvements have not yet been implemented. In both basins, flows and stage increase in the Without Project scenarios between 2017 and 2067 because of the effect of climate change on hydrology and sea level rise. However, the projects included in the With Project Scenario improve the flow and stage results in both basins in 2067. In the Sacramento Basin, the Yolo Bypass multi-benefit improvements allow for more flow to go down the bypass and thereby reduce stages in both the Yolo Bypass and in the Sacramento River. In the San Joaquin River Basin, the reservoir management actions reduce peak flows at Vernalis.

CVFPP climate change analysis indicates that climate change impacts on the San Joaquin River Basin would be much greater than on the Sacramento River Basin. This is because most of the watersheds in the San Joaquin River Basin are at higher elevations and dominated by snow accumulation and snowmelt. Large storms with rainfall at the top of the San Joaquin River watersheds (above 10,000 feet) have not been experienced historically. By the late twenty-first century, flood magnitudes in some San Joaquin River watersheds are expected to increase by 60 to 80% relative to historical conditions. Over the same period, flood magnitudes in the Sacramento River Basin are expected to increase by 10 to 20%.

Deterioration of flood control facilities could occur in the future if O&M investments are not increased beyond current funding levels.

It should also be noted that the 2067 scenarios do not include the potential effects of deterioration of flood control facilities that could occur in the future if O&M investments are not increased beyond current funding levels (continued growth of deferred maintenance). If deferred maintenance continues to grow, then the flood risk results in the future (2067 Without Project Scenario) may be greater than projected here.

[2] The results for the 2017 scenarios are the same because the enhanced flood response and emergency management actions do not affect flood system operations.

Climate Change Adaptation

Climate change is likely to generate more severe floods over the long-term future in the Central Valley. Recent legislation and an executive order require all state agencies to account for current and future impacts of climate change when planning, designing, building, operating, maintaining and investing in State infrastructure, which DWR and the CVFPB are committed to doing.

California has made significant advances in climate science since the State conducted its first climate change assessment in 2006, but the State must continue to invest in cutting-edge research to inform analysis for future updates to the CVFPP. DWR's analysis for the 2017 CVFPP Update is consistent with the best available science being produced as part of California's Fourth Climate Change Assessment,[1] but more work is needed to refine inland climate change, sea-level rise projections, and the ways they will interact. Climate change flood hydrology is an emerging science, and the CVFPP used the latest projections that include some scientific uncertainty about the timing and severity of climate change impacts. DWR plans to update the climate change analysis as additional information is developed in future updates to the CVFPP. Monitoring and tracking climate change impacts and flood system investment outcomes over time will inform the continued evolution toward a more resilient and sustainable flood management system.

Wise floodplain management provides one of the most cost-effective strategies for adapting to climate change over the long-term in the Central Valley as recognized by the *Safeguarding California Plan*, the State's climate adaptation strategy. In addition, preserving and enhancing land use in agricultural production, natural, or other non-urban uses avoids risk intensification and life loss while reducing future flood damages, especially in deep floodplains.

Sacramento River Basin

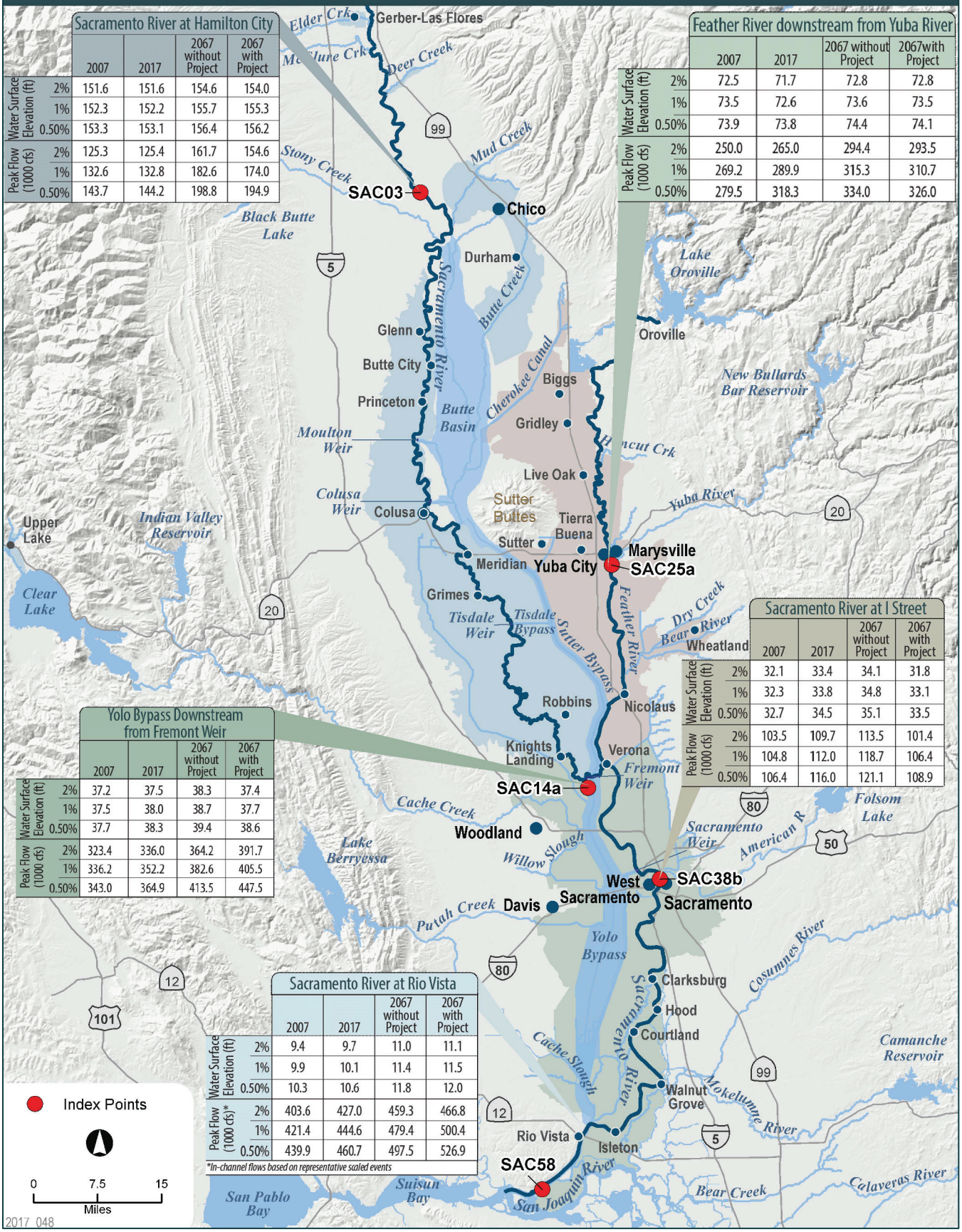
Climate change analysis projections in this basin increased flood volumes by 10 to 20% over 50 years. The CVFPP includes a basin-wide strategy that increases flood system capacity primarily through weir and bypass expansions (and other systemwide actions) to lower floodwater surface elevations and increase flexibility to accommodate the larger flood flows projected to occur with future climate change. These systemwide actions would complement regional and small-scale actions.

San Joaquin River Basin

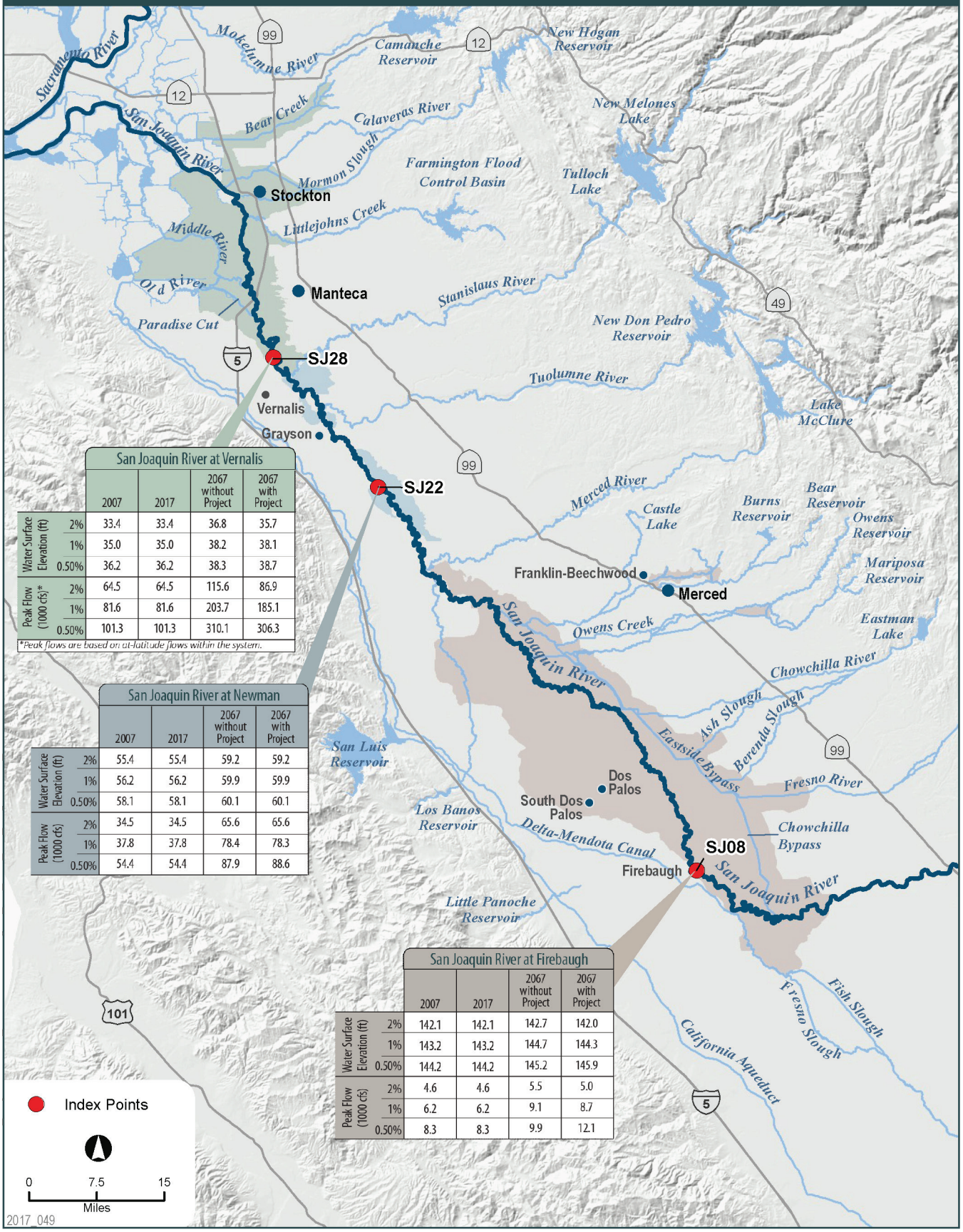
Climate change analysis projections in this basin increased flood volumes by 60 to 80% over 50 years. Most of the watersheds in this basin are at higher elevations and dominated by snow accumulation, with historically snowmelt-driven flood peaks. A wider variety of actions and strategies will be needed in this basin to adapt to large, projected climate change impacts. Wise floodplain management is especially important along the tributaries and San Joaquin River corridor for allowing future adaptation. Floodplain transitory storage could provide wise use of the floodplain because of its ability to provide nonstructural flood risk reduction (by keeping land out of urban development), and provide important ecosystem restoration benefits. Floodplain transitory storage could also provide potential groundwater recharge benefits, help to offset subsidence where channel capacity is threatened, and reduce O&M needs. At Paradise Cut, bypass expansion to accommodate larger flood flows can lower flood stages in nearby high-risk areas. Reservoir management actions, such as F-CO, or additional flood storage space through F-IO or conjunctive use operations, could significantly attenuate peak flows systemwide.

[1] Source: http://resources.ca.gov/climate/safeguarding/research/

Map 3-8. Flow and Stage Results for Each Scenario at Key Locations in the Sacramento River Basin



Map 3-9. Flow and Stage Results for Each Scenario at Key Locations in the San Joaquin River Basin



San Joaquin River at Vernalis

		2007	2017	2067 without Project	2067 with Project
Water Surface Elevation (ft)	2%	33.4	33.4	36.8	35.7
	1%	35.0	35.0	38.2	38.1
	0.50%	36.2	36.2	38.3	38.7
Peak Flow (1000 cfs)*	2%	64.5	64.5	115.6	86.9
	1%	81.6	81.6	203.7	185.1
	0.50%	101.3	101.3	310.1	306.3

*Peak flows are based on at-latitude flows within the system.

San Joaquin River at Newman

		2007	2017	2067 without Project	2067 with Project
Water Surface Elevation (ft)	2%	55.4	55.4	59.2	59.2
	1%	56.2	56.2	59.9	59.9
	0.50%	58.1	58.1	60.1	60.1
Peak Flow (1000 cfs)	2%	34.5	34.5	65.6	65.6
	1%	37.8	37.8	78.4	78.3
	0.50%	54.4	54.4	87.9	88.6

San Joaquin River at Firebaugh

		2007	2017	2067 without Project	2067 with Project
Water Surface Elevation (ft)	2%	142.1	142.1	142.7	142.0
	1%	143.2	143.2	144.7	144.3
	0.50%	144.2	144.2	145.2	145.9
Peak Flow (1000 cfs)	2%	4.6	4.6	5.5	5.0
	1%	6.2	6.2	9.1	8.7
	0.50%	8.3	8.3	9.9	12.1

Additional Outcomes from Proposed Actions in the 2017 Refined SSIA Portfolio

Beyond the modeling results described above, additional estimates of potential outcomes were identified through the Sacramento River and San Joaquin River BWFS. Continued planning efforts beyond the 2017 CVFPP Update may continue to refine and quantify expected outcomes from systemwide, urban, small community, and rural actions as resources allow, particularly for contributions to CVFPP supporting goals. For instance, ongoing collaboration with the regions will continue to identify and refine potential actions across scales (systemwide, regional, and local) to collectively provide desired ecosystem vitality and related multi-benefit outcomes for the CVFPP. Additional key outcomes could include the following:

- Ecosystem improvement actions in the Yolo Bypass, Paradise Cut, Firebaugh, and other locations identified in the Sacramento River and San Joaquin River BWFS would result in approximately 6,000 acres of new riparian and wetland habitats, 4,700 acres of inundated floodplain habitat, and 5 miles of SRA habitat. These improvements would restore natural processes and support a mosaic of habitat and species. Potential contributions to ecosystem vitality outcomes are summarized in Table 3-5 for the Yolo Bypass and Paradise Cut multi-benefit improvements.

- Systemwide and regional actions identified by the Sacramento River and San Joaquin River BWFS would provide increased opportunities for recreation, such as hiking, wildlife viewing, fishing, and hunting, providing more than 300,000 potential recreation visitor-use days per year.

- The 2017 refined SSIA portfolio supports exploring groundwater recharge opportunities at Madera Ranch and western Madera County, which would help reduce subsidence in the Upper San Joaquin Basin and provide up to 30,000 acre feet of water supply per year.

Estimating Ecosystem Vitality Contributions from Regional Actions

The three RFMPs in the Sacramento River Basin have begun to identify local and regional scale opportunities for ecosystem restoration and enhancement in their regions and estimate potential contributions to ecosystem vitality outcomes. Future regional collaboration could continue to develop and refine such opportunities and extend the effort to other regions in support of future CVFPP updates.

Table 3-5. Multi-benefit Improvement Ecosystem Vitality Outcomes

Metric	Value
Yolo Bypass Multi-benefit Improvements	
Inundated floodplain: total amount (acres) of 50 percent flows (i.e., 2-year event)	3,841–3,992
Natural bank: total length (miles)	1.2
Shaded riverine aquatic (SRA) cover: total length (miles)	2
Riparian Habitat amount: total amount in floodways (acres)	1,879–2,408
Marsh/Wetland Habitat Amount: total amount in floodways (acres)	877–1,143
Fish passage barriers removed	3
Invasive plants: total area (acres)	12–30
Paradise Cut Multi-benefit Improvements	
Inundated floodplain: total amount (acres) of 50 percent flows (i.e., 2-year event) with 14-day or longer duration during December through May	not applicable
Natural bank: total length (miles)	2
River meander potential: total amount (acres)	519
Shaded riverine aquatic (SRA) cover: total length (miles)	2
Riparian Habitat amount: total amount in floodways (acres)	587
Marsh/Wetland Habitat Amount: total amount in floodways (acres)	169

3.2 Driving Policies Toward More Effective Implementation

Just as the effectiveness and resiliency of different management actions vary with scale and area of interest, the necessary policy and financial conditions for effective implementation of those management actions can vary greatly depending on action type and context. Furthermore, many policy issues overlap or have dependencies on others. The following discussion elaborates on the key policy issues hindering successful implementation of the CVFPP (introduced in Chapters 1 and 2). Many policy issues are intertwined, and the successful implementation of the CVFPP requires concurrent progress on all issues. All top policy issues are discussed below, with the exception of the need for sustainable funding, which is discussed in greater detail within Chapter 4.

Many policy issues are intertwined, and the successful implementation of the CVFPP requires concurrent progress on all issues.

3.2.1 Improved Land Use and Floodplain Management

As population growth and urban development continues in the Central Valley's floodplains, cumulative flood damages and loss of life will likely increase over time. Population growth within the SPFC Planning area is projected at approximately 70% over the next 50 years. Managing the increased flood risk associated with this population growth will require a wide variety of approaches. Structural flood improvements can never fully eliminate the risk of flooding, and are costly to construct and maintain over the long-term. An important part of the strategy to reduce flood risk should be to avoid or minimize damages through wise land use and floodplain management policies and investments.

The State continues to emphasize that wise land use and floodplain management are an integral part of the CVFPP and represent some of the most cost-effective means of reducing long-term flood risk. However, very little funding is currently allocated to floodplain management, which translates into a lack of financial incentive for the development and proposal of these types of actions by local or regional partners throughout the Central Valley.

Wise Use of Floodplains

Wise use of floodplains means enjoying the benefits of floodplain lands and waters while still minimizing the loss of life and damage from flooding and at the same time preserving and restoring the natural resources of floodplains as much as possible. Wise use thus is any activity or set of activities that is compatible with both the risks to the natural resources of floodplains and the risks to human resources (life and property). *Source: Federal Interagency Floodplain Management Task Force, A Unified National Program for Floodplain Management, 1994.*

Consistent with national trends, State floodplain management is shifting greater emphasis onto risk management, primarily to slow the rapidly escalating cost of flood damages over time, but also to improve environmental quality and sustainability over time. In addition to land use and floodplain management policies described in the 2012 CVFPP, the 2017 CVFPP Update recommends actions to more effectively address the need for improved land use and floodplain management in the SPFC.

Consistent with Executive Order B-39-77, the SSIA Portfolio was designed to reduce the chance of flooding while discouraging population growth in rural floodplains, with the intention of reducing aggregate flood risk. The State does not promote flood management improvements that would induce population growth in rural areas. Deep floodplains subject to rapid-rise flooding are the most critical concerns due to the high risk of life loss and property damage in such areas. Urban flood risk reduction investments under the SSIA will be structured to assure that the aggregate economic and life safety risks are held constant or reduced over time, and will be limited to areas protected by facilities of the SPFC. Agricultural conservation measures proposed by the SSIA are also designed to limit conversion of agricultural land to urban uses, and to preserve the robust agricultural economy of the Central Valley.

3.2.2 Improved Residual Risk Management

The SPFC has greatly reduced the frequency of flooding and made possible the vibrant communities and agricultural development of floodplains in the Central Valley. Yet even with the realization of major physical improvements to the flood management system, the risk of flooding can never be completely eliminated. Unanticipated facility failures or extreme flood events may cause flooding. This remaining flood threat is called "residual risk."

This residual flood risk can be comprehensively managed and reduced over time through a number of actions. It is managed through floodplain management, operations and maintenance, nonstructural actions (such as elevation and floodproofing), and flood emergency preparedness and response. Such actions are implemented at the local and regional levels, but may require State and federal actions as well. Consistent with Executive Order B-30-15, the CVFPP reaffirms the principle that making investments that are sustainable for multiple generations is necessary. The CVFPP focuses keenly on residual risk management, and this approach continues to be an essential component of the update.

3.2.3 Establishment of the Hydraulic/Ecosystem Baseline and Program Phasing

The structural improvements proposed as part of the CVFPP (including Yolo Bypass expansion, Paradise Cut, and other large system-scale projects) require implementation in phases over many decades. Each phase of implementation will require project-level CEQA and NEPA compliance as well as compliance with other State and federal laws and requirements.

Current regulatory practices hinder the ability to obtain credit for benefits of improvements made early in a long-term program in order to offset impacts that may occur later in the program. This complicates phased system-scale implementation of CVFPP structural improvements, making it more difficult to demonstrate net long-term improvements of program implementation. Currently, the environmental baseline for evaluating project impacts is fixed to the date of the Notice of Preparation of the environmental documentation; this results in the baseline changing, or being "reset," as each phase or individual project is completed. There is no legal or institutional mechanism which can subsequently be applied to offset ecosystem restoration or enhancements achieved early in program implementation as part of the new ecosystem baseline.

Resources Baselines

A set of metrics describing the quantity and quality of various resources, against which changes over time can be evaluated

In addition, there is no legal or institutional mechanism to account for increased downstream channel capacity created in early program phase(s) which can be applied to offset increased flows created by increased upstream channel capacity in later phase(s). Further complicating this issue are federal guidelines for cost-shared projects. These guidelines require incremental analysis of economic benefits of "separable elements" of projects, or of phases for large multi-phased regional projects, to be calculated from successive hydraulic baselines. These baseline requirements present a challenge in implementing regional long-term phasing of system-scale improvements.

3.2.4 Operations and Maintenance of the Flood System

Operations, maintenance, and repair activities are critical for long-term, sustainable flood management. A robust and fully-funded O&M program is fundamental to the proper function of the SPFC, ensuring public safety and upholding the State's legal assurances to maintain federal flood project features, and enabling the implementation and maintenance of multi-benefit projects. At present, the challenge is twofold:

- O&M activities have been chronically under-funded
- Declining natural resources have led to a regulatory framework in which flood managers often face conflicting mandates, and which does not easily support implementation and long-term management of a multi-benefit system

The State will need to work with local agencies and the State legislature to establish new State and local funding mechanisms that are applicable for O&M activities and can be relied upon for consistent revenue from year to year.

In many cases, funding and regulatory constraints have hampered efficient and timely O&M and contributed to deferred maintenance, which has led to increased flood risk. These constraints have also contributed to the lack of eligibility for federal levee rehabilitation funds under Public Law 84-99 in portions of the system, and could negatively affect levee accreditation under the FEMA National Flood Insurance Program. An improved regulatory framework and consistent funding for routine O&M activities and O&M of new system improvements will require that all levels of government work together to address regulatory hurdles and conflicting mandates. The State will need to work with local agencies and the State legislature to establish new State and local funding mechanisms that are applicable for O&M activities and can be relied upon for consistent revenue from year to year.

Regulatory demands on the flood system have increased over time, as have societal expectations for a flood management system that supports multiple benefits. Flood system managers are increasingly being tasked as resource managers with public trust responsibilities, in addition to public safety responsibilities. For example, flood system managers must meet federal flood system maintenance criteria, which require rigorous maintenance of flood system integrity and capacity, and at the same time, comply with environmental protection laws enacted mostly after the State and LMAs accepted responsibility for ensuring O&M of federal projects. State and local flood management agencies are struggling, and in some cases, are not capable of fulfilling their maintenance and repair obligations due to financial constraints and conflicting legal mandates.

Over the past three decades, several flood management districts in California have revised their approach to O&M to incorporate multiple objectives, including ecosystem restoration and protection, to address changing standards, permitting and mitigation, and funding challenges. These examples of multiple-objective O&M programs can serve to inform a conversation about how to improve O&M at the scale encompassed by the SPFC. Programmatic permitting of O&M and flood improvement projects to the extent possible should be further investigated as a potential strategy to add efficiencies and ecosystem improvements at local, regional, and systemwide scales. Shifting the regulatory paradigm to address the constraints described above should begin with a conversation about how to allow the State and local flood/resources management agencies to adopt programmatic planning, permitting, and funding strategies to implement a more effective, efficient, and sustainable multiple-objective approach to O&M (see box). This approach should involve close collaboration between stakeholders, and should leverage innovative approaches to managing resources within the SPFC Planning Area, such as the Central Valley Habitat Exchange (see box), to the extent feasible.

Multiple-Objective Operations and Maintenance

Multiple-objective O&M programs are flood system maintenance programs that incorporate multiple objectives, such as environmental stewardship, recreation, water quality, water supply, and public education, along with flood risk reduction. By incorporating the management of ecosystem processes, habitats, native species, and other values within a flood system operations and maintenance program, and funding and structuring O&M program activities to explicitly manage for those attributes within the floodway, conflicts between flood performance, ecosystem integrity, and other uses could be managed and resolved within the context of the O&M program. However, this would require that projects are formulated and authorized to achieve multiple objectives, institutional and legal barriers are addressed, and adequate funding and other resources are available. This would better provide multi-benefit outcomes such as improved flood management facility performance and ecosystem functions.

Several multiple-objective O&M programs are in place today in California. These programs are generally organized under one master maintenance plan for all areas with activities that are clearly defined (including ecosystem and flood facility management) over large and diverse settings. Other elements of these programs that could be considered for the SPFC include: an overall O&M vision that includes flood and ecosystem management objectives; a data-driven monitoring, tracking, and reporting framework utilizing a centralized GIS database; use of performance-based indicators to achieve flood and ecosystem management objectives and resolve potential conflicts; a permitting approach defined by interagency collaboration and effective mitigation strategies; diversified funding opportunities related to the multiple program objectives; and an adaptive management approach driven by an annual maintenance planning process.

Development of a multiple-objective O&M program at the scale of the SPFC would require cooperation among federal, State, regional, and local partners, actions to address institutional and legal barriers, and higher levels of funding from stable sources. Recent CVFPP planning activities have included an updated estimate of the cost of long-term O&M and assessment of potential new funding sources, an initial process to outline an approach for overcoming regulatory barriers, and how to coordinate with partners.

Central Valley Habitat Exchange

The Central Valley Habitat Exchange (the Exchange) is a program to facilitate effective habitat conservation and mitigation. The Exchange's long-term goals are to increase opportunities for farmers and ranchers to profit from habitat restoration and conservation outcomes, and to improve public understanding of the environmental return on habitat investments through quantitative and outcome-based reporting.

To achieve these goals, the Exchange has developed a multi-species habitat quantification tool (HQT) to measure and track the habitat functionality of conservation and restoration projects. By leveraging the HQT and Exchange support, agencies and plan administrators are able to improve project design and ongoing stewardship to maximize habitat outcomes for species. The Exchange can secure habitat projects that meet both conservation objectives and compensatory mitigation requirements. Exchange credits will be based on habitat functionality as determined by the HQT and can be adjusted to meet permit or program requirements, including permanent and term projects.

Regional Conservation Investment Strategies

Assembly Bill 2087 (Levine), entitled "Regional Conservation Investment Strategies," was signed by the Governor on September 22, 2016, and represents a Brown Administration priority to seek more effective and efficient mechanisms for regional planning of public infrastructure that includes conservation goals and objectives for an area. The bill allows the California Department of Fish and Wildlife to approve eight pilot Regional Conservation Investment Strategies by January 1, 2020. The bill allows conservation and habitat enhancement actions that would measurably advance the conservation objectives of a Regional Conservation Investment Strategy to be used as mitigation credits pursuant to an agreement with the California Department of Fish and Wildlife. The mitigation credits could then be used to fulfill compensatory mitigation requirements established under any State or federal environmental law, as determined by the applicable local, State, or federal regulatory agency. The bill is also significant in that allows for flexibility with regard to mechanisms for funding long-term operations and maintenance of areas used for mitigation, and mechanisms to preserve land in perpetuity. Any public agency may propose to be one of the eight pilots. DWR is developing a pilot in Yolo County pursuant to this bill with the California Natural Resources Agency and the Yolo Habitat Conservancy.

3.2.5 Development of Multi-benefit Projects

Consistent with the CWAP, the State strongly supports and encourages the planning and implementation of projects that provide multiple benefits, including increasing resilience by protecting and restoring important ecosystems, and improving water supply, water quality, recreation, and public education related to integrated water management. A multi-benefit approach more efficiently and effectively leverages flood infrastructure to achieve a broader array of public benefits and may potentially increase access to more funding sources.

However, many policy and institutional barriers hinder the implementation of multi-benefit actions. Limited financial resources currently exist to support the development of flood management projects, even those with multi-benefit features. Conflicting flood management, resource management, and environmental regulatory frameworks hinder the implementation, operations, and maintenance of multi-benefit projects as discussed above. Furthermore, modifications to SPFC facilities can be extremely difficult and costly to permit. High costs and inefficiencies in existing regulatory and environmental permitting processes remain among the primary challenges to effective and timely implementation of multi-benefit projects that provide needed flood system performance and associated multi-benefit improvements, such as ecosystem uplift. Differences between federal and State levee and channel vegetation policies also create conflicting mandates. In addition, agricultural stakeholders and landowners have expressed concerns over the potential impacts of attracting species, endangered species in particular, on or near private lands as a result of habitat restoration.

The Challenges of Conflicting Objectives

Giant Garter Snake

In December 2015, the United States Fish Wildlife Service (USFWS) issued a revised draft Recovery Plan (Recovery Plan) for the giant garter snake (GGS), a species listed as threatened under both the State and federal Endangered Species Acts. The Recovery Plan lists a variety of factors that are cited as threats to the recovery of GGS, including "levee and canal maintenance." DWR and the CVFPB support GGS conservation and recovery. However, the challenge for flood system managers is that GGS habitat needs often conflict with specific of State and federal O&M requirements. Timely resolution of these challenges is imperative for both public safety and ecosystem functions.

California giant garter snake
Photo: US Geological Survey

Western Yellow-billed Cuckoo

Another example of difficultly in navigating the current regulatory frameworks for species protection and flood protection is the listing and subsequent proposed designation of critical habitat for the western distinct population segment of the yellow-billed cuckoo (WYBC). The USFWS, required by law to designate habitat considered critical for listed species, recently proposed designation of 546,335 acres across nine states, including California, as critical habitat for the WYBC. This included key portions of the SPFC Planning Area, and special habitat management considerations in the proposed designation included:

Western yellow-billed cuckoo
Photo: US Fish and Wildfire Service, Mark Dettling

1. Avoidance of "[c]learing channels for flood flow conveyance," and
2. "Reduction of bank stabilization features, including rip-rap, levees, and other structures that limit fluvial processes…." *79 Fed. Reg. 48548, 48555 (Aug. 15, 2014).*

Complying with these can mean in some circumstances flood system managers will fail to comply with maintenance requirements in federal regulations, and operations and maintenance manuals developed by USACE.

The USFWS is working hard to prevent the decline and loss of species, as other environmental regulatory agencies are working to protect other critical resources, and flood system managers work to protect the people, assets, species and habitat protected by the flood system. Differing requirements must be reconciled in a manner that supports serving the full suite of these critical needs. This will require more effective governance and institutional support at the federal, State, and local levels.

3.2.6 Effective Governance and Institutional Support

Overlapping authorities and conflicting mandates that sometimes occur can complicate flood system improvements and maintenance, and is partially a consequence of existing governance structures that are inadequate to support the broad range of actions included in the CVFPP at federal, State, and local levels.

Central Valley flood management is affected by a complex framework of public agencies (over 300 in the Sacramento Basin and over 200 in the San Joaquin Basin). At the local level, governance is complicated by multiple small LMAs with limited resources, including staff, revenues, and authorities. Enhanced regional governance can empower groups of local agencies to more effectively pool and leverage funding and resources, enhance collaboration and coordination, coordinate political advocacy, and create shared ownership of the flood system. Regional planning and project implementation is greatly improved through enhanced regional governance. Regional governance not only improves collaboration among local agencies within a region, but also facilitates more effective partnering with State and federal governments, greatly helping to define and achieve a shared regional vision.

Strong regional governance and shared understanding of roles and responsibilities will support a shift toward system-scale, long-term, outcome-driven resource management that balances a broad array of public values and priorities. Dialogues should be fostered within a structured, transparent process that includes schedules, actionable recommendations, and stakeholder engagement. For example, some SPFC levees and other facilities are no longer used for purposes that were originally intended. However, federal and State processes for removing these levees or other facilities from the SPFC are onerous to navigate, making it difficult to work collaboratively to make changes to the system. This is further challenged by a lack of resources to support planning and reevaluation efforts.

3.2.7 Coordination with Federal Agencies

Flood management in California is a shared responsibility among State, federal, and local agencies. Effective partnerships with federal agencies are essential to achieve financial and regulatory objectives. Since the 1950s, the co-location of the National Weather Service California Nevada River Forecast Center and DWR has sustained effective coordination on water supply, flood forecasting, and reservoir operation activities. Although the State and other LMAs are responsible for maintenance, USACE retains permitting authority for any physical change or change in operations to the SPFC. Additionally, the ESA charges federal agencies to aid in the conservation of listed species, and section 7(a)(2) requires the agencies, through consultation with the USFWS and National Marine Fisheries Service, to ensure that their activities are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitats. The Federal Emergency Management Agency (FEMA) requires land use agencies that participate in the NFIP to adopt ordinances to regulate the use of floodplains, as well as provides hazard mitigation and disaster grants. Successful coordination with federal agencies is critical to efficiently and effectively implementing the CVFPP and managing the

flood system over the long-term future. Reclamation implements, operates, and maintains water management projects that affect the SPFC from a systemwide perspective, such as operations and maintenance of several major multipurpose reservoirs, the Central Valley Project (CVP), and implementation of the San Joaquin River Restoration Program (SJRRP).

3.3 Moving from Recommended Actions Toward Implementation

This chapter described the 2017 refined SSIA portfolio of proposed management actions that will achieve the CVFPP goals. Given the magnitude and geographic scope of the CVFPP, it is necessary to articulate the amount of investment needed and to identify different ways of funding those investments. The success of this implementation approach will depend upon a demonstrated cumulative record of effective, cost-efficient, and balanced investments in the flood management system. Chapter 4 builds upon the discussions in this chapter to develop cost estimates and priorities for actions in the SSIA portfolio, identify applicable funding mechanisms for each management action category, propose the phasing of the various management action types within the broader SSIA portfolio, and discuss methods for accountability for performance tracking of outcomes.

Increased investments and new approaches to sustainable funding will protect millions of people, billions of dollars of assets, and important habitat and ecosystems.

Funding and Implementing the 2017 Refined SSIA Portfolio

Chapter 4

Funding and implementing the CVFPP relies on the establishment of priorities for the next 30 years and lays the groundwork for future actions and investment. Each CVFPP update will describe implementation progress, new information, and changes in available funding resources, thereby continually informing and enabling the next cycle of near-term and longer-term implementation for future updates of the CVFPP, conceptually shown in Figure 4-1.

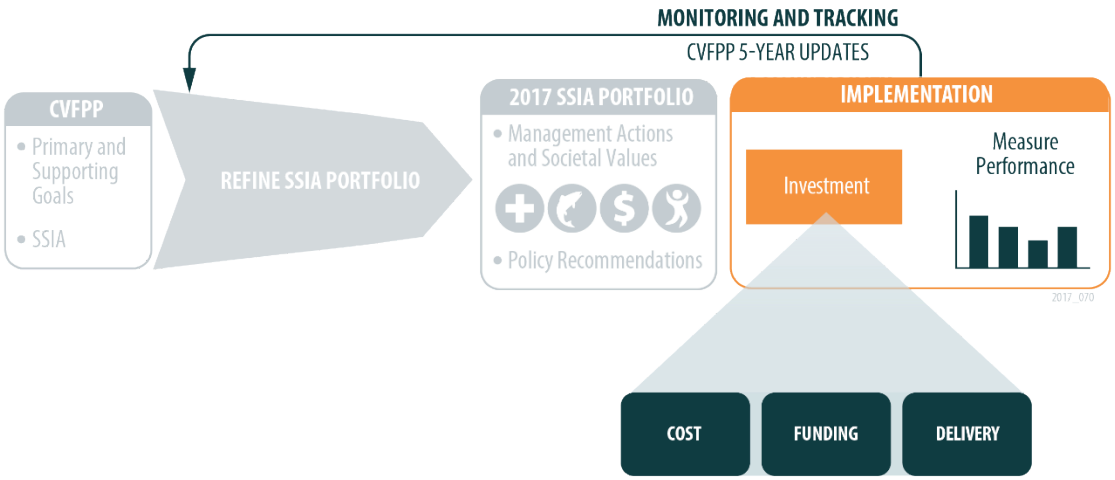


Figure 4-1. 2017 Central Valley Flood Protection Plan Update Development Process

CVFPP implementation is phased to ensure that the primary goal of the CVFPP—to improve flood risk management—is addressed first by improving public safety. Implementation phasing must account for relationships between upstream and downstream actions, while also ensuring that near-term actions are feasible with regard to readily available funding, secured cost-sharing, stakeholder coordination, and other important factors. Phased implementation will also help accommodate the timing of project design, permitting, land acquisition, stakeholder alignment, and partner cost-share funding availability. The following discussion covers five key topics:

- Cost estimates for capital and ongoing investment in the prioritized management action categories described in Chapter 3
- A funding plan overview for funding the 2017 refined SSIA portfolio
- Proposed implementation phasing and delivery of the 2017 refined SSIA portfolio through DWR implementation programs
- Tracking of the intended outcomes from CVFPP implementation, and demonstrating return on investment to California taxpayers
- A summary of key flood management policy recommendations for continuing implementation of the CVFPP and the plan for moving forward

Collaboration with Delta Levee Investment Strategy

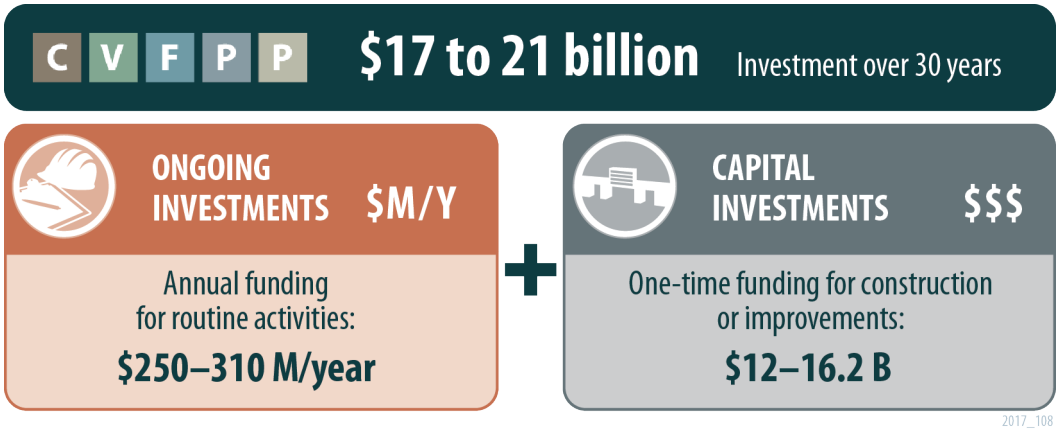
The Sacramento–San Joaquin Delta Reform Act of 2009 directed the Delta Stewardship Council to provide a Delta Plan that reduces risks to people, property, and outlines the State's interest in the Delta. The Delta Stewardship Council supported the Delta Plan through the draft Delta Levee Investment Strategy (DLIS), an updated prioritization of levee investments.

The Delta is part of the overall system for which the CVFPP has guided the State's participation in managing flood risk in areas protected by the SPFC as directed by the Central Valley Flood Protection Act of 2008. Collaboration between the investment strategies supporting the Delta Plan and CVFPP is necessary to deliver effective improvements in integrated flood management to the Central Valley and Delta.

4.1 Total Investment Costs

Data sources from multiple planning and implementation efforts (described in further detail in Chapters 2 and 3) provided a basis for estimating total costs for the broad portfolio of management actions that will contribute to achieving CVFPP goals. Investment is divided into two types: capital and ongoing. Many management actions require only capital investment, whereas others require ongoing, annual investment sustained over the entire 30-year planning horizon. Because funding for these two types of investment are different, they are often discussed separately:

- Capital investment in improvements, which often requires years to spend and implement, are described in terms of **present value cost**.
- Ongoing investments are described in terms of **annual levels of investment**.



4.1.1 Estimating Costs

Multiple planning and implementation efforts completed or initiated since 2012 provided a wealth of data, cost, and other information that enabled identification and refinement of SSIA investment opportunities across the Central Valley. These efforts include State-Federal feasibility studies, BWFSs, RFMPs, the CVFPP Conservation Strategy, OMRR&R TM, and other efforts with data that supported updating a total cost estimate for the 2017 refined SSIA portfolio. Other efforts provided detail on costs for emergency and floodplain management activities and for State operation, planning, and performance tracking activities. A more detailed discussion of the analysis performed to develop these cost estimates and phasing for investment is provided in the Draft CVFPP Investment Strategy TM.

4.1.2 Summary of Capital and Ongoing Costs over 30 Years

The total 30-year investment for the CVFPP is broken down by the two river basins and by the four areas of interest: systemwide, urban, rural, and small community. All applicable tables presented in this chapter are organized similarly and presented as an approximate range of costs. Table 4-1 represents the summation of the cost estimates provided by the State-Federal feasibility studies, BWFSs, RFMPs, OMRR&R Work Group, and other efforts. This summation is the critical "need" for SPFC investments demonstrated by multiple efforts and agencies with responsibility for improving and maintaining the SPFC. Both the 30-year capital investment and 30-year ongoing investments of the 2017 refined SSIA portfolio are summarized in Table 4-1 and Figure 4-2 in 2016 dollars.

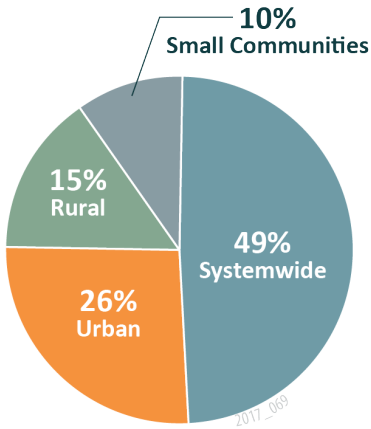


Figure 4-2. CVFPP 30-Year Investment

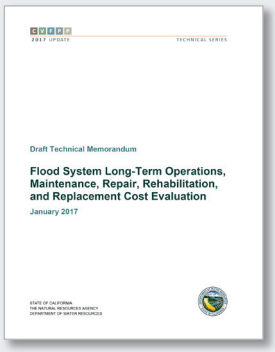
Taken together, the cost estimates indicate a total present value investment need of approximately $17 to $21 billion over the next 30 years. The cost of implementing the full range of investments identified in the CVFPP represents a major increase from current and historical levels of funding, and will need to occur over 30 years.

Table 4-1. Total Capital and Ongoing CVFPP Investments Over 30 Years

Area of Interest	Sacramento Basin		San Joaquin Basin		Total	
	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)
Systemwide	$6,310	$7,710	$2,220	$2,720	$8,530	$10,430
Urban	$3,410	$4,160	$1,090	$1,330	$4,500	$5,490
Rural	$1,640	$2,000	$950	$1,160	$2,590	$3,160
Small Community	$1,490	$1,830	$320	$390	$1,810	$2,220
Grand Total:	**$12,850**	**$15,700**	**$4,580**	**$5,600**	**$17,430**	**$21,300**

Note: Totals reflect annual ongoing investments converted to present value (2016 dollars) and summed with present value capital investment costs.

Understanding the True Cost of OMRR&R



Many parts of the flood system are aging and experiencing a substantial backlog of deferred maintenance resulting in part from a lack of consistent funding. In response, the 2012 CVFPP included the improvement of operations and maintenance as the first of its supporting goals. Additionally, several LMAs[1] have passed assessments pursuant to the requirements of Proposition 218 during the past 5 years to address deferred maintenance.

While progress has been made to address these issues, necessary ongoing maintenance is still critically underfunded. Within their budgets and assurances, maintainers must make difficult decisions and prioritize their work to sustain a functioning flood control system. Societal expectations, changing standards, regulatory requirements, and multiple uses of the flood management system have all influenced the current cost of OMRR&R.

DWR convened an OMRR&R Workgroup after adoption of the CVFPP in 2012 to identify true long-term OMRR&R costs of current and proposed urban and rural facilities[2] in the SPFC planning area over a 50-year time horizon.[3] This true-cost analysis is meant to include both the State and local shares of OMRR&R activities, and assumes no accumulation of future deferred maintenance. The Workgroup developed cost estimates based on review of a variety of sources and input received from DWR staff, LMA representatives, and regional stakeholders and experts.

Projected OMRR&R costs identified by this Workgroup focus on future needs:

- Future ongoing annual maintenance needs, estimated at $88M annually
- Future repair, rehabilitation and replacement needs, estimated at $43M annually
- Total future OMRR&R estimate: $131M annually
- Current local and State expenditures on OMRR&R: $30M annually

Total future OMRR&R cost estimate:
$131M annually

The Workgroup's cost estimates do not account for necessary deferred maintenance and repairs required to address known design deficiencies. The OMRR&R Workgroup focused instead on the true cost of long-term OMRR&R throughout the SPFC after deferred maintenance is complete. The OMRR&R TM documents an estimate of how much funding is needed so that deferred maintenance does not continue to increase in the future. The OMRR&R Workgroup estimate is reflected in the ongoing routine maintenance management action category.

Other key efforts supporting the CVFPP, such as the RFMPs, also address needed deferred maintenance and repairs. DWR's flood project inspections and Flood System Repair Project (FSRP) also provided information on deferred maintenance and repair needs to supplement what was described in the RFMPs. These efforts collectively identified solutions to address deferred maintenance and repairs in support of a more resilient flood management system. The present value of deferred repair, rehabilitation and replacement needs provided by RFMPs and DWR are reflected in the capital investments of the 2017 refined SSIA portfolio.

[1] LMAs passing assessments since 2012 include, RD 784, RD 999, RD 900, RD 1001, RD 10, RD 2103, RD 536, and San Joaquin County.

[2] The estimated true long-term OMRR&R costs assume fully functioning facilities that meet applicable standards. The true-costs analysis included the following urban and rural SPFC facilities: levees, channels, major structures (as described in CWC Section 8361 and 12878 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants), and minor structures (stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments). Non-project levees and non-project ecosystem and multi-benefit features are not included within the OMRR&R true costs provided by the OMRR&R Workgroup.

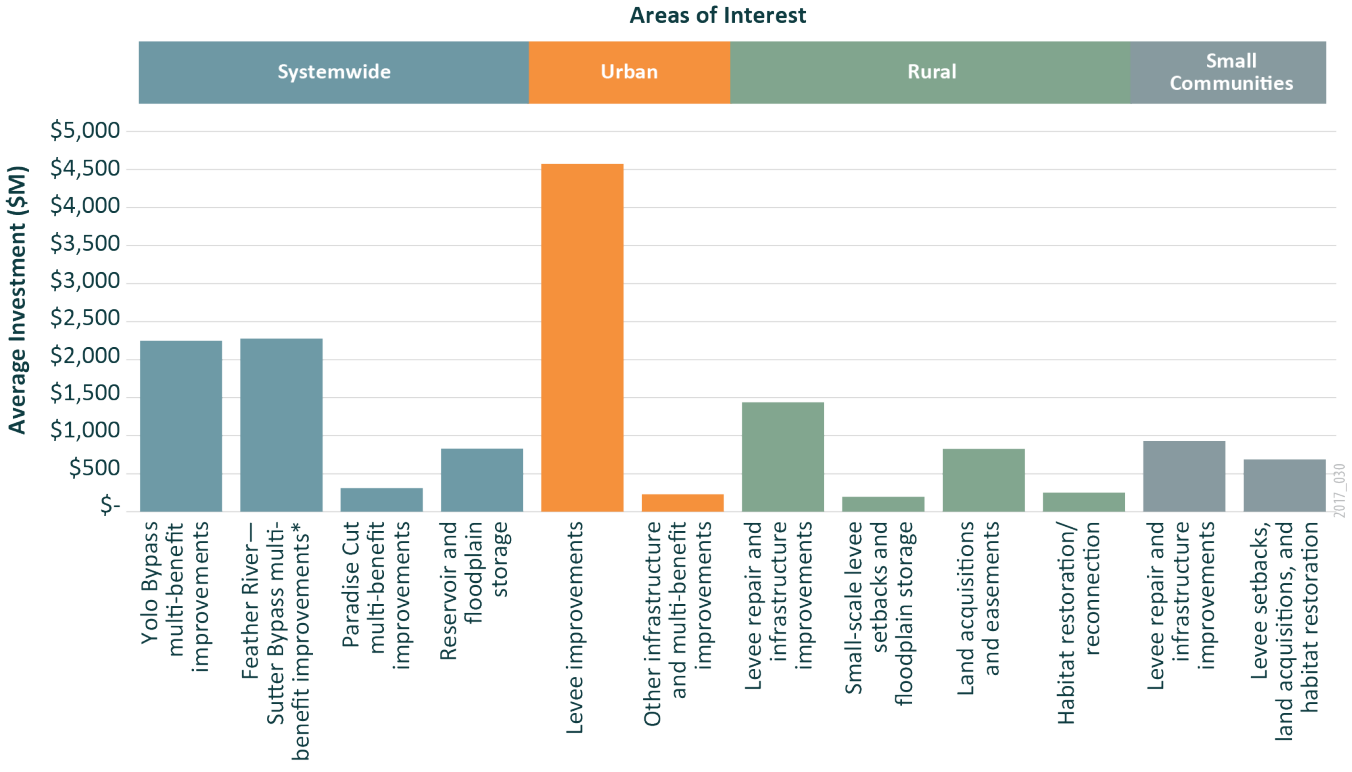
[3] Although the CVFPP has a 30-year time horizon, a 50-year time horizon was chosen for this effort because it better corresponds to the typical design life of flood management infrastructure.

4.1.3 Capital Investment Costs over 30 Years

Actions contributing toward CVFPP supporting goals of promoting ecosystem functions and multi-benefit projects are embedded mostly in larger-scale activities

Implementation of the 2017 refined SSIA portfolio of capital improvements is estimated to cost approximately $12.0 to $16.2 billion over the next 30 years, as summarized in Figure 4-3. Table 4-2 elaborates on cost estimates and data sources for each management action category under each area of interest. Many systemwide actions are expected to promote ecosystem functions and multi-benefit projects, as are some rural easements, levee setbacks, and floodplain storage actions. Therefore, costs for actions that promote ecosystem functions and multi-benefit projects are included in all areas of interest, and are embedded mostly within larger-scale activities, where feasible. An estimated cumulative capital and ongoing cost of approximately $1.3B within the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects. All of the State funding mechanisms could provide a funding stream for multi-benefit projects, including ecosystem components, depending on what is legally authorized. Each funding mechanism's applicability depends on the nature of the mechanism's revenue stream (ongoing vs. limited-duration capital) and nexus of the mechanism's purpose with the proposed action's benefits. Other funding mechanisms, such as federal ecosystem programs, could also provide funding for ecosystem components of multi-benefit projects. For more information on funding mechanisms, see Section 4.2.1.

Figure 4-3. Total Capital CVFPP Investments Over 30 Years



Note: All estimated dollar values are in 2016 dollars and indicate average annual investments made over 30 years.

*The high end cost estimate was used for the Feather River—Sutter Bypass multi-benefit improvements. This is due to the larger range of uncertainty compared to other systemwide improvements, given the Sacramento River BWFS recommendations to determine an array of multi-benefit actions through future study in close coordination with local and regional partners after Yolo Bypass improvements are implemented.

Table 4-2. Capital Investments of the 2017 Refined SSIA Portfolio Over 30 Years (shown in 2016 $)

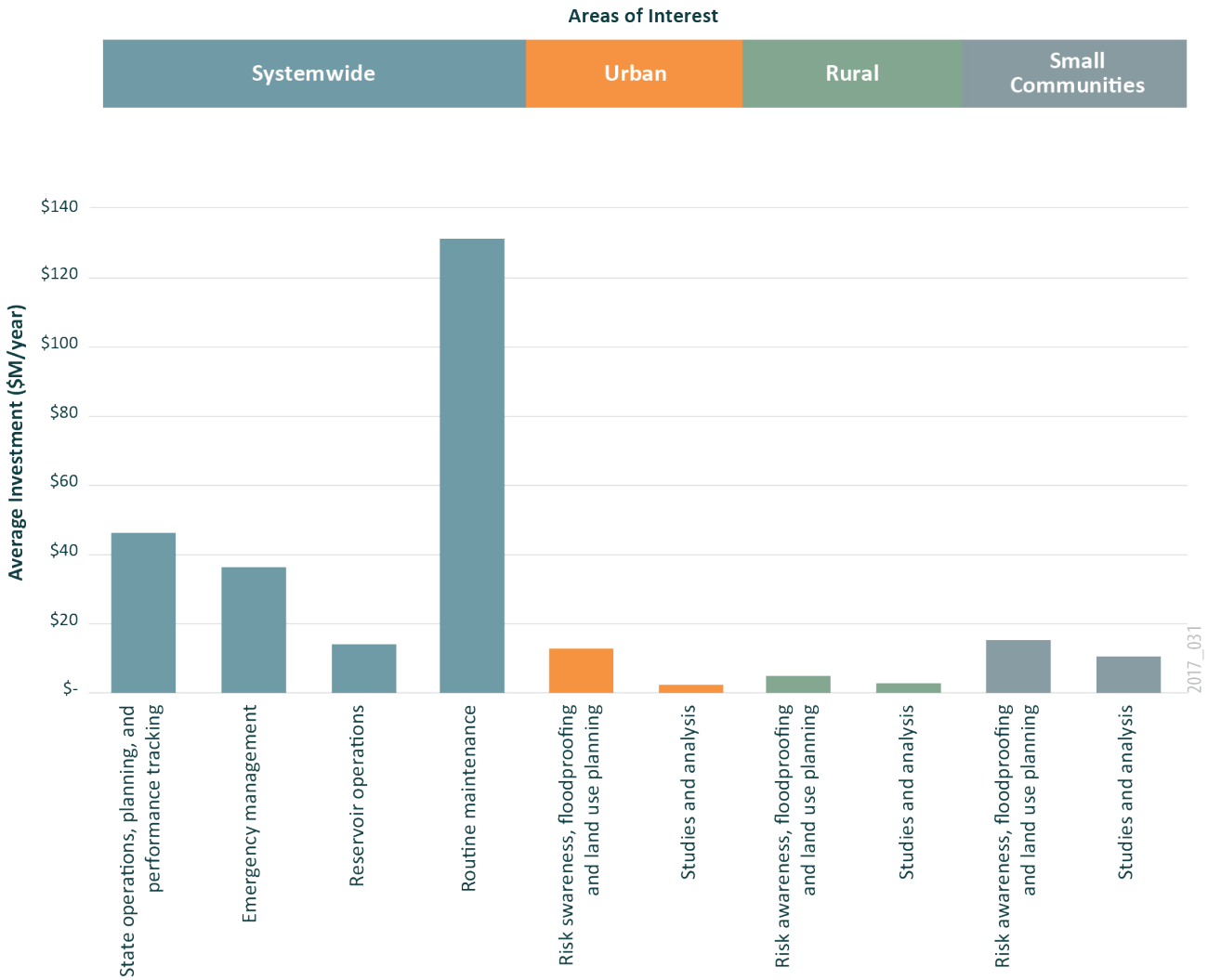
Management Action Category and Area of Interest	Data Source	Sacramento		San Joaquin		Total	
		Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)
Systemwide							
Yolo Bypass multi-benefit improvements	BWFSs	$2,050	$2,500	$–	$–	$2,050	$2,500
Feather River–Sutter Bypass multi-benefit improvements	BWFSs	$600	$2,300	$–	$–	$600	$2,300
Paradise Cut multi-benefit improvements	BWFSs	$–	$–	$280	$340	$280	$340
Reservoir and floodplain storage	BWFSs and RFMPs	$130	$150	$620	$750	$750	$900
	Subtotal:	**$2,780**	**$4,950**	**$900**	**$1,090**	**$3,680**	**$6,040**
Urban							
Levee improvements	USACE	$3,240	$3,960	$900	$1,100	$4,140	$5,060
Other infrastructure and multi-benefit improvements	BWFSs and RFMPs	$100	$120	$50	$60	$150	$180
	Subtotal:	**$3,340**	**$4,080**	**$950**	**$1,160**	**$4,290**	**$5,240**
Rural							
Levee repair and infrastructure improvements	BWFSs and RFMPs	$790	$960	$540	$660	$1,330	$1,620
Small-scale levee setbacks and floodplain storage	BWFSs and RFMPs	$100	$120	$70	$90	$170	$210
Land acquisitions and easements	RFMPs and floodplain management effort	$490	$590	$280	$340	$770	$930
Habitat restoration/ reconnection	RFMPs	$250	$300	$10	$10	$260	$310
	Subtotal:	**$1,630**	**$1,970**	**$900**	**$1,100**	**$2,530**	**$3,070**
Small Community							
Levee repair and infrastructure improvements	BWFSs and RFMPs	$750	$910	$110	$140	$860	$1,050
Levee setbacks, land acquisitions, and habitat restoration	RFMPs and floodplain management effort	$530	$640	$110	$140	$640	$780
	Subtotal:	**$1,280**	**$1,550**	**$220**	**$280**	**$1,500**	**$1,830**
	Capital Total:	**$9,030**	**$12,550**	**$2,970**	**$3,630**	**$12,000**	**$16,180**

Notes:
1. All estimated dollar values are in 2016 dollars and indicate an investment over 30 years.
2. Feather River–Sutter Bypass Multi-benefit Improvement cost ranges are included for completeness, but additional study is needed to refine recommended improvements, including consideration of improvements to Tisdale and Colusa Weirs.
3. An estimated cumulative capital and ongoing cost of $1.3B within the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects, embedded most within larger scale activities.

4.1.4 Ongoing Investment Costs over 30 Years

Implementation of the 2017 refined SSIA portfolio for ongoing investments is estimated to range in cost annually from $251 to $305 million. Figure 4-4 summarizes annualized costs for the ongoing investments by each area of interest. Ongoing investments are discussed in annualized dollar values throughout this section. This estimate is informed by the same efforts as described in Section 4.1.1. Table 4-3 elaborates on cost estimates and data sources for each management action category under each area of interest.

Figure 4-4. Annual Total of Ongoing CVFPP Investments



Note: All estimated dollar values are in 2016 dollars and indicate average annual investments made over 30 years. They have not been discounted to present value nor escalated for inflation.

Table 4-3. Ongoing Investments of the 2017 Refined SSIA Portfolio Per Year (shown in 2016 $)

Management Action Category and Area of Interest	Data Source	Sacramento		San Joaquin		Total	
		Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)
Systemwide							
State operations, planning and performance tracking	RFMPs and State operations/planning effort	$21	$26	$20	$24	$41	$50
Emergency management	RFMPs and emergency management effort	$16	$20	$16	$20	$32	$40
Reservoir operations	BWFSs	$1	$1	$12	$14	$13	$15
Routine maintenance	OMRR&R Workgroup	$81	$99	$37	$45	$118	$144
	Annual Subtotal:	**$119**	**$146**	**$85**	**$104**	**$205**	**$250**
Urban							
Risk awareness, floodproofing and land use planning	RFMPs and floodplain management effort	$4	$5	$8	$10	$12	$15
Studies and analysis	RFMPs and USACE	$2	$2	$1	$1	$3	$3
	Annual Subtotal:	**$6**	**$7**	**$9**	**$11**	**$15**	**$18**
Rural							
Risk awareness, floodproofing and land use planning	RFMPs and floodplain management effort	$1	$2	$3	$4	$4	$6
Studies and analysis	RFMPs	$1	$1	$2	$3	$3	$4
	Annual Subtotal:	**$2**	**$3**	**$5**	**$7**	**$7**	**$10**
Small Community							
Risk awareness, floodproofing and land use planning	RFMPs and floodplain management effort	$7	$9	$7	$9	$14	$18
Studies and analysis	RFMPs and Small Communities Program	$10	$12	$–	$–	$10	$12
	Annual Subtotal:	**$17**	**$21**	**$7**	**$9**	**$24**	**$30**
	Ongoing Annual Total:	**$144**	**$177**	**$106**	**$131**	**$251**	**$308**

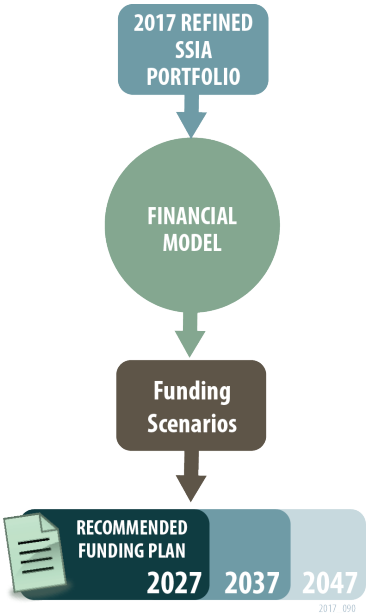
Notes:
1. Estimated dollar values are in 2016 dollars and indicate annual investments made over 30 years. They have not been discounted to present value nor escalated for inflation.
2. Present value of total ongoing investments is approximately $5B over 30 years.
3. A cumulative capital and ongoing cost of $1.3B within the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects, embedded most within larger scale activities.
4. Currently, DWR's Division of Flood Management spends an approximate annual $58M/year. SPFC-related staff work on a range of activities and management actions across all areas of interest. Therefore, staff costs may be incorporated into other ongoing management action categories other than the State operations, planning, and performance tracking line item.

4.2 CVFPP Funding Plan

The CVFPP funding plan (included in the Draft CVFPP Investment Strategy TM) aligns the 2017 refined SSIA portfolio with appropriate funding mechanisms and implementation programs. The CVFPP funding plan also considers other influential factors affecting the timing of investments and provides a recommended approach to fully fund the 2017 refined SSIA portfolio. Actions needed at the local, State, and federal levels to support the fully funded 2017 refined SSIA portfolio are included in the recommended CVFPP funding plan. Figure 4-5 presents the process used to develop the recommended CVFPP funding plan. The process included the following steps within the financial analysis:

- 2017 refined SSIA portfolio
  - Analyze the categories and costs of capital and ongoing management actions within the 2017 refined SSIA portfolio to develop investment priorities
- Financial Model
  - Apply existing and potential new funding mechanisms
  - Apply other influential factors, such as ability to pay and cost-share agreements
  - Assign DWR implementation program with potential funding mechanisms
- Funding Scenarios
  - The financial model analyzed several possible funding scenarios ranging from partial to full funding.
  - Funding scenarios provide insight on mechanisms required and contribution from cost-share partners.
- Recommended Funding Plan
  - The timing of investments results from an optimal funding scenario that would fully fund the 2017 refined SSIA portfolio for both capital and ongoing investments.
  - $17 to $21 billion over the next 30 years, divided into three 10-year phases.
  - New funding mechanisms required
  - Increase cost-shares for federal, State, and local partners

Figure 4-5.
Financial Model Development Overview



4.2.1 Analyzing the Portfolio and Applying Funding Mechanisms

Many uncertainties will affect future flood management investments; the financial analysis builds in these uncertainties as prescribed constraints. Financial analysis of the 2017 refined SSIA portfolio consists of these constraints: prioritized management actions, existing and potential new funding mechanisms, and other influential factors such as ability to pay or cost-share agreements.

The financial analysis was organized by area of interest and by prioritized management action categories as described in Chapter 3. The management action categories were matched with the DWR flood management implementation programs for delivery. The management action categories were then matched to existing and new funding mechanisms. The Draft CVFPP Investment Strategy TM includes multiple scenarios that vary the revenues of existing and potential new funding mechanisms, contributions from cost-share partners, and other constraints. The multitude of scenarios included in the investment strategy ranges across (1) decreased investment in all activities, (2) current level of investment for all activities, (3) funding only ongoing investments and no capital investments, (4) fully funding ongoing investments and partially funding capital investments, and (5) fully funding ongoing and capital investments. This range of scenarios helps identify solutions as future funding constraints and political conditions change. The recommended CVFPP funding plan was chosen as the most promising of these possible scenarios that would fully fund the ongoing and capital investments, with flexibility to make adjustments over time in future CVFPP updates as implementation proceeds.

What is a Funding Plan?

- The 2017 CVFPP Update states why flood investments are needed.
- The 2017 CVFPP Update and Investment Strategy TM specify what investments are needed.
- The CVFPP funding plan then identifies how these investments could be funded over the 30-year planning horizon.

Current bond funding for flood system investments is expected to be depleted by 2019.[1] Continued implementation of the CVFPP requires new incremental State, federal, and local funding. Greater use of existing—and establishment of new—funding mechanisms is needed to provide more stable and secure funding for critical ongoing investments, such as operations and maintenance and emergency management.

A variety of potential funding mechanisms are summarized in Table 4-4. The table briefly describes local, State, and federal funding mechanisms by providing a summary description of each mechanism, what management actions it best applies to, and the role the mechanism could play in the CVFPP investment strategy. Assessment-based funding mechanisms are designed to have a clear nexus between the benefits received and the costs allocated to the user or property. More detailed evaluations of each mechanism are provided in the Draft CVFPP Investment Strategy TM. Funding mechanisms that could apply to pay for the 2017 refined SSIA portfolio within the 30-year planning horizon are described in Section 4.2.2.

[1] DWR anticipates that by FY 2019/2020, it will no longer have the ability to commit Proposition 1E and 84 funds. Funds will not be completely expended until after 2020, because several projects under construction will continue using those funds.

Table 4-4. Summary of Funding and Financing Mechanisms by State, Federal, and Local Entities

Mechanism	New Mechanism	Description	Applicable Management Actions	Level of Applicability	Inter-annual Reliability	Recommendations for CVFPP Funding Plan
State						
Additional State General Fund		The General Fund has traditionally funded some flood management. The CVFPP funding plan recommends increasing General Fund appropriations.	All capital and ongoing management actions	Applicability is high. There is a nexus between lowering the risk of flooding and benefits to the State economy.	Moderate	Key part of the near-term approach
Sacramento and San Joaquin Drainage District	✓	Reutilize the function of the Sacramento and San Joaquin Drainage District to provide another source of funding. This would require new legislation to amend the Sacramento and San Joaquin Drainage District currently in the California Water Code. This mechanism would need to be coordinated with other potential assessments.	All capital and ongoing management actions	Applicability is high. There is a strong nexus between the assessments and benefits received in the drainage district.	High	A new funding source to pay local cost shares
State River Basin Assessment	✓	A river basin assessment would be a tool for integrated water management. Assessment revenue would be returned to the watershed to be shared across the integrated water management activities. This assessment would cover the whole watershed and be shared by water agencies within the watershed.	All capital and ongoing management actions	Applicability is low (if implemented, assessment revenue would be spread across other water activities in the basin with likely no more than $5 to $10M/year for flood management). Nexus is strong between the assessment and the benefits received in the watershed.	High	A new funding source that could fund some projects in the longer term, but a minor role in the CVFPP funding plan
State Flood Insurance Program	✓	The State would augment/replace the NFIP program with a State-led program. Beyond providing risk coverage, the program would be set up to invest in infrastructure and other floodplain management activities that reduce flood risk. Another version of this could be a local basin-wide insurance program. A local basin-wide insurance program could potentially be a companion program with the Statewide Flood Insurance Program. Any new program could also consider insurance for agricultural properties.	Levee improvements, small-scale levee setbacks and floodplain storage, land acquisitions and easements	Applicability is high (anticipated to generate $5 to $20M/year; however, this would require significant effort to determine feasibility). There is a strong nexus between insurance and the benefits received as rates could fluctuate depending on benefit level.	High	A new funding source that could fund projects in the longer term

Table 4-4. Summary of Funding and Financing Mechanisms by State, Federal, and Local Entities

Mechanism	New Mechanism	Description	Applicable Management Actions	Level of Applicability	Inter-annual Reliability	Recommendations for CVFPP Funding Plan
General Obligation Bonds (GO Bonds)		Issuance of new State general obligation bonds would require a statewide vote. This mechanism would require time to prepare language for the bond measure for the statewide vote, as well as a 2-year lag before funds would be available after passage.	Systemwide capital actions, levee improvements, small-scale levee setbacks and floodplain storage, land acquisitions and easements, habitat restoration/reconnection	Applicability is high. The benefits of reducing the flood risk and benefits to the State economy create a nexus with this mechanism.	High for bonds that have passed, low over the long term	Could continue to play a significant role in capital investments
Federal						
USACE		The Water Resource Development Act (WRDA) authorizes the Secretary of the Army to study and/or implement various projects and programs for improvements and other purposes to rivers and harbors of the United States. Federal authorized funds would require appropriation by Congress.	Systemwide capital actions; urban levee improvements; small-scale levee setbacks and floodplain storage; *rural land acquisitions and easements*; habitat restoration/ reconnection; risk awareness, floodproofing, and land use planning; urban and *small community studies and analysis*	Applicability is high. Projects qualifying for USACE funding have to demonstrate that they provide national benefits to receive funding.	Moderate	A key part of the federal contribution
FEMA		FEMA is the disaster response agency of the federal government. As such, FEMA provides State and local governments with funding for emergency preparedness programs in the form of non-disaster Grants.	Risk awareness, floodproofing, and land use planning; rural and small community studies and analysis	Applicability is high (expected to generate no more than $10M/year). The limited uses of the funds maintain the nexus between the funds and benefits received.	High	Part of the CVFPP funding plan, but provides smaller percentage of overall CVFPP funds
Ecosystem Programs		There are several federal programs that provide grants for ecosystem purposes. For example, voluntary Farm Bill conservation programs are offered through Natural Resources Conservation Service (NRCS).	Habitat restoration/ reconnection, rural land acquisitions and easements	Applicability is high. The application process for these funds would require a nexus to be shown.	Moderate	Programs should be explored to augment funding
Local						
Benefit Assessments and Special Taxes		The typical mechanism for funding local activities. Increases to benefit assessments and special taxes would require a property owner or a registered voter vote (depending upon specific circumstances).	All capital and ongoing management actions	Applicability is high. Benefit assessments by definition would have a strong nexus.	High	Could continue to play a major role in local funding

Notes:
1. *Italics* represent a requested change for the USACE project approval methodology.
2. All funding mechanisms listed are used in the recommended funding plan. Additional funding mechanisms that have been explored are described in the Draft CVFPP Investment Strategy TM.

4.2.2 Timing of Investments

The CVFPP investment strategy considers priorities, complexity and variety of management actions, availability and applicability of funding mechanisms, and other influential factors to optimize the timing of investments. The financial model varied these factors to analyze several possible funding scenarios. These influential factors included: historical expenditures, political sentiment, cost-share agreements, project benefits, competing demands and complementary actions, ability and willingness to pay.

These scenarios included consideration of historical levels of funding through a fully funded 2017 refined SSIA portfolio. Using only the current revenue sources, generating revenue at historical levels would only fund $4 to 5 billion of the SSIA over the next 30 years. Other scenarios varied the cost shares among federal, State, and local entities, as well as the amount of revenue that could be generated from the various funding mechanisms.

The recommended timing of investments results from a funding scenario that would fully fund the 2017 refined SSIA portfolio over 30 years, for both capital and ongoing investments, is divided into three 10-year phases generally described below.

- **Phase 1:** Reactively address the highest levels of risk to lives and assets concentrated in the densely populated areas
- **Phase 2:** Actively transition to more balanced flood management
- **Phase 3:** Proactively balance flood investments for both capital and ongoing activities in a sustainable manner

Table 4-5 describes details on each phase. Each CVFPP 5-year update will refine investment timing as priorities and conditions change during CVFPP implementation. Figure 4-6 shows capital investments phased over time by areas of interest and Figure 4-7 shows ongoing investments phased over time by management action category.

Table 4-5. Recommended Timing of CVFPP Investments Shown by Average Annual Expenditures in Each Phase ($M/year, 2016 dollars)

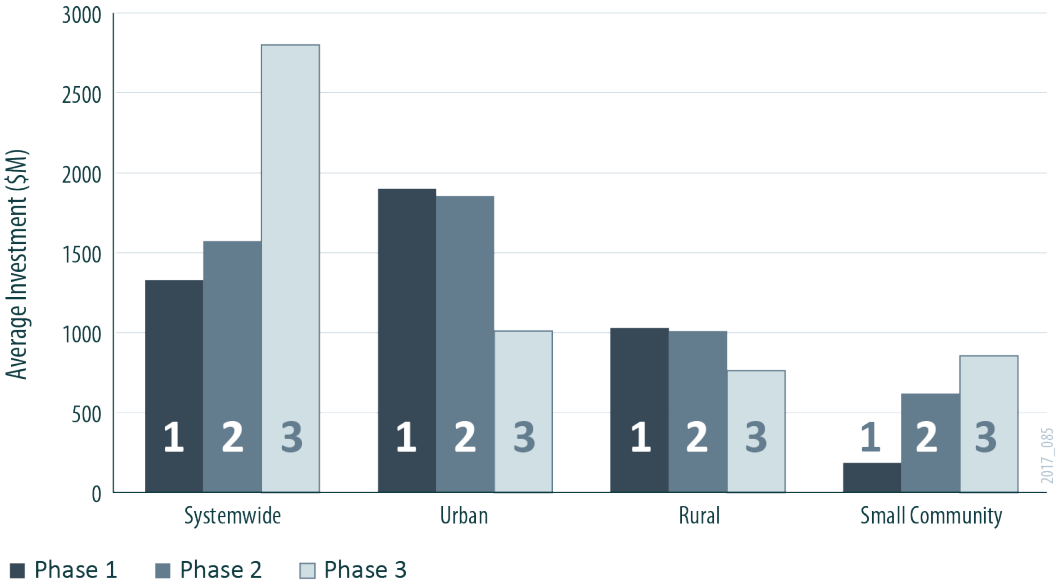
	Phase 1	Phase 2	Phase 3
Focus	Reactively address the highest levels of risk to lives and assets concentrated in the densely populated areas	Actively transition to more balanced flood management	Proactively balance flood investments for both capital and ongoing activities in a sustainable manner
Anticipated Duration	2017 to 2027	2027 to 2037	2037 to 2047
Capital Investment			
Capital Revenue Sources	■ State ▸ $13M/year Sacramento/San Joaquin Drainage District (once established) ▸ 2020s $2.5B GO Bond ■ Federal ▸ $200M/year USACE ▸ $3M/year FEMA ■ Local ▸ Incremental increase of $15M/year local revenue	■ State ▸ $14M/year Sacramento/San Joaquin Drainage District ▸ $5M/year State river basin assessment (once established) ▸ $11M/year State flood insurance program (once established) ▸ 2030s $2.5B GO Bond ■ Federal ▸ $220M/year USACE ▸ $3M/year FEMA ■ Local ▸ Incremental increase of $20M/year local revenue	■ State ▸ $19M/year Sacramento/San Joaquin Drainage District ▸ $15M/year State river basin assessment ▸ $11M/year State flood insurance program ▸ 2040s $2.5B GO Bond ■ Federal ▸ $240M/year USACE ▸ $3M/year FEMA ■ Local ▸ Incremental increase of $25M/year local revenue
Ongoing Investment			
Ongoing Revenue Sources	■ State ▸ $135M/year general fund ▸ $2M/year Sacramento/San Joaquin Drainage District (once established) ■ Federal ▸ $10M/year USACE ▸ $7M/year FEMA ■ Local ▸ Incremental increase of $30M/year local revenue	■ State ▸ $170M/year general fund ▸ $6M/year Sacramento/San Joaquin Drainage District ▸ $10M/year State river basin assessment (once established) ▸ $1M/year State flood insurance program (once established) ■ Federal ▸ $12M/year USACE ▸ $12M/year FEMA ■ Local ▸ Incremental increase of $35M/year local revenue	■ State ▸ $190M/year general fund ▸ $6M/year Sacramento/San Joaquin Drainage District ▸ $10M/year State river basin assessment ▸ $1M/year State flood insurance program ■ Federal ▸ $15M/year USACE ▸ $17M/year FEMA ■ Local ▸ Incremental increase of $35M/year local revenue

Notes:
1. Estimated values are in 2016 dollars, and are annual averages over each 10-year period.
2. General Obligation Bond (GO Bond): GO Bonds issued by the State of California are full faith and credit bonds pledged by the State's general fund, and require majority voter approval.
3. Phase 3 allocations represent the real need of annual ongoing investments within the 2017 refined SSIA portfolio. Ramping of investments shown here represent needed increases of staff and resources.

- **Phase 1** is aimed at *reactively* addressing the highest levels of risk to lives and assets concentrated in the densely populated areas (urban and small communities). Funding comes from increasing revenue from existing sources and recommends seeking additional funding from the Sacramento San Joaquin Drainage District after necessary legislative amendments are made. Phase 1 also leverages the most promising and readily viable opportunities for ecosystem restoration that exist in the Central Valley. Phase 1 includes Yolo Bypass multi-benefit improvements, land acquisition for Paradise Cut multi-benefit improvements, and reservoir and floodplain storage. It also includes continued investment in urban levees and other infrastructure, some rural levee repairs and other infrastructure improvements, and beginning investment in small communities. Ongoing Phase 1 actions emphasize actions related to addressing deferred and ongoing maintenance of the SPFC with additional emergency preparedness and flood risk awareness activities that are timely and a highly cost-effective means of improving public safety.

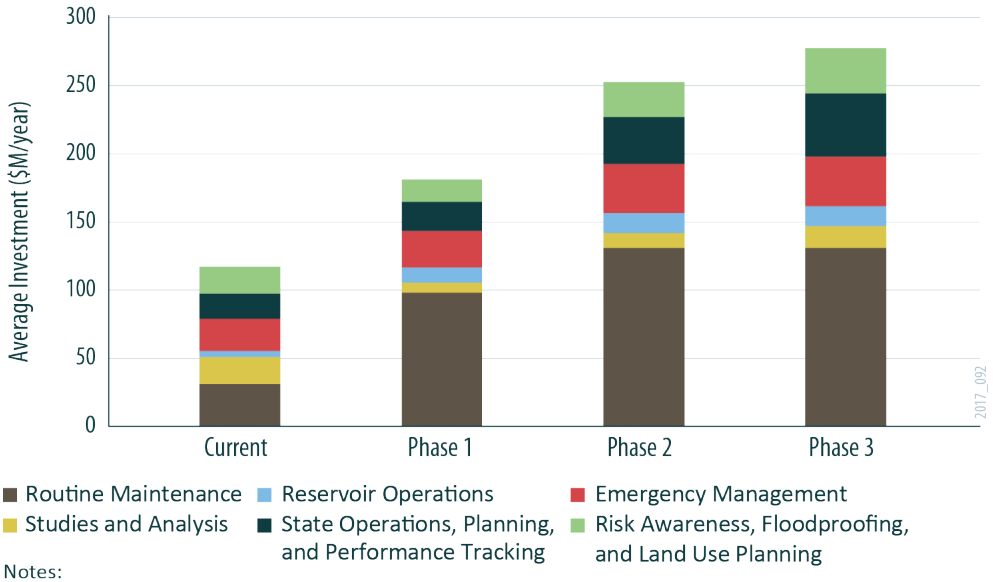
- **Phase 2** is aimed at *actively* transitioning to more balanced flood management. Funding would require sustaining Phase 1 revenues and adding new statewide revenue sources (such as funds through a new State flood insurance program and State river basin assessment). Phase 2 includes continued Yolo Bypass multi-benefit improvements, increased investment in Paradise Cut multi-benefit improvements, and continued investment in reservoir and floodplain storage. It also includes decreasing investment in urban levees and other infrastructure, decreasing rural levee repairs and other infrastructure improvements, and increasing investment in small communities. Ongoing Phase 2 actions emphasize increasing State operations, planning, and performance tracking activities; studies and analysis; reservoir operations; and more floodproofing and land use planning activities.

- **Phase 3** is aimed at *proactively* balancing flood management system investments for both capital and ongoing activities in a sustainable manner. Funding is based on sustaining revenue levels as established in Phases 1 and 2. Phase 3 includes completion of Yolo Bypass multi-benefit improvements, investment in Feather River–Sutter Bypass multi-benefit improvements, and continued investment in reservoir and floodplain storage. It also includes continued ongoing investments, such as O&M, needed to sustain the value of past capital investments. It also includes decreased investment in new or improved urban levees and other infrastructure, increased rural levee repairs and other infrastructure improvements, and decreased investment in small communities. Ongoing Phase 3 actions continue the ramping up of investments established in Phases 1 and 2.



Note: All estimated dollar values are in 2016 dollars and indicate an investment over 30 years.

Figure 4-6. Capital SSIA Phased Over Time by Area of Interest



Notes:
1. All estimated dollar values are in 2016 dollars and indicate average annual investments made over 30 years. They have not been discounted to present value nor escalated for inflation.
2. Ramping of investments shown represent capacity building of staff and resources, it is not intended to account for escalating costs from inflation.

Figure 4-7. Ongoing SSIA Phased Over Time by Management Action Categories

To implement the CVFPP over the next 30 years, much larger contributions would be required from all entities. Figure 4-8 outlines recommended funding and phasing of funding for each cost share partner to support the CVFPP funding plan. The information is presented this way to demonstrate when funding mechanisms could be available and how much would be needed. The recommended CVFPP funding plan would take advantage of existing revenues sources and needed increases in revenue-generation capacity.

Larger State Contributions and New Funding Mechanisms Are Needed

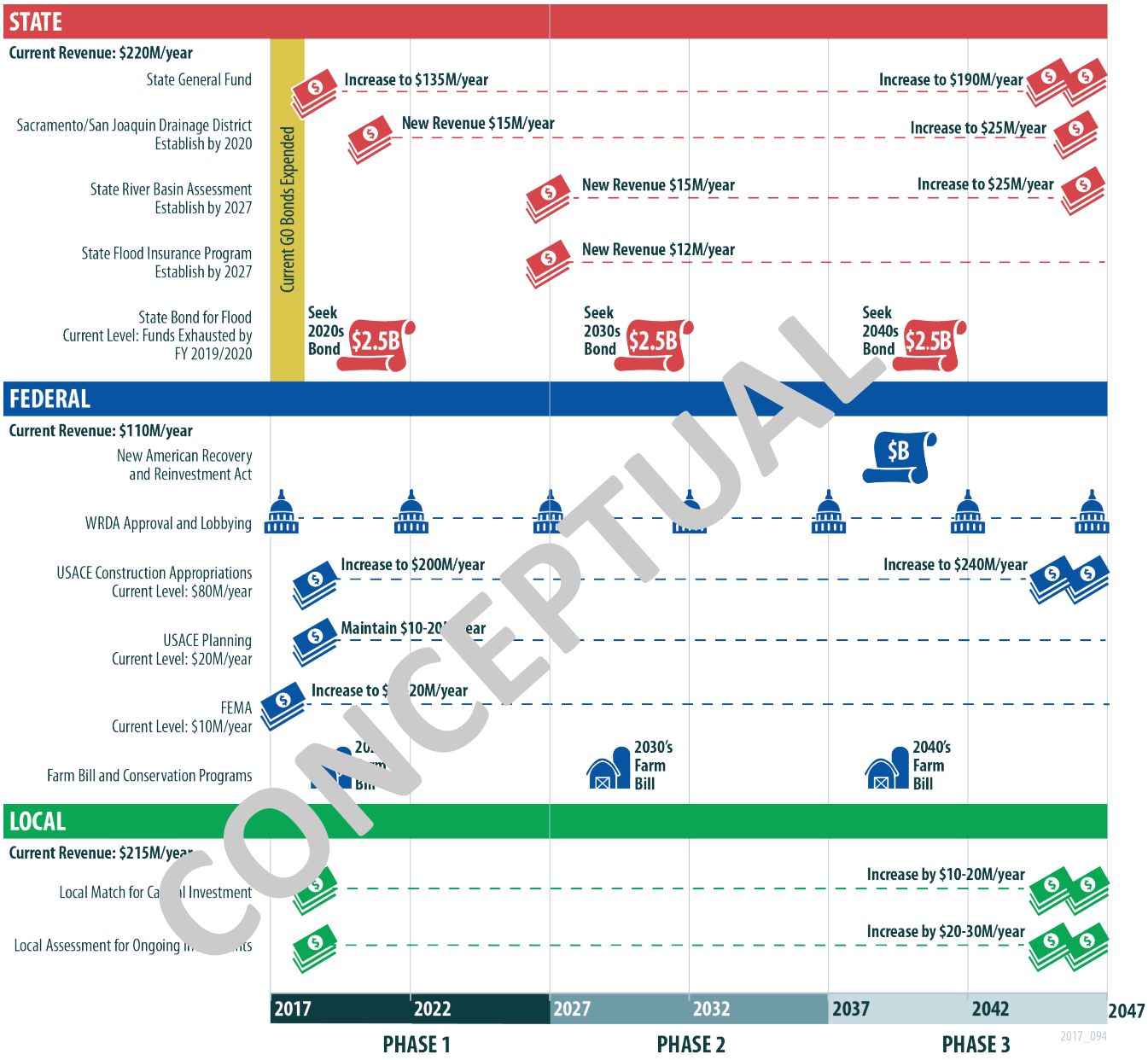
- Increasing contributions from the State General Fund
- Successfully passing new State bonds with unprecedented amounts and frequency for flood management investments
- Developing new sources of funds, including evaluating a State flood insurance program and implementing a State river basin assessment program
- Reutilize the function of the Sacramento and San Joaquin Drainage District to conduct assessments and amending its authority in the California Water Code to modernize it for today's needs

For the State, this would include a much larger contribution from the State General Fund and successfully passing new State bonds. The three bonds would be unprecedented in the amount of funding requested and frequency for flood-specific investments: an estimated 10-year frequency tied to overall State capacity to implement flood management system improvements. Time and effort would be required to develop new funding mechanisms, including evaluating the feasibility of a State flood insurance program and implementing a State river basin assessment program. In addition, the Sacramento and San Joaquin Drainage District could be reutilized if its authority is amended in the California Water Code. This district would be a vehicle to implement an assessment.

For the federal government, contributions from the USACE would need to increase from current levels. This requires the State to effectively promote the SSIA, likely seeking federal authorizations through the WRDA and annual appropriations from Congress to fund the authorized projects. FEMA contributions could remain at current levels. The NRCS programs (such as the Farm Bill and Conservation Programs) could also provide some funds for flood management and ecosystem restoration projects.

Local entities would need to generate funds to provide the local match for federal and State capital investments. Locals would also need to generate more funds for their share of ongoing costs.

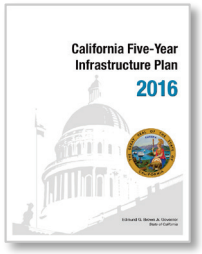
Figure 4-8. Recommended Funding Plan Timeline for CVFPP



Notes:

1. Although revenues from the Sacramento/San Joaquin Drainage District would be generated from locals within the district boundaries, it would require action by the California State Legislature to implement. This is why this funding mechanism appears as a State mechanism.
2. Current State contributions include approximately $40M/year from the General Fund and current GO Bond funding from Propositions 84 and 1E.
3. Current local contributions to all capital and ongoing investments are unknown. The $215M/year local revenue estimate (reflects the average revenue from 2003 – 2014) is assumed to cover capital and maintenance obligations and expenditures for local operating costs. It was assumed that this revenue could not be applied to the CVFPP funding plan, with one exception: local maintenance expenditures already currently being spent on SPFC facilities are applied towards the ongoing portion of the 2017 refined SSIA portfolio.
4. All estimates provided include both capital and ongoing activities unless otherwise specified.

4.2.3 Near-Term Funding Actions



The recommended CVFPP funding plan for the 2017 refined SSIA portfolio supports approximately $17 to $21 billion over the next 30 years, requiring substantially more funding in the Central Valley than has been generated in the past. This would require a combination of significant changes in how the State and its partners fund flood project implementation, operations and maintenance, as well as increased funding through existing and new mechanisms. Recommendations are presented for local, State, and federal partners to successfully implement the CVFPP. Additionally, the CVFPP funding plan will also inform the flood investment needs of the Central Valley for California's Five-Year Infrastructure Plan, which the Governor is required to submit to the Legislature for consideration with the annual budget bill.

Figure 4-9 presents the estimated cost shares between federal, State, and local for the 2017 refined SSIA portfolio investment, along with a comparison of CVFPP cost shares estimated in 2012. The State's estimated share of the SSIA has increased, whereas the federal share has decreased. The 2017 refined SSIA portfolio also has greater investment needs identified for rural and small communities compared to 2012. It is anticipated that these types of investments are less likely to meet current federal guidelines for federal participation, so these costs shifted more to the State.

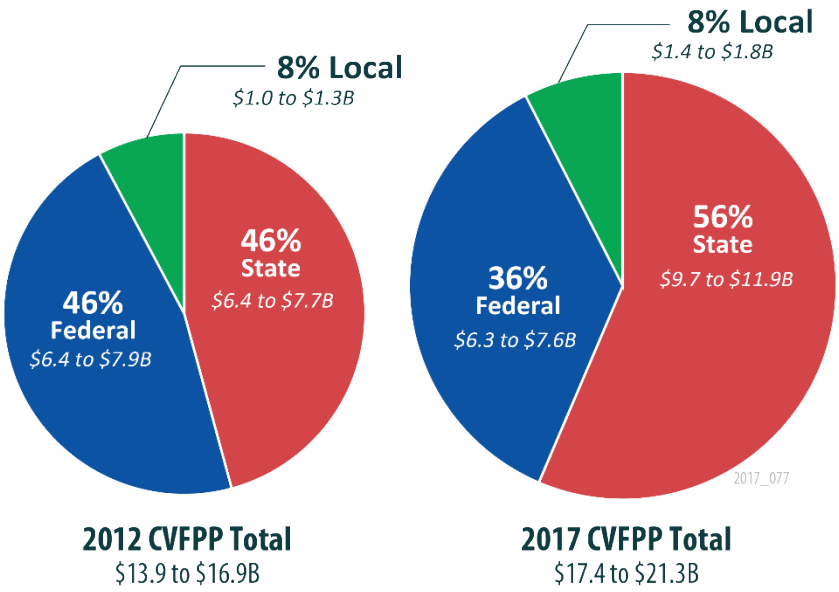
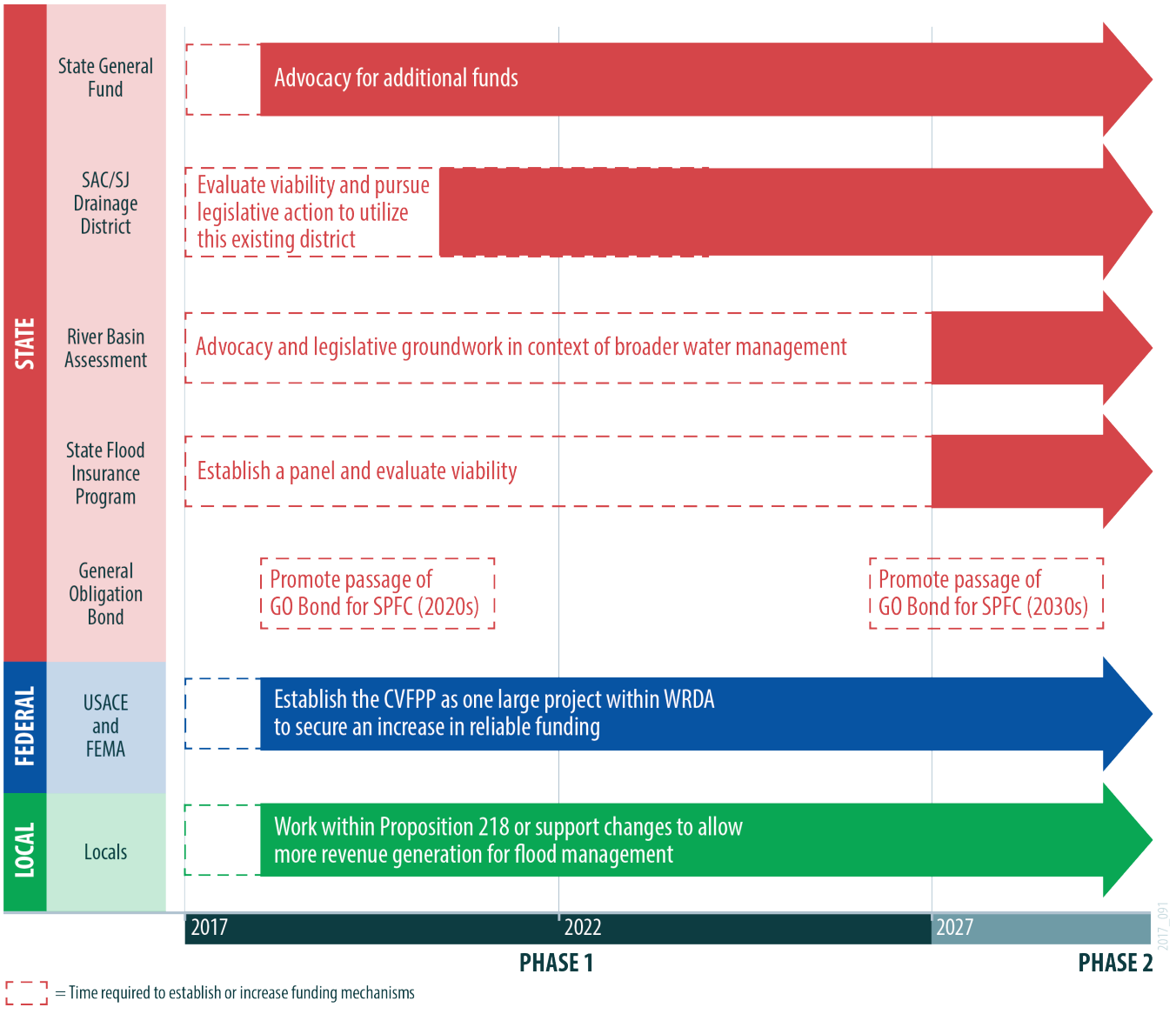


Figure 4-9. 2012 and 2017 Cost Share Comparisons

Notes:
1. 2017 CVFPP Totals reflect annual ongoing investments in present value terms (2016 dollars) and summed with present value capital investment costs.
2. 2012 CVFPP Totals are from Table 4.3 in the 2012 CVFPP.

Each funding mechanism in the CVFPP funding plan requires some level of groundwork to establish and/or be implemented. Figure 4-10 describes the actions necessary to initiate each potential funding mechanism, along with the estimated time the funding would become available. The State and its partners must work closely together over the next few years to initiate these actions so that additional funding can be realized beyond current levels.

Figure 4-10. Ten-year Recommended Funding Actions for CVFPP

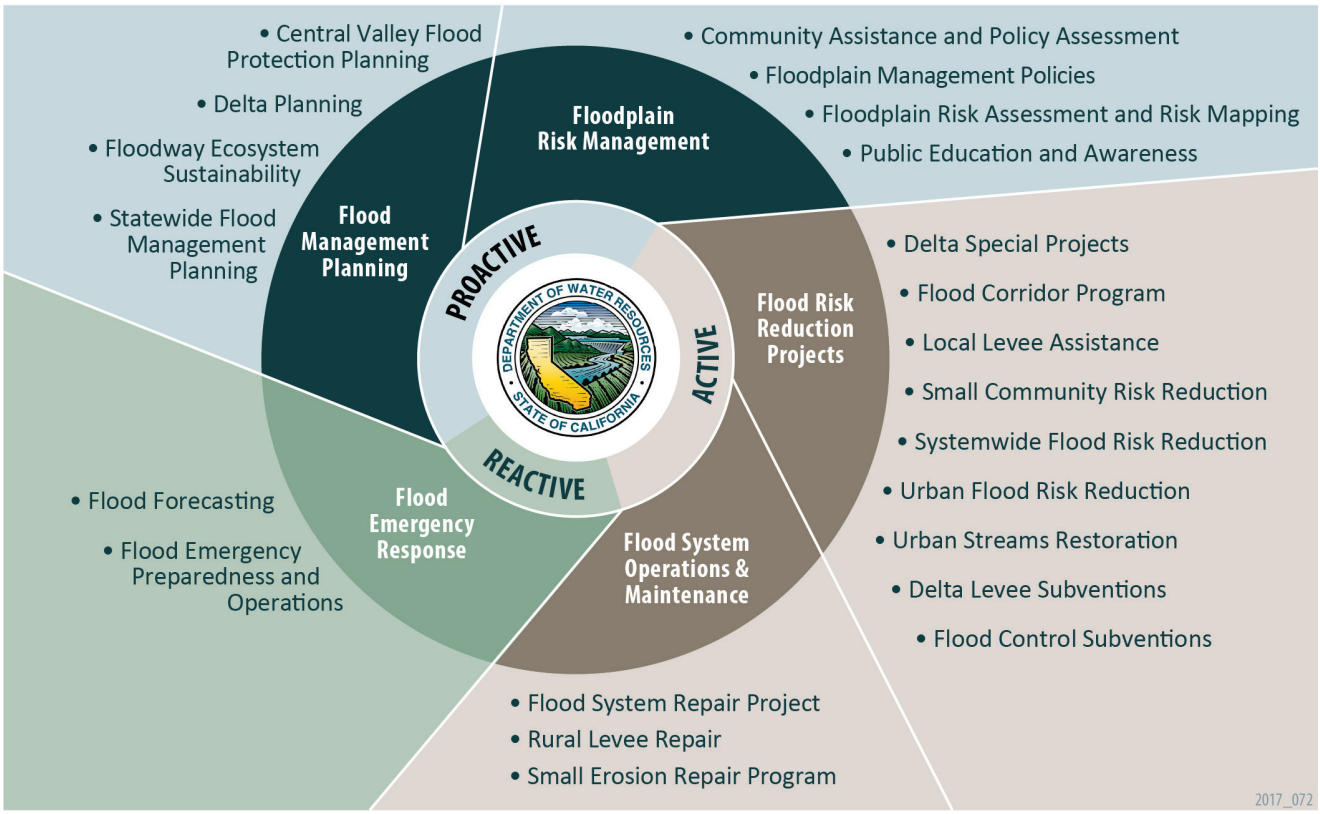


4.3 Implementation through Program Delivery

Along with obtaining funding for the 2017 refined SSIA portfolio through the various mechanisms described in Section 4.2, important aspects of implementation such as program delivery must be considered. The following sections provide a brief overview of CVFPP delivery through DWR's flood management programs.

Delivery of the program activities and implementation of near-term and longer-term actions require a wide range of expertise to plan, design, fund, construct, and operate improvements to the flood management system. At the State level, this work is organized into five major flood management programs with DWR staff working closely with CVFPB and other local, State, and federal partner agencies and non-governmental organizations (NGOs). Each program is responsible for specialized implementation of different types of actions (together, they cover all work required for implementation of the actions identified in the CVFPP) and for overall flood management in the areas protected by SPFC facilities. Each DWR flood management program is divided into sub-programs that are responsible for various aspects of flood management. Figure 4-11 shows the organization of five programs and their sub-programs.

Figure 4-11. Existing DWR Flood Management Programs and Sub-Programs



The Flood Management Planning program is responsible for formulation of CVFPP Updates, feasibility assessment, and prioritization of actions for implementation. The Flood Risk Reduction Projects program is responsible for implementation. The remaining three programs, Floodplain Risk Management, Flood System Operations and Maintenance, and Flood Emergency Response, are responsible for various categories of residual risk management.

- **Flood Management Planning:** This program performs the planning and feasibility assessments of the SPFC facilities and formulates potential actions to repair, rehabilitate, or improve facilities. The program provides the rationale, engineering support, and feasibility evaluations to support development of site-specific improvements for the CVFPP. Feasibility studies and updates to the CVFPP are prepared under this program. This program also performs flood system engineering and ecosystem modeling assessments of existing facility conditions for use in identifying areas needing improvements and flood management policy development.
- **Floodplain Risk Management:** The program strives to reduce the consequences of riverine flooding in the Central Valley. A major focus of this work is the delineation and evaluation of floodplains to assist local decision makers with their near-term and long-term land use planning efforts. Risk awareness campaigns and flood insurance activities are also a major focus of this program. In addition to its routine activities, this program will implement floodplain management enhancement activities from the CVFPP.
- **Flood Risk Reduction Projects:** This program conducts the work necessary to implement on-the-ground projects that are formulated and recommended through the CVFPP. State investments in system improvements may be through direct investment in new or improved facilities, or through grant programs. System improvements will generally be implemented through partnership programs among DWR, CVFPB, and USACE, and in coordination with local agencies and NGOs.
- **Flood System Operations and Maintenance:** This program includes work to keep SPFC flood management facilities, including those for which the State is responsible for as defined in California Water Code Sections 8361 and 12878, maintained pursuant to State and federal requirements so facilities continue to function as designed. This program's work includes on-the-ground daily and annual routine maintenance activities, and frequent coordination with regulatory agencies.
- **Flood Emergency Response:** The responsibility of this program is to prepare for floods, effectively respond to flood events, and support quick recovery when flooding occurs. This program will implement flood emergency response enhancements formulated in the CVFPP, including the provision of technical and funding assistance to local agencies to improve local flood emergency response.

The State covers the cost of operation and administration of all of these programs under the ongoing investment category of State operations, planning, and performance tracking as described in Section 4.1.4 to the extent funding is available. It is critical that the State maintain capacity to provide efficient project delivery to local agencies.

Table 4-6. Comparative Investment by DWR Flood Management Programs
Total Program Investment (State, Local, and Federal Investment)

Flood Management Program	2012 Total CVFPP Investment Estimate[1]		2017 Total CVFPP Investment Estimate	
	Low ($M)	High ($M)	Low ($M)	High ($M)
Flood Management Planning	$1,890	$2,300	$750	$930
Floodplain Risk Management	$600	$800	$4,720	$5,080
Flood Risk Reduction Projects	$10,520	$12,740	$9,000	$11,700
Flood System Operations and Maintenance	$440	$560	$2,310	$2,820
Flood Emergency Response	$480	$510	$650	$770
Total	**$13,920**	**$16,910**	**$17,430**	**$21,300**

Notes:
1. From Table 4.3 in the 2012 CVFPP
2. Estimated totals reflect annual ongoing investments in present value terms (2016 dollars) and summed with present value capital investment costs.

The 2012 CVFPP organized the funding of the entire SSIA and the State's share of the SSIA over time through the flood management programs described above. Table 4-6 provides a comparison of the 2012 SSIA investment by program to the 2017 refined SSIA portfolio.

Table 4-7 presents the 2017 refined SSIA portfolio phased investment over time (in 2016 dollars) organized by DWR flood management program and broken down by State, federal, and local share. This information was provided similarly in the 2012 CVFPP. The 2017 refined SSIA portfolio provides more clarity on the funding need for several of the flood management programs, specifically the Flood Emergency Response and Flood System Operations and Maintenance programs.

Table 4-8 presents only the capital portion of the 2017 refined SSIA portfolio investment phased over time in present value terms.

Table 4-9 presents only the ongoing portion of the 2017 refined SSIA portfolio in annualized amounts. Annual ongoing investments are shown without discounting in order to highlight the real need for increased resources to many of the DWR flood management programs necessary for achieving CVFPP goals. Ramping of ongoing investments is based on assumptions of time needed to build capacity for these programs.

The 2017 refined SSIA portfolio is aimed in part at rebuilding and expanding the programs with a surge of investment to reduce flood risk in the Central Valley and contribute toward CVFPP goals. This is why recommended investments identified types of management actions categories rather than individual projects. This approach allows flexibility for the individual programs to fund the necessary types of management actions as priorities or conditions change throughout time. Individual projects will still have to apply for these programs and comply with program guidelines to receive implementation funding. Additionally, individual projects can pursue other potential avenues of funding, including funding from other State or federal grant programs, philanthropic contributions, private industry investment, and NGOs.

Table 4-7. Combined Present Value Capital and Ongoing State Systemwide Investment Approach Range of Investments Over Time

Flood Management Programs		Flood Management Planning		Floodplain Risk Management		Flood Risk Reduction Projects		Flood System Operations and Maintenance		Flood Emergency Response		Total	
		Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)
Phase 1	State	$140	$170	$1,270	$1,280	$890	$1,390	$720	$730	$190	$220	$3,210	$3,790
	Federal	$130	$170	$450	$460	$1,380	$1,610	$10	$20	$0	$0	$1,970	$2,260
	Local	$0	$10	$20	$30	$230	$280	$160	$170	$0	$10	$410	$500
	Subtotal	**$270**	**$350**	**$1,740**	**$1,770**	**$2,500**	**$3,280**	**$890**	**$920**	**$190**	**$230**	**$5,590**	**$6,550**
Phase 2	State	$170	$200	$880	$1,160	$1,240	$1,510	$670	$710	$320	$360	$3,280	$3,940
	Federal	$70	$80	$1,000	$1,010	$1,540	$1,850	$10	$20	$0	$0	$2,620	$2,960
	Local	$0	$10	$20	$30	$390	$400	$180	$190	$0	$10	$590	$640
	Subtotal	**$240**	**$290**	**$1,900**	**$2,200**	**$3,170**	**$3,760**	**$860**	**$920**	**$320**	**$370**	**$6,490**	**$7,540**
Phase 3	State	$180	$200	$780	$790	$1,550	$1,940	$390	$790	$140	$160	$3,040	$3,880
	Federal	$60	$80	$280	$290	$1,420	$2,090	$0	$10	$0	$0	$1,760	$2,470
	Local	$0	$10	$20	$30	$360	$630	$170	$180	$0	$10	$550	$860
	Subtotal	**$240**	**$290**	**$1,080**	**$1,110**	**$3,330**	**$4,660**	**$560**	**$980**	**$140**	**$170**	**$5,350**	**$7,210**
Total	State	$490	$570	$2,930	$3,230	$3,680	$4,840	$1,780	$2,230	$650	$740	$9,530	$11,610
	Federal	$260	$330	$1,730	$1,760	$4,340	$5,550	$20	$50	$0	$0	$6,350	$7,690
	Local	$0	$30	$60	$90	$980	$1,310	$510	$540	$0	$30	$1,550	$2,000
	Subtotal	**$750**	**$930**	**$4,720**	**$5,080**	**$9,000**	**$11,700**	**$2,310**	**$2,820**	**$650**	**$770**	**$17,430**	**$21,300**

Notes:
1. Estimated totals are the sum of annual ongoing and capital investments in present value terms (2016 dollars).
2. Flood Emergency Response program does not include federal contributions because the 2017 refined SSIA portfolio only includes State and local emergency response activities. The federal government does not participate in cost share on these State and local emergency response activities.

Table 4-8. Capital State Systemwide Investment Approach Range of Investments Over Time

Flood Management Programs		Flood Management Planning		Floodplain Risk Management		Flood Risk Reduction Projects		Flood System Operations and Maintenance		Flood Emergency Response		Total	
		Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)	Low ($M)	High ($M)
Phase 1	State	$0	$0	$840	$1,200	$890	$1,390	$0	$0	$0	$0	$1,730	$2,590
	Federal	$0	$0	$350	$460	$1,380	$1,610	$0	$0	$0	$0	$1,730	$2,070
	Local	$0	$0	$20	$30	$230	$280	$0	$0	$0	$0	$250	$310
	Subtotal	**$0**	**$0**	**$1,210**	**$1,690**	**$2,500**	**$3,280**	**$0**	**$0**	**$0**	**$0**	**$3,710**	**$4,970**
Phase 2	State	$0	$0	$810	$1,160	$1,240	$1,510	$0	$0	$0	$0	$2,050	$2,670
	Federal	$0	$0	$270	$570	$1,540	$1,850	$0	$0	$0	$0	$1,810	$2,420
	Local	$0	$0	$20	$30	$390	$400	$0	$0	$0	$0	$410	$430
	Subtotal	**$0**	**$0**	**$1,100**	**$1,760**	**$3,170**	**$3,760**	**$0**	**$0**	**$0**	**$0**	**$4,270**	**$5,520**
Phase 3	State	$0	$0	$500	$790	$1,550	$1,940	$0	$0	$0	$0	$2,050	$2,730
	Federal	$0	$0	$180	$220	$1,420	$2,090	$0	$0	$0	$0	$1,600	$2,310
	Local	$0	$0	$10	$20	$360	$630	$0	$0	$0	$0	$370	$650
	Subtotal	**$0**	**$0**	**$690**	**$1,030**	**$3,330**	**$4,660**	**$0**	**$0**	**$0**	**$0**	**$4,020**	**$5,690**
Total	State	$0	$0	$2,150	$3,150	$3,680	$4,840	$0	$0	$0	$0	$5,830	$7,990
	Federal	$0	$0	$800	$1,250	$4,340	$5,550	$0	$0	$0	$0	$5,140	$6,800
	Local	$0	$0	$50	$80	$980	$1,310	$0	$0	$0	$0	$1,030	$1,390
	Subtotal	**$0**	**$0**	**$3,000**	**$4,480**	**$9,000**	**$11,700**	**$0**	**$0**	**$0**	**$0**	**$12,000**	**$16,180**

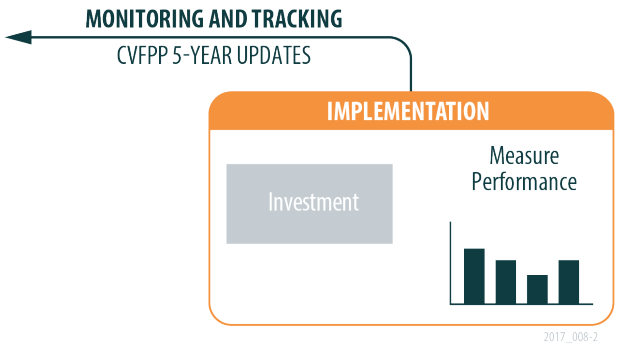
Note:
1. Estimated capital investment costs are in present value (2016 $) terms.

Table 4-9. Annual Ongoing State Systemwide Investment Approach Range of Investments Over Time

Flood Management Programs		Flood Management Planning		Floodplain Risk Management		Flood Risk Reduction Projects		Flood System Operations and Maintenance		Flood Emergency Response		Total	
		Low ($M/yr.)	High ($M/yr.)	Low ($M/yr.)	High ($M/yr.)	Low ($M/yr.)	High ($M/yr.)	Low ($M/yr.)	High ($M/yr.)	Low ($M/yr.)	High ($M/yr.)	Low ($M/yr.)	High ($M/yr.)
Phase 1	State	$27	$30	$5	$6	$0	$0	$68	$82	$22	$27	$122	$145
	Federal	$4	$5	$9	$11	$0	$0	$1	$2	$0	$0	$14	$18
	Local	$0	$1	$0	$1	$0	$0	$26	$32	$0	$1	$26	$35
	Subtotal	**$31**	**$36**	**$14**	**$18**	**$0**	**$0**	**$95**	**$116**	**$22**	**$28**	**$162**	**$198**
Phase 2	State	$39	$44	$7	$9	$0	$0	$92	$112	$30	$37	$168	$201
	Federal	$6	$8	$14	$17	$0	$0	$1	$2	$0	$0	$21	$27
	Local	$0	$1	$1	$2	$0	$0	$35	$43	$1	$2	$37	$48
	Subtotal	**$45**	**$53**	**$22**	**$28**	**$0**	**$0**	**$128**	**$157**	**$31**	**$39**	**$226**	**$276**
Phase 3	State	$54	$65	$9	$11	$0	$0	$93	$112	$30	$37	$186	$225
	Federal	$9	$11	$19	$23	$0	$0	$1	$2	$0	$0	$29	$36
	Local	$0	$1	$0	$1	$0	$0	$35	$43	$1	$2	$36	$47
	Subtotal	**$63**	**$77**	**$28**	**$35**	**$0**	**$0**	**$129**	**$157**	**$31**	**$39**	**$251**	**$308**

Notes:
1. Estimated ongoing annual investments are in 2016 dollars. They have not been discounted to present value nor escalated for inflation.
2. Phase 3 allocations represent the real need of annual ongoing investments within the 2017 refined SSIA portfolio. Ramping of investments shown here represent the time needed to build capacity of staff and resources for all programs other than Flood Risk Reduction Projects.
3. Present value of total ongoing investments is approximately $5 billion over 30 years.
4. Flood Emergency Response program does not include federal contributions because the 2017 refined SSIA portfolio only includes State and local emergency response activities. The federal government does not participate in cost share on these State and local emergency response activities.

4.4 Measuring Performance



The value of flood management system investments for the SPFC will only be fully realized over the long term. As implementation of flood system improvements proceeds, it is necessary to track performance as a means to evaluate effectiveness of investments. Further, as the flood system is tested over time, performance tracking should be improved to inform future CVFPP updates. This contributes to a meaningful iterative planning process that allows for course-correction and adaptation. At the same time, the planning process reflects a commitment to carry forward the vision adopted in the CVFPP.

For the CVFPP, specific outcomes contributing to the ultimate goal of sustainability have been formulated in the context of achieving the CVFPP primary and supporting goals as directed by the Act. Examples of these outcomes (and metrics) were described in Chapter 2. Outcomes are intended to be actionable, measurable, and attainable within the life of the CVFPP. Furthermore, tracking the progress of these outcomes is key to demonstrating the return on investment of the flood system improvements and raising the State and federal funds needed for future implementation. Ultimately, the specific outcomes should result in desired trends that indicate how CVFPP investment is contributing towards the broader societal values, as conceptually depicted in Figure 4-12.

Although it is conceptually easy to track to one metric that addresses each of the societal values, each of the four societal values is a composite of several flood-specific outcomes. Examples of potential flood-specific outcomes that contribute towards the societal values are shown in Section 2.1.2. For example, in order to accurately understand how many lives are lost or injured in large flood events, an understanding of the following is needed: number of people within the floodplain, percentage of people vulnerable when flood occurs, and level of system performance in populous areas. Flood-specific outcomes are more thoroughly addressed in the Draft CVFPP Investment Strategy TM.

The State is committed to improving its ability to assess progress in future CVFPP updates. This will require data acquisition, management, and analysis. To this end, the State will dedicate sufficient institutional capacity to the ongoing tracking, interpreting, and reporting of outcomes at regular intervals for the purpose of evaluating the effectiveness of flood system improvements to the extent available resources allow. This more clearly demonstrates the value of flood management to California taxpayers and to justify course-corrections and continued public support.

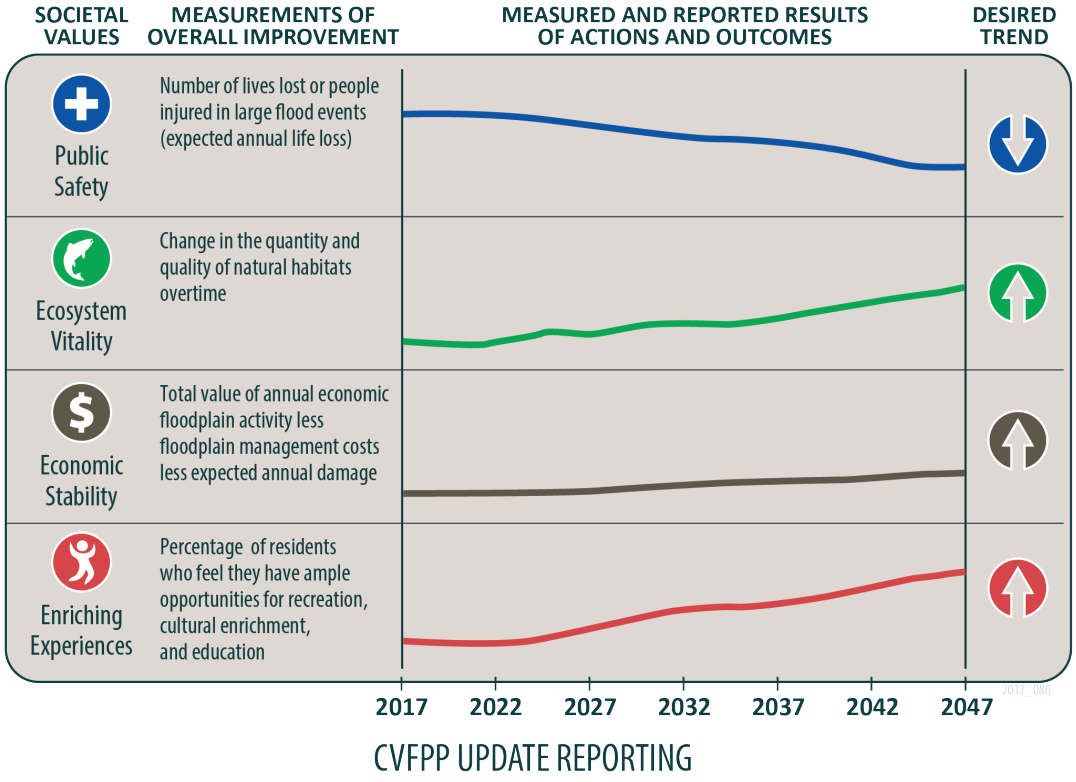


Figure 4-12. Conceptual Example of Monitoring and Reporting Trends

The FSSR focuses on describing the current status (i.e., the physical condition) of SPFC facilities at a systemwide level. In support of the 2017 CVFPP Update, the 2017 FSSR primarily presents information about the physical condition of SPFC facilities, and will help guide future inspection, evaluation, reconstruction, and improvement of those facilities. To support future updates to the CVFPP, the FSSR will continue to track changes in physical conditions of SPFC facilities such as levee conditions and channel capacities, but will also be expanded to include a more comprehensive set of performance tracking metrics. Examples of potential metrics were presented in Chapter 2, but developing a more comprehensive set of outcome-based metrics requires further effort with stakeholder input. Improved performance tracking for future updates to the CVFPP could begin to measure and track contributions to ecosystem vitality according to the metrics identified in the CVFPP Conservation Strategy. Measurement and tracking of value related to improvements in O&M (and outcomes for public safety, economic stability, and ecosystem vitality) could also be improved for future CVFPP updates. Furthermore, additional metrics for tracking outcomes related to economic stability and enriching experiences could be developed. Future updates to the FSSR could also track the amount of funding received and where that funding is applied during implementation of the CVFPP. Sufficient and sustainable funding is one of the largest challenges facing the flood management system; demonstration of responsible and effective investments is necessary.

4.5 The Way Forward

Implementation of significant flood management system improvements has been enabled by funding from State general obligation bonds, but this temporary funding boost is nearing its end.

Over the previous 5 years, the State, in cooperation with local, regional, and federal partners, has made significant progress in advancing the CVFPP goals as a result of on-the-ground project implementation and further planning. Implementation of significant flood management system improvements has been enabled by funding from State general obligation bonds, but this temporary funding boost is nearing its end. Additional funding sources will be required to manage and improve the flood management system into the future. For full implementation of the CVFPP, this 2017 CVFPP Update provides an updated estimate of needed investments that total $17 to $21 billion over the next 30 years.

However, additional funding alone is not enough; flood management policy issues present longstanding impediments to achieving full implementation of the CVFPP that must be addressed. To promote progress toward addressing these longstanding impediments, the flood management policy issues discussed in this 2017 CVFPP Update are organized with a consistent structure that will enable the creation of work plans to collectively address the issues. These work plans will drive toward implementation progress, but it is critical that all levels of government increase time and resources dedicated to working together to balance prioritization of near-term actions and realize longer-term opportunities.

All CVFPP partners and stakeholders will need to sustain this momentum and focus on continued cooperation looking forward to the 2022 CVFPP Update and beyond.

4.5.1 Recommendations for Flood Management Policy Issues

The flood management policy discussions in this update have included a brief introduction to each issue in Chapter 1, partner and stakeholder perspectives relative to these issues in Chapter 2, strategies for addressing these issues in Chapter 3, and, finally, recommended actions addressing these issues presented here. By articulating these policy recommendations and the associated achievement strategies described in Chapter 3, the 2017 CVFPP Update provides broad guidance for an important shift in approach—one that will lead to more resilient and long-lasting flood risk management, and which can reconcile flood risk management with other economic, social, and environmental values. All flood management policy issues discussions under the following recommendations are structured to support the creation of work plans to collectively and consistently address these issues. Each policy issue follows this structure:

- **Flood management policy issue name**
- **Issue Summary:** brief definition statement of what the issue encompasses
- **Near-term Milestone:** brief statement of progress that may be achieved by the 2022 CVFPP Update if sufficient resources are available
- **Recommended Actions:** compiled list of near- and longer-term recommendations with supporting details and recommended participating agencies. Where applicable, participating agencies are denoted as State (S), federal (F), and local (L).

Recommendations for Land Use and Floodplain Management

Issue Summary: Ongoing and planned development in the floodplain continues to intensify flood risk.

Near-Term Milestone: Seek resources to establish floodplain management programs to implement key activities such as expanded agricultural easements, environmental conservation, flood risk awareness campaigns, floodproofing, and similar activities that promote land uses compatible with periodic flooding.

Recommended Actions:

- **Reaffirm and clarify the CVFPP land use policy to guide State investments (S).** As stated in the 2012 CVFPP, the SSIA is intended to reduce flood risk in the areas protected by SPFC facilities while avoiding land use changes that promote growth in deep floodplains and increase State flood hazards. The State encourages policies and actions that avoid, to the extent feasible, putting people and property at risk that are not presently at risk in flood hazard areas. The 2017 CVFPP Update reaffirms and refines the CVFPP land use policy to guide State investments (see Section 3.2.1).
- **Establish a DWR Floodplain Management Strategic Implementation Plan (S).** Originally developed in 2002, the California Floodplain Management Task Force outlined a vision for floodplain management across the state. This vision included 38 recommendations State, local, and federal agencies should undertake with the intent to promote wise use of floodplains. *A California Challenge – Flooding in the Central Valley* (California Floodplain Management Task Force Independent Panel, 2007) also articulated specific recommendations California should take toward the same goal. These recommendations reflect a system approach to dealing with Central Valley flood risk. As work progresses, the estimated long-term economic, engineering, environmental, and social costs and benefits of actions will be considered. Establishing a Floodplain Management Strategic Implementation Plan would track what recommendations have progressed since the 2002 and 2007 reports and propose a framework to prioritize any outstanding recommendations.
- **Ensure State implementation of floodplain management actions (S).** The State will promote internal efforts to facilitate implementation of measures prioritized in the update to the Floodplain Management Strategic Implementation Plan. This includes an evaluation of resources and actions that can be utilized and executed and updated every 5 years.
- **Assess the benefits and costs of participation in the NFIP and evaluate the feasibility of a State insurance program. Mitigate losses to those subject to flooding through flood insurance (S/L).** The assessment should evaluate potential options and cost effectiveness of a State insurance program in comparison to the NFIP to assess the relative ability to mitigate losses to those subject to flooding through flood insurance.
- **Continue to work with the Agricultural Floodplain Ordinance Task Force (S/L).** The State will continue working with this task force to identify and recommend policies and actions that minimize impacts and preserve agriculture while facilitating the wise use of floodplains. The State will continue to work with the task force to develop the Agricultural Floodplain Ordinance Task Force Report.

- **Seek establishment of post-disaster agricultural recovery programs (S/F/L).** Recognizing that a majority of the SPFC system is maintained by rural and agricultural LMAs, it is important to quickly address the economic sustainability of any area impacted by a flood disaster. Post-disaster agricultural recovery programs are a key mechanism to helping these communities recover after a flood event. Furthermore, keeping areas subject to periodic flooding in agriculture prevents future risk intensification.
- **Seek support for post-disaster habitat recovery programs (S/F).** The State and federal governments should continue to promote programs that recognize the importance of prime habitat for aquatic and riverine species. For example, FEMA has supported recovery in the Yolo Basin Wildlife Area in the past.
- **Partner with FEMA to increase investments in non-structural actions (S/L).** The State should partner with FEMA to seek increased investments in non-structural actions by working with FEMA and Cal OES on multi-hazard mitigation planning (included in recommendations to address the residual risk management flood management policy issue).
- **Track land use changes and flood management system improvements to assess whether life loss and property damage risks are increasing or decreasing (S/L).** The State, in partnership with local agencies, should track new areas of residential and commercial development within SPFC floodplains and the improvements to the flood management system within these areas to assess whether life loss and property damage risks are increasing or decreasing.

Recommendations for Residual Risk Management

Issue Summary: Flood risk can be reduced, but never eliminated. Commitment to enhanced resilience and public awareness falls short in many areas.

Near-Term Milestone: Link the CVFPP related climate change activities to other ongoing State and Federal climate change assessments, seek augmentation for activities to promote risk communication widely, and provide resources to bolster flood emergency management programs.

Recommended Actions:

- **Convene a State-sponsored climate change task force to charter climate change evaluations using the best available science (S/F).** The uncertainty associated with climate change has the effect of increasing flood risk over time. To understand this increased risk, the State will use the best available science. The climate change task force would advise how best to account for climate change in different levels of planning versus design; this could inform the development of a technical work plans considering further climate change analyses.
- **Complete a climate change vulnerability assessment at a system scale to identify the anticipated change in physical extent of SPFC floodplains during the design life of future State cost-shared investments (S/F).** As mentioned above, the uncertainty associated with climate change has the effect of increasing flood risk over time. Further, the physical extent of SPFC floodplains may change with changing climate scenarios. To understand how the physical extent of SPFC floodplains may change, the State will undertake a climate change vulnerability assessment. This assessment could be shared with the State team responsible for preparing the Safeguarding California report.
- **Provide the climate change hydrology and sea-level rise methodology used in the CVFPP to the USACE for review (S/F).** The State will share the results from the USACE's review with researchers and others to provide for transparency of the CVFPP analyses.
- **Promote activities that manage residual risk through implementation of the CVFPP, such as public awareness campaigns and flood risk notifications (S/F/L).** The goal of public awareness campaigns is to motivate people to take individual actions to protect themselves: to develop personal evacuation plans, to prepare supplies and provisions for a flood emergency, and to insure themselves against flood damages. Public awareness campaigns, flood risk notifications, and flood emergency preparedness and response programs offer opportunities to empower communities and individuals to take steps to further reduce residual risk. Awareness campaigns can also increase overall willingness to support flood system improvements.
- **Partner with FEMA and Cal OES to seek increased investments to promote multi-hazard mitigation planning (S/F/L).** Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. It is most effective when implemented under a comprehensive, long-term mitigation plan. Mitigation plans are key to breaking the cycle of disaster damage, reconstruction, and repeated damage. The State will work with FEMA to develop FEMA-approved hazard mitigation plans, a condition for certain types of non-emergency disaster assistance.

- **Promote activities that manage residual risk through implementation of the CVFPP, such as flood emergency preparedness and response management (S/F/L).** A program to assist local agencies in preparing flood response plans, regional communication tools, and processes for emergency response operations will help address slow increases in residual risk over time. The State will continue investment in the Flood Risk Notification Program, where DWR notifies property owners within SPFC Levee Flood Protection Zones (LFPZs) and coordinates with federal, State, and local partners to provide information about flood risks. The State and local agencies should develop/improve flood emergency management plans, including evacuation plans, for populations in deep floodplains protected by the SPFC. The State may continue investment in flood emergency training and exercises with local agencies and reservoir operators at the local, State, and federal levels.
- **Consider resiliency of actions related to the SPFC in providing outcomes in future Updates to the CVFPP (S/F/L).** The State may assist local and federal planning efforts related to the SPFC by actively participating in development, assessment, and refinement of proposed actions.

Recommendations for Hydraulic and Ecosystem Baselines and Program Phasing

Issue Summary: Current regulatory practices hinder the ability to obtain credits for benefits of improvements made early in a long-term program to offset impacts that may occur later in the program, complicating phased implementation of CVFPP multi-benefit improvements.

Near-Term Milestone: Utilize the FSSR as a vehicle to document and update understanding of physical conditions related to the SPFC more broadly, updated by DWR every 5 years.[2]

Recommended Actions:

- **Convene workgroups to determine the legal and institutional mechanisms whereby the systemwide structural elements of the CVFPP can be implemented over multiple decades, accounting for local and regional benefits and impacts (S/F/L).** This could include developing the methods of analysis, thresholds of significance, the legal and institutional frameworks needed to establish hydraulic and ecosystem baselines for tracking benefits and impacts, addressing early implementation actions not yet accounted for, and accounting for, and managing, the incremental and cumulative effects of large-scale structural improvements over time. Actions may include new State and federal legislation, long-term interagency contracts, memoranda of understanding (MOU), new institutions or authorities, and long-term monitoring of system performance. For example, establishing appropriate hydraulic and ecosystem baselines is an important component of system- or watershed-scale planning, for which federal authority is being considered in proposed WRDA legislation. It is important to note that as projects move forward together, hydraulic impacts and advanced mitigation should be tracked separately, and analysis performed at a regional scale.
- **Collect information on the status of proposed and existing projects for use in updating the CVFPP and its supporting documents (S/L).** CVFPP supporting efforts such as the RFMPs were useful in identifying potential management actions for the 2017 CVFPP Update. It is recommended that the RFMPs be continued, to the extent sufficient resources allow.
- **Track and report changes in hydrologic and sea level rise conditions and subsidence over time through updates to the Flood System Status Report (S/L).** California Executive Order B-30-15 calls upon State agencies to consider life cycle analysis and climate change impacts in their investment decisions. The climate change information collected will help support future updates of the CVFPP and land use and residual risk management recommendations.

[2] Although establishing hydraulic and ecosystem baselines will be the initial focus, baselines for other benefits and impacts (such as flood damages, life loss, water supply, and others) may also be considered.

Recommendations for Operations and Maintenance of the Flood System

Issue Summary: Underfunding and complex, time-consuming permits lead to a backlog of deferred maintenance and greater risk to life and property.

Near-Term Milestones: Utilize improved O&M cost and value tracking systems to inform administrative actions by regulatory agencies that improve the overall efficiency of existing O&M activities.

Recommended Actions:

- **Work toward securing sufficient and reliable annual funding for proper long-term operations and maintenance (S/L).** The State will continue to invest in existing programs that provide funding for O&M activities, such as the Deferred Maintenance Program, Flood System Repair Project, and Delta Subventions Programs. For example, in 2016, DWR allocated $100 million for LMAs and DWR to address deferred maintenance, particularly pipe penetrations in the SPFC. Finally, the State will work to develop a sustainable program through State legislation to ensure adequate annual funding for operations, maintenance, and minor repair activities. It is important to note that routine operation and maintenance is considered a shared local responsibility of the State and LMAs. The federal government does not contribute to these activities.
- **Support a framework for regional conservation and efficient regional-scale permitting strategies for long-term O&M activities (S/F/L).** With support from federal and local partners, the State would continue to develop and implement efficient regional-scale permitting strategies to enable routine O&M activities. In addition, regional conservation planning would continue as part of the updates to the CVFPP and its supporting documents. Efforts for programmatic permitting may be advised or coordinated through the CVFPB's committees.
- **Create a tracking system of O&M investments and outcomes to demonstrate the value that LMAs attain for their investments (S/L).** DWR should create a database of information on completed activities, associated costs, and data in a Geographic Information System that can be used to track O&M activities in the SPFC. The database could also be used by the State and LMAs to document value and prioritize future O&M activities.
- **Evaluate the feasibility of initiating a regionally based multiple-objective O&M program in the SPFC to efficiently integrate flood system maintenance practices with ecological uplift (S/F/L).** A multiple-objective O&M program, leveraging work completed for the CVFPP Conservation Strategy and other CVFPP supporting documents, is a promising potential solution to the issue of conflicting regulatory requirements and continued degradation of the SPFC and riparian and aquatic ecosystems in the Central Valley. The State could evaluate how such a program could be structured and implemented at the SPFC scale, including potential legislative improvements.

- **Develop an SPFC annual subventions program for LMAs not already covered by the existing Delta Levees Maintenance Subventions Program to proactively maintain the SPFC facilities to current State and federal standards, recognizing that all SPFC levees are a part of a broader system (S/F/L).** The State should evaluate, in coordination with the USACE and LMAs, how the State could provide levee maintenance subventions to LMAs outside of the Sacramento–San Joaquin Delta using the Delta Levees Maintenance Subventions Program as a model. This effort would include the identification of potential funding sources to sustainably support an SPFC subventions program.

Recommendations for Development of Multi-benefit Projects

Issue Summary: Ineffective institutional frameworks have hindered implementation of multi-benefit actions.

Near-Term Milestone: Seek establishment of an implementable framework to facilitate design and construction of multi-benefit projects that addresses funding, interagency collaboration, regulatory mechanisms, long-term O&M, mitigation, and tools and methods for monitoring and tracking progress toward ecosystem vitality, economic stability, and other societal benefits.

Recommended Actions:

- **Seek additional funding sources to incentivize multi-benefit projects (S/F/L).** Consistent with the California Water Action Plan, the State will seek additional funding sources to incentivize the planning, design, implementation and long-term management of multi-benefit projects.
- **Explore regional-scale and long-term permitting mechanisms for implementation and maintenance of multi-benefit projects (S/F/L).** The State, in coordination with federal and local partners, will continue to explore regional-scale and long-term permitting mechanisms for projects (and their maintenance) that will allow multi-benefit projects to be more efficiently and effectively implemented and managed, including integrated permitting with overlapping habitat improvement projects or programs. Efforts for programmatic permitting may be advised or coordinated through the CVFPB's committees.
- **Collaborate with stakeholders to explore and advance implementation of Safe Harbor Agreements (S/F/L).** The State would collaborate with agricultural stakeholders and resource agencies to explore and advance the implementation of Safe Harbor (and State-listed species through Voluntary Local Program) Agreements.
- **Facilitate processes with USACE for modifying SPFC facilities to allow addition of other project purposes (S/F/L).** CVFPB and DWR would work with USACE to facilitate processes for making modifications to SPFC facilities that would allow the addition of other project purposes and/or facilitate the incorporation of multiple benefits to the flood system.
- **Continue coordination with federal and State agencies on levee and channel vegetation policy and research (S/F/L).** The CVFPB and DWR would continue coordination with federal and State agencies on levee and channel vegetation policy and research.

- **Identify policies and laws which may need updating or revisions to support adaptive management of multiple benefits (S/F/L).** In cooperation with the USACE and LMAs, the State would identify those policies and laws which may need updating or revisions to incorporate habitat and sensitive species management best management practices (BMPs), and appropriate hydraulic and ecosystem performance indicators to support adaptive management of flood management infrastructure, ecosystem processes, and habitats.
- **Make mitigation banking programs more efficient and effective (S/F/L).** DWR, in coordination with resources agencies, can utilize mitigation banking programs to procure mitigation credits for SPFC improvements. By tracking transactions with banks and the status of the mitigation banks, these programs can be more efficient and effective.
- **Monitor and track outcomes of multi-benefit projects over time (S).** By tracking and quantifying the outcomes of multi-benefit projects via future updates to the FSSR, the benefits of investments at regional and system scales can be better understood.
- **Refine the CVFPP Conservation Strategy's tools and processes to support planning, design, permitting, and implementation of multi-benefit projects (S/L).** The State should support future updates to the RFMPs to use these tools to identify ecosystem restoration opportunities.
- **Support updates to the RFMPs that incorporate other multi-benefit water management opportunities identified through other planning activities, such as water supply, water quality, groundwater management, recreation, and education (S/L).** Consistent with the California Water Action Plan, the State should work with RFMPs to leverage other programs to achieve multiple benefits and secure funding coming from diverse sources.
- **Support better integration of IWM and flood management planning to promote multi-benefit projects that may include water supply, water quality, groundwater management, recreation, and education components (S/F/L).** The State is committed to an IWM approach, which promotes system flexibility and resiliency to accommodate changing conditions. Consistent with the California Water Action Plan, the State will seek additional funding sources to incentivize the planning, design, implementation and long-term management of multi-benefit projects that may enhance water supply (surface water and groundwater), protect water quality, and provide recreational and educational opportunities.

Recommendations for Effective Governance and Institutional Support

Issue Summary: Overlapping authorities and conflicting mandates can complicate flood system improvements and maintenance, and are partially the result of existing governance structures, which are inadequate to support the broad range of actions included in the CVFPP.

Near-Term Milestone: Contingent upon resources being provided for future updates to the RFMPs, the State will facilitate a governance study to examine existing flood governance, identify overlapping authorities, and propose meaningful reconciliation between and among local, State, and federal levels of government.

Recommended Actions:

- **Provide assistance (technical or funding) to local agencies to advance regional governance within their regions (S/L).** A wide variety of governance mechanisms (such as special districts, joint powers authorities, and memoranda of understanding, etc.) are available to regions to best meet specific local and regional needs. The State will encourage local agencies to determine for themselves which regional governance structures are most appropriate to facilitate project implementation.
- **Continue a dialogue between federal, State and local agencies with responsibilities for public safety, resource management, and permitting to reconcile differing regulatory frameworks (S/F/L).** The goal of the dialogue is to identify actions for multi-benefit outcomes within the flood system that are more cost-effective, efficient, and successful, which may require legislative action to achieve.
- **Prepare a roles and responsibilities appendix to the SPFC Descriptive Document that includes authorities and institutional challenges, and makes specific recommendations to improve flood management efficiencies across all levels of government (S).** By documenting the roles and responsibilities of all institutions responsible for managing the SPFC, overlapping authorities and gaps in authorities can be identified. This would support meaningful reconciliation between and among local, State, and federal levels of government to improve and better manage the system.
- **Continue coordination with State resource agencies to effectively manage State resources (S/L).** For example, the State Department of Fish and Wildlife is to implement effective O&M for managed wetlands to increase bird populations and wetland habitat in the Pacific Flyway in accordance with the North American Wetlands Conservation Act.
- **Continue to support disadvantaged communities in participating in RFMPs and future updates of the CVFPP (S/L).** The State is committed to the continued support of disadvantaged communities consistent with the Governor's Water Action Plan through facilitating their continued participation in planning efforts at all planning scales and, to the extent feasible based on available resources, providing assistance to them for project implementation.

Recommendations for Coordination with Federal Agencies

Issue Summary: Federal agencies share responsibility for flood management, but complicated coordination, policies, funding, and approvals slow progress.

Near-Term Milestone: In coordination with local entities, the State will engage federal agencies to implement projects and address policies affecting flood management in California, including clarifying requirements for obtaining Section 408 permits, vegetation management policy strategies, and establishing a FEMA flood zone for agricultural communities.

Recommended Actions:

- **Continue to work closely with USACE (S/F/L).** Key elements of the State's strategy for coordinating with USACE include the following:
  - Coordinate and collaborate on planning, implementation, and operation of system improvements to achieve sustainable and integrated flood management.
  - Communicate and coordinate on development and implementation of federal and State policies and legislation affecting flood management in California.
  - Provide input to federal legislation, such as the biennial WRDA that provides federal authorization for potential changes to the SPFC.
  - Continue to work with USACE to clarify requirements for alterations to the SPFC through Section 408.
  - Work with USACE to reauthorize federal projects to incorporate multiple benefits, where feasible.
  - Continue to pursue compatibility between State and federal vegetation management policies, emphasizing risk prioritization and the imperative function of levee vegetation relative to the requirements of the Federal Endangered Species Act.
  - Foster interagency coordination and collaboration through leading the USACE California Silver Jackets Program.[3]
  - Work with USACE and LMAs to reevaluate project purposes for SPFC projects, considering facility removal or abandonment, modifications, and/or updates to assurance agreements, O&M manuals, and reservoir operations control manuals to provide different purposes as needed.

[3] USACE California Silver Jackets Program: Silver Jackets teams in states across the country bring together multiple state, federal, tribal, and local agencies to learn from one another and apply their knowledge to reduce the risk of flooding and other natural disasters in the United States and enhance response and recovery efforts when such events do occur. https://silverjackets.nfrmp.us/Home/About-The-Silver-Jackets-Program

- **Continue to work closely with FEMA (S/F/L).** Key elements of the State's strategy for coordinating with FEMA include the following:
  - Provide technical assistance to local communities under the NFIP.
  - Continue to engage FEMA to help provide grants to local agencies and citizens for applicable nonstructural risk mitigation actions.
  - In partnership with the Agricultural Floodplain Ordinance Task Force, identify and implement strategies to allow FEMA to establish a FEMA flood zone for agriculturally based communities, which would allow for replacement or reinvestment in infrastructure needed to sustain existing agricultural use in floodplains.
  - Continue to engage FEMA and Cal OES on emergency response and disaster assistance/recovery.
- **Continue to work closely with the Bureau of Reclamation (S/F/L).** Key elements of the State's strategy for coordinating with Reclamation include the following:
  - Continue coordination with the San Joaquin River Restoration Program (SJRRP) where there is a flood management nexus (e.g., may result in repairs or improvements to SPFC facilities).
  - Continue partnership with the Yolo Bypass Fish Passage and Improvement Project (Bi-Ops) through multi-benefit project implementation efforts in the Yolo Bypass.
  - Provide technical and funding resources for multi-purpose reservoir flood storage and operations studies (such as F-CO and F-IO) recognizing the nexus of flood management, environmental outflows, water temperature, recreation, hydropower, water quality, and water supply benefits.
  - Initiate conversations with Reclamation and its cost-share partners about greater coordination between the flood management community and Reclamation planning studies for their relevance to future updates to the CVFPP.
- **Continue to closely coordinate with federal resource agencies (S/F/L).** Key elements of the State's strategy for coordinating with federal resources agencies include the following:
  - Increase the operational and regulatory efficiency of the Central Valley flood management system. To achieve this, the State will coordinate with resource agencies seeking to develop and implement regional-scale permitting strategies, and will seek legislative improvements to existing regulatory processes at the State and federal levels to facilitate regulatory compliance for O&M activities and make more efficient use of limited local, State, and federal funding resources.
  - Coordinate preparation and review of updates to the FSSR with federal and State resource agencies.

Recommendations for Funding

Issue Summary: Insufficient and unstable flood management funding has led to delayed investment and greater risk to life and property.

Near-Term Milestone: Seek increased General Fund dollars and reutilize the function of the Sacramento and San Joaquin Drainage District to conduct assessments to increase the State's ability to more reliably fund ongoing activities. Demonstrate the need and appropriateness for a new flood-focused GO bond to fund capital improvements that reduce flood risk across the Central Valley. A new flood-focused GO bond should only be pursued after existing flood-focused GO bonds are committed.

Recommended Actions:

- Continue to closely coordinate with State agencies and other partners, to generate State funding and support for CVFPP's flood investments.
  - **Seek increased appropriation from the State general fund and pursue general obligation bonds (S/L).** It is recommended that appropriations from the State general fund for Central Valley flood management increase from the $40M currently expected to $190M annually by the end of the 30-year period. General obligation bonds could be used to fund some of the more critical flood risk reduction projects, including the completion of the Yolo Bypass expansion. The CVFPP funding plan recommends pursuing flood management funding in three bond issues. The first issue of $2.5 billion would be targeted for the 2020 election, the second issue of $2.5 billion approximately a decade later, and the third issue of $2.5 billion a decade after that.
  - **Evaluate the viability and effectiveness of reutilizing the Sacramento and San Joaquin Drainage District (S/L).** The Sacramento and San Joaquin Drainage District is currently in the California Water Code to fund capital projects. It has been nearly 80 years since this district generated revenue. Within the next few years, the CVFPB and DWR could evaluate the viability of the district to conduct assessments. The evaluation should involve local stakeholder input and cover topics such as benefits, funding, capacity, and legal constraints. This analysis should conclude what level of assessment is viable and what legislative changes would be necessary to allow generated revenue to be used for capital and ongoing investments. The CVFPP funding plan assumes this mechanism would begin in approximately 2020 and could potentially generate $25M/year by the end of the 30-year period.
  - **Evaluate the viability and effectiveness of establishing a State river basin assessment (S).** IWM is the focus of this type of assessment, and the State should develop a watershed approach to managing and funding projects. For example, a river basin assessment would return money to the watershed, to be shared across the IWM activities. DWR should develop criteria, in coordination with local stakeholders, for the evaluation of the viability and effectiveness of this potential funding mechanism for implementation of the CVFPP. The CVFPP funding plan assumes that this mechanism could begin in Phase 2 and potentially generate $25M/year by the end of the 30-year period.

- **Evaluate the viability and effectiveness of establishing a State flood insurance program (S).** Following the evaluation of the statewide flood insurance as described in the floodplain and land use management recommendations, a new approach to insurance could potentially generate funds to reduce flood risk while providing the same level of financial protection as offered by the NFIP. The CVFPP funding plan assumes that $12M/year of potential revenue from this mechanism could begin in Phase 2. A State flood insurance program could use a portion of the premiums to reduce flood risk by contributing funds for flood management system repairs, improvements, and flood risk mapping and notification. Another version of this could be a local basin-wide insurance program. This could potentially be a companion program with a Statewide Flood Insurance Program. Any new program should also consider insurance for agricultural properties. All of these potential uses of funds from a State flood insurance program would need to be further evaluated. Criteria for the evaluation should be developed in close collaboration with affected stakeholders.
- **Track outcomes from flood investments to demonstrate value (S).** Outcomes from local, State, and federal investments should be tracked to demonstrate the value of their actions through annual progress reports. These reports can help inform updates to the California Water Plan and California's Five-year Infrastructure Plan.
- **Commit to annually updating California's Five-year Infrastructure Plan (S).** DWR will provide the necessary annual budget information regarding flood system ongoing and capital investments to the California Department of Finance for incorporation into the California's Five-year Infrastructure Plan, which compiles all infrastructure needs, including water, flood, transportation, and others, across the State. Incorporate infrastructure life-cycle analysis per California Executive Order B-30-15.

- Continue to closely coordinate with federal agencies and other partners, to generate federal funding and support for CVFPP's flood investments.
  - **Establish a strategic, integrated flood management approach for California's Central Valley (S/F/L).** A strategic, integrated approach that emphasizes cooperation across all levels of government is required. This would require USACE programmatic authorities to conduct project budgeting and planning on a systemwide/watershed basis to streamline the time and reduce the costs incurred by all levels of government in managing California's flood risks. This should reduce transactional costs and avoid redundancy in programs. This recommendation would stretch the spending for State operations, planning, and performance tracking. This should also include federal funding for IWM science and services. DWR should continue to support language in upcoming federal water infrastructure legislation that would authorize the USACE, in coordination with other federal, State, and local agencies, and NGOs, to develop watershed-based flood-risk planning and budgeting for projects across multiple communities and regions. Similar programs include the Greater Mississippi River Basin, the Comprehensive Everglades Restoration Program, and the Chesapeake Bay Program.

- **Seek Congressional Support of State-sponsored projects in federal water infrastructure legislation (S/F/L).** The State should seek Congressional support for State-sponsored flood risk reduction and ecosystem restoration projects in federal water infrastructure legislation. Several State-sponsored flood risk and ecosystem restoration projects would benefit from continued Congressional support.
- **Seek guidance clarification for USACE project credit usage (F).** The State will seek guidance clarification from USACE for implementing Section 1020 of the WRDA 2014 (Water Resources Reform and Development Act of 2014), as modified by WRDA 2016 (Water Infrastructure Improvement for the Nation Act of 2016) Section 1166. The guidance clarification could help the State submit a comprehensive plan requesting transfer of excess credit prior to completion of specific studies and projects consistent with the CVFPP. This would help maximize the leveraging of local dollars.
- **Support integration of federal and State floodplain management policies (S/F).** To prevent continued risk intensification in deep floodplains, the State supports integration of federal and State floodplain management policies to facilitate consistency. Ongoing trends for urbanization behind levees originally intended only for rural flood protection have brought the issue of risk intensification in deep floodplains in California to the forefront. As part of this, the State should seek Congressional support for USACE and FEMA to develop plans and encourage additional investments in rural flood risk management. This should include risk awareness, easements, ecosystem restoration, as well as sustaining agriculture in the floodplain.
- **Seek Federal support for flood risk reduction and for ecosystem improvements in rural areas (S/F/L).** Bringing more federal dollars to the Central Valley for flood risk reduction and ecosystem improvements in rural areas will likely have to take a different approach in how projects are approved or selected. It is typically very difficult to meet the benefit-cost ratio requirements for these types of projects using current guidelines. Current guidelines tend to favor projects in an urban area. The State supports USACE developing a project funding approach that takes into account more of the qualitative and other non-monetary benefits to support land productivity for agricultural and ecosystem purposes. The approach could also recognize that support of agriculture helps prevent risk intensification in rural areas.
- **Support annual contribution to the 2017 refined SSIA portfolio (S/F/L).** To implement the 2017 refined SSIA portfolio within 30 years would require a federal contribution of 36% (mostly through USACE), ramping up to $260 million per year. This would require the State to effectively lobby the federal government for inclusion into federal water infrastructure legislation on an ongoing basis and secure annual appropriations from USACE. The State would also seek funding available from United States Department of Agriculture (USDA) at current levels through NRCS.

- Continue to closely coordinate with local agencies and other partners, to generate local funding for CVFPP investments. If more revenue is requested from the federal and state governments, local governments would also need to raise additional revenue to meet increased O&M and their cost-share requirements.
  - **Pursue a coordinated effort to amend Proposition 218 (S/L).** There have been many attempts to amend Proposition 218 requirements so that flood control can be treated similar to water, sewer, and sanitation utilities. A coordinated effort could make the process of raising assessments for flood control agencies similar to other utilities. Additionally, local flood risk awareness campaigns and accomplishments reporting have been effective in increasing local support for funding flood management system improvements.
  - **Increase assessments to meet cost-share requirements (L).** Local agencies may increase their assessments to meet cost-share requirements for the proposed projects and their share of O&M.

4.5.2 Outlining Work Plans to Address Flood Management-Related Policy Issues

To address the flood management policy issues described in this CVFPP Update, a reasonable number of issues and a consistent structure were needed to enable development of work plans to drive CVFPP implementation progress. These work plans should outline the implementation framework for each issue recommendation presented in Section 4.5.1. The work plans should include a description of what actions would be taken, who would lead or participate in the action (State, federal, and local partners), and when the action would be initiated and completed. Work plans would define a path for activities for State, federal, and local partners to lead to the next CVFPP Update. A conceptual work plan template is shown in Figure 4-13, depicting coordinated activities, timing, milestones, and responsible agencies to address the policy issue.

Based on the lessons learned during RFMP scoping, these policy work plans will need to be flexible to accommodate developments that have not been anticipated in this CVFPP Update. Staff and funding resources will be needed to effectively advance these efforts. By providing appropriate resources delays can be minimized or avoided in achieving the milestones and recommendations described above (see Section 4.5.1).

Figure 4-13. Conceptual Flood Management-Related Policy Issues Work Plan Template

4.5.3 Focusing on Investment and Cooperation into the Future

The CVFPP planning process has brought together many stakeholders and flood management-related efforts in the Central Valley. Many of the planning efforts that informed this 2017 CVFPP Update were prepared in close coordination with State, federal, and regional partners and guided by a robust, multi-year stakeholder engagement process that began in 2012. As part of this process, the 2012 SSIA has been refined to develop the 2017 refined SSIA portfolio, which refines the set of actions associated with each physical and operational element in the 2012 SSIA. These additional actions were identified as part of the many technical studies that have contributed to a greater understanding of the system and its opportunities.

With the large investment recommended for implementation of the CVFPP, updating funding mechanisms is the single most important aspect to raising the funding required to improve the SPFC over the next 30 years. To be as efficient as possible with limited funding, a strategic, integrated approach that emphasizes cooperation across all levels of government is required. All cost-sharing partners will be asked to contribute significantly more than they have in the past, as historical revenue sources would only be able fund approximately 20% of needed flood system investment. Consideration should be given to ways to increase landowner participation in expanded ecosystem service markets. For more information, see Section 3.2.5. It is the intent of the CVFPP to promote multi-benefit projects within the flood system. Ongoing project examples include the Bear River setback levee and the Three Amigos habitat area. Examples being planned in cooperation with landowners are the Paradise Cut and Yolo Bypass expansions. Yolo Bypass multi-benefit improvements are planned to include widening the Fremont and Sacramento weirs, fish passage over Fremont Weir, and flood-season rearing of juvenile salmon.

Updating funding mechanisms is the single most important aspect to raising the funding required to improve the SPFC over the next 30 years.

The State would like Congress to support State-sponsored flood risk reduction and ecosystem restoration projects in the WRDA and to enable USACE and FEMA to focus on more proactive participation in State and local efforts. In addition, annual appropriations from the State general fund should be increased in the near term, and new funding mechanisms and three precedent-setting general obligation flood bonds must be secured in the longer term, to fund, in part, the contributions by multiple State agencies to flood management projects. The CVFPB may consider making a recommendation to the Legislature to provide sources of funding for the array of multi-benefit elements of the CVFPP. While more revenue is required from federal and state governments, local governments will also need to raise additional revenue through mechanisms such as Proposition 218 and any future amendments to that proposition, to increase investments in O&M and provide local cost-shares.

Moving towards the next CVFPP Update, the CVFPB and DWR will continue to build upon the improved collaboration and public outreach that has occurred to date for the 2017 CVFPP Update, including the RFMPs, work groups, and advisory committees, and other communications and engagement that was completed as described in Section 2.3. Subsequent collaborative efforts led by the CVFPB and DWR to support the next CVFPP update may consider (1) channel maintenance requirements and design profiles (e.g., 1955/57 profiles), (2) environmental and hydraulic baselines, and (3) development and implementation of a transparent process, independent from environmental permitting, that applies the CVFPP Conservation Strategy and measurable objectives for both ecosystem uplift and improved flood management to assess and track the contribution of future projects to a functional flood system.

The CVFPB may consider establishing a committee similar to the CVFPP Conservation Strategy Advisory Committee to evaluate how to improve permitting, reduce the cost of and time required to obtain permits, and improve ecosystem functions and habitats. This committee could address the following:

1. Integration of the CVFPP Conservation Strategy's measurable objectives
2. Leveraging projects within and across regions to collectively achieve multiple benefits
3. Leveraging of new legislation such as AB 2087 (Regional Conservation Investment Strategies)
4. Applying new tools for quantifying and crediting project benefits
5. Identifying additional needs for permitting improvements and the pathways to implement them
6. Permitting of pilot projects, applying innovative approaches and refining them, including:
    a. evaluation of the potential to establish regional plans as Regional Conservation Investment Strategies (RCISs) under AB 2087,
    b. quantification of estimation of regional plan contributions to CVFPP Conservation Strategy measurable objectives ecosystem vitality outcomes along with other multi-benefit outcomes, and
    c. identification of specific regional plan proposed regional projects as potential case studies for innovative permitting.

Consideration should also be given to the lessons learned from regional advanced mitigation projects and the Central Valley Habitat Exchange, as it continues to develop. Successfully realizing an improved system for permitting projects will require a collaborative effort to successfully permit a suite of pilot projects that can help establish new permitting pathways and procedures, uncover and resolve issues and obstacles, and demonstrate success and the benefits associated with a new approach.

To the extent funds are available, it is recommended that the State continue to fund the RFMPs to assist in formulation of potential flood projects, including multi-benefit elements and support for measurable objectives. Additional effort is needed for regional collaboration in order to further develop and refine estimated contributions to ecosystem objectives from regional-scale actions and progress toward measurable objectives, in coordination with the State (see Section 3.1.6). The RFMPs have proven extremely valuable in the development of the 2017 CVFPP Update. In order to assist in future updates, it would be very beneficial for the State to continue to provide funding to the extent available to the RFMPs or LMAs, especially for those that engage in corridor management plans and project development. An additional State cost-share may be appropriate for disadvantaged communities.

Demonstrating an appropriate return on investment to broader public interests is key to raising and sustaining needed State and Federal funds for implementation of the 2017 refined SSIA portfolio. To accomplish this, the State is committed to improving its ability to assess progress and track investments in future CVFPP updates. Characterizing a management action's ability to contribute to the CVFPP goals and provide societal value is an essential first step toward this commitment. Furthermore, tracking the effectiveness of past actions to achieve intended outcomes is critical to prioritizing funding and implementation activities. The success of our collective actions since 2007 has reduced the potential for significant life loss in California's deep floodplains. The CVFPP updates represent a proactive approach to mitigating consequences of major flood events of a scale like Hurricane Katrina in 2005. This update has refined the path that was set by the 2012 CVFPP for the necessary call to action; however, there is still tremendous shared responsibility and effort across all levels of government that must occur within the Central Valley to implement the CVFPP. The 2022 CVFPP Update will continue the progression toward an effective, resilient, and sustainable flood management system.

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Appendix A
Central Valley Flood Protection Board Adoption Resolution 2017-10, Amending and Adopting the 2017 Central Valley Flood Protection Plan Update

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Appendix A: Central Valley Flood Protection Board Adoption Resolution 2017-10, Amending and Adopting the 2017 Central Valley Flood Protection Plan Update

August 2017

STATE OF CALIFORNIA
THE NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

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Appendix B
Legislative Reference and Reader's Guide to the 2017 Central Valley Flood Protection Plan Update

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Appendix B: Legislative Reference and Reader's Guide to the 2017 Central Valley Flood Protection Plan Update

August 2017

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This Document Prepared by:

Management Review	Preparation Team	Technical Support
Michael Mierzwa *DWR*	Christopher Williams *DWR*	Naser Bateni *GEI Consultants, Inc.*
Mary Jimenez *DWR*		Kristin Reardon *CH2M*
Laura Hollender *DWR*		Laura Byrd *CH2M*
Edward Winkler *CH2M*		

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1.0 Introduction and Background

This Legislative Reference and Reader's Guide to the 2017 Central Valley Flood Protection Plan Update (Guide) has been prepared in support of the 2017 Central Valley Flood Protection Plan Update (2017 CVFPP Update). The purpose of this Guide is to demonstrate how the 2017 CVFPP Update meets the requirements of the Central Valley Flood Protection Act of 2008 and to orient readers with the attachments to the 2017 CVFPP Update and the supporting documents that assisted with guiding and informing the 2017 CVFPP Update.

This Guide provides a legislative reference table and summaries of the documents adopted by the CVFPB in addition to the 2017 CVFPP Update. Additionally, this Guide provides summaries of the Supplemental Program Environmental Impact Report (Supplemental PEIR) created for the 2017 CVFPP Update pursuant to the California Environmental Quality Act (CEQA) and the 13 supporting documents to the 2017 CVFPP Update.

The supporting documents generally present detailed results of various planning, engineering, environmental, and financial studies that have been conducted to assist with the development of the 2017 CVFPP Update. The CVFPP planning process has brought together many stakeholders and flood management-related efforts in preparation of these documents and the 2017 CVFPP Update. Some efforts focused on rigorous technical analysis, while others addressed the need for more effective implementation, such as developing a CVFPP Investment Strategy. In the past 5 years, the planning process has been carried out in the following way:

- **Evaluation of Flood Management Needs and Opportunities:** Extensive planning, engineering, environmental, and financial analyses of the flood management system have been carried out in support of the 2017 CVFPP Update. These evaluations identified flood management needs and opportunities and contributed to the formulation of necessary management actions resulting in the 2017 refined State Systemwide Investment Approach (SSIA) portfolio. In addition, these evaluations quantified how effectively these management actions could potentially improve flood management within the Central Valley.

- **Development of a CVFPP Investment Strategy:** Several of the evaluations of the flood management system also provided cost estimates along with the identification of 2017 refined SSIA portfolio for various flood management improvements, both capital and ongoing. These cost estimates provided the foundation for preparing an informed CVFPP Investment Strategy to accompany the 2017 CVFPP Update. The CVFPP Investment Strategy includes a detailed analysis of existing and potential new funding mechanisms, influential factors, and priorities needed for a flexible approach to support implementation of the CVFPP over a 30-year planning horizon.

- **Development of Implementation Phasing and Delivery:** The evaluation of flood management needs and opportunities, and development of the CVFPP Investment Strategy informed the development phasing of capital and ongoing investments. Implementation of the CVFPP will occur programmatically through DWR's five implementation programs:

Flood Management Planning, Floodplain Risk Management, Flood Risk Reduction Projects, Flood System Operations and Maintenance, and Flood Emergency Response. Implementation phasing and delivery is described in Chapter 4 of the 2017 CVFPP Update.

1.1 List of 2017 CVFPP Update Documents Adopted by the CVFPB

In addition to the 2017 CVFPP Update, the following documents have been adopted by the CVFPB to meet the requirements of the Central Valley Flood Protection Act of 2008:

- 2017 State Plan of Flood Control Descriptive Document Update
- 2017 Flood System Status Report

In addition, the CVFPB has adopted the following:

- 2016 CVFPP Conservation Strategy

More information relating to the adoption of these documents can be found in CVFPB Resolution No. 2017-10.

1.2 California Environmental Quality Act Documentation

The 2017 CVFPP Update is accompanied by a Supplemental PEIR pursuant to the requirements of CEQA. The Supplemental PEIR updates the Program EIR adopted by the CVFPB for the 2012 CVFPP.

1.3 List of 2017 CVFPP Supporting Documents

The following are documents that informed and guided development of the 2017 CVFPP Update; they also provide additional background and information relevant to topics discussed in the plan:

1. 2016 CVFPP Conservation Strategy
2. Draft Sacramento River Basin-Wide Feasibility Study
3. Draft San Joaquin River Basin-Wide Feasibility Study
4. Regional Flood Management Plans
    a. Feather River Region
    b. Lower Sacramento River/Delta North Region
    c. Mid & Upper Sacramento River Region
    d. Lower San Joaquin River and Delta South Region

   e. Mid San Joaquin River Region
   f. Upper San Joaquin River Region

5. Draft CVFPP Investment Strategy Technical Memorandum
6. Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum
7. Draft CVFPP Scenario Technical Analyses Summary Report
8. Draft CVFPP Climate Change Analysis Technical Memorandum
9. Urban Levee Design Criteria
10. Urban Level of Protection Criteria
11. CVFPP Accomplishments Record
12. CVFPP Engagement Record
13. Contributing Authors and Workgroup Members List

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2.0 Legislative Reference

Table 2-1 illustrates which document—the 2017 CVFPP Update and the associated documents adopted by the CVFPB—satisfy the requirements of the Central Valley Flood Protection Act of 2008, and details which supporting documents contain additional information used to guide and inform the 2017 CVFPP Update.

Table 2-1. Central Valley Flood Protection Act of 2008 Central Valley Flood Protection Plan Requirements

California Water Code Section	2017 CVFPP Update and Documents Fulfilling Water Code Section Requirements	Supporting Documents Relevant to Water Code Section
9603. Requires the Central Valley Flood Protection Plan (Plan) to be a descriptive document reflecting a systemwide approach to protecting the lands covered by the facilities of the State Plan of Flood Control (SPFC).	• 2017 CVFPP Update	• Draft Sacramento River Basin-Wide Feasibility Study • Draft San Joaquin River Basin-Wide Feasibility Study • All six RFMPs[1]
9614. Provides that Plan shall include the following: • A description of Sacramento-San Joaquin River Flood Management System and the cities and counties included in the system. • A description of the performance of the system and the challenges to modifying the system to provide appropriate levels of flood protection. • A description of the facilities included in the SPFC and uncertainties regarding performance capability. • A description of each existing dam that is not part of the SPFC that provides either significant systemwide benefits for managing flood risks within the Sacramento-San Joaquin Valley or protects urban areas within the same area. • A description of each existing levee and other flood management facility not described in subdivision that is not part of the SPFC and that provides either significant systemwide benefits for managing flood risks within the Sacramento-San Joaquin Valley or protects an urban area. • A description of the probable impacts of projected climate change, projected land use patterns, and other challenges. • An evaluation of the structural improvements and repairs necessary to bring the facilities of the SPFC described within its design standard. • A list of facilities recommended to be removed from the SPFC. • A description of both structural and nonstructural methods for providing an urban level of flood protection to current urban areas. • A description of structural and nonstructural means for enabling or improving systemwide riverine ecosystem function, including establishment of riparian habitat and seasonal inundation of available flood plains where feasible.	• 2017 State Plan of Flood Control Descriptive Document Update • 2017 Flood System Status Report • 2017 CVFPP Update	• 2016 CVFPP Conservation Strategy • Draft CVFPP Climate Change Analysis TM • All six RFMPs • Draft Sacramento River Basin-Wide Feasibility Study • Draft San Joaquin River Basin-Wide Feasibility Study • Draft Flood System Long-Term OMRR&R Cost Evaluation TM

Table 2-1. Central Valley Flood Protection Act of 2008 Central Valley Flood Protection Plan Requirements

California Water Code Section	2017 CVFPP Update and Documents Fulfilling Water Code Section Requirements	Supporting Documents Relevant to Water Code Section
9616. Provides that the Plan shall include a description of both structural and nonstructural means for improving the performance and elimination of deficiencies of levees, weirs, bypasses, and facilities, including facilities of the SPFC, and, wherever feasible, meet multiple objectives, including each of the following: • Reduce the risk to human life, health, and safety from flooding, including protection of public safety infrastructure. • Expand the capacity of the flood protection system in the Sacramento-San Joaquin Valley to either reduce floodflows or convey floodwaters away from urban areas. • Link the flood protection system with the water supply system. • Reduce flood risks in currently non-urbanized areas. • Increase the engagement of local agencies willing to participate in improving flood protection. • Improve flood protection for urban areas to the urban level of flood protection. • Promote natural dynamic hydrologic and geomorphic processes. • Reduce damage from flooding. • Increase and improve the quantity, diversity, and connectivity of riparian, wetland, flood plain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands. • Minimize the flood management system operation and maintenance requirements. • Promote the recovery and stability of native species populations and overall biotic community diversity. • Identify opportunities and incentives for expanding or increasing use of floodway corridors. • Provide a feasible, comprehensive, and long-term financing plan for implementing the plan. • Identify opportunities for reservoir reoperation in conjunction with groundwater flood storage. The Plan shall include a prioritized list of recommended actions to reduce flood risks and meet the objectives described above.	• 2017 CVFPP Update	• Draft Sacramento River BWFS • Draft San Joaquin River BWFS • All six RFMPs • 2016 CVFPP Conservation Strategy • Supplemental PEIR • Draft Flood System Long-Term OMRR&R Cost Evaluation TM • Draft CVFPP Investment Strategy TM

Note:
1. "All six RFMPs" includes Regional Flood Management Plans for these regions: Feather River, Mid Upper Sacramento River, Lower Sacramento Delta North, Lower San Joaquin Delta South, Mid San Joaquin River, Upper San Joaquin River.

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3.0 Reader's Guide to the 2017 Central Valley Flood Protection Plan Update

This Guide summarizes the two appendixes and three documents that were adopted by the CVFPB in additional to the 2017 CVFPP Update, 13 supporting documents to the 2017 CVFPP Update, and the Supplemental PEIR. The supporting documents generally present detailed results of various planning, engineering, environmental, and financial studies that have been conducted in support of the 2017 CVFPP Update.

3.1 2017 CVFPP Update and Adopted Documents

Appendix A: Central Valley Flood Protection Board Adoption Resolution 2017-10 Amending and Adopting the 2017 Central Valley Flood Protection Plan Update, August 2017

The purpose of the Central Valley Flood Protection Board Adoption Resolution 2017-10 is to amend and adopt the 2017 CVFPP Update along with its appendixes and the following three documents: the 2017 State Plan of Flood Control Descriptive Document Update, 2017 Flood System Status Report, and the 2016 CVFPP Conservation Strategy.

Appendix B: Legislative Reference and Reader's Guide to the 2017 Central Valley Flood Protection Update

The purpose of the Legislative Reference portion of this document is to demonstrate how the 2017 CVFPP Update meets the State of California legislative requirements. The purpose of the Reader's Guide portion of this document is to summarize two attachments, documentation required by CEQA and 13 supporting documents and describe how these documents have been used to inform and guide the 2017 CVFPP Update.

2017 State Plan of Flood Control Descriptive Document Update

The 2010 State Plan of Flood Control (SPFC) Descriptive Document was the first inventory of the SPFC facilities compiled in a single report. The 2017 SPFC Descriptive Document Update includes revisions to the 2010 inventory to reflect current documentation. The SPFC is only a portion of the complex flood protection system in the Central Valley and includes State and federally authorized projects for which the CVFPB or DWR has provided assurances of cooperation to the federal government. The purpose of SPFC Descriptive Document is as a reference describing the SPFC. It identifies and describes SPFC components (facilities, lands, programs, plans, conditions, modes of operation and maintenance); it describes *what* the SPFC is. The CVFPP covers the entire flood system, including the SPFC, and relies on information from this report.

Release Summary

- Available December 2016
- Some web addresses, links, and text have been updated. These changes do not affect findings
- Publication title and date adjusted to August 2017 as adopted by CVFPB

2017 Flood System Status Report

The 2011 Flood Control System Status Report (FCSSR) provided an inventory of the status or physical condition of SPFC facilities systemwide. The 2017 Flood System Status Report (FSSR) includes revisions to the 2011 report to reflect current conditions. The 2017 FSSR consolidates all available systemwide information from multiple DWR programs regarding SPFC physical conditions, including the current conditions of levees and channels within the SPFC and finalized project information from DWR's Levee Evaluations Program. It also includes information about inspecting and evaluating SPFC facilities. In short, the 2017 FSSR describes *how well* the SPFC is performing. The purpose of the 2017 FSSR is to inform flood management system challenges and needs, alternative solutions, and future projects to address identified problems and improve the current condition of the flood management system.

In addition, information in the 2017 FSSR may be used to support the core functions and long-term activities of DWR's Division of Flood Management, including emergency response, facility maintenance, and inspections. Periodic updates to the FSSR will help DWR track progress as ongoing inspections and evaluations are completed and more SPFC facilities are reconstructed or improved to meet current design criteria. Future updates have potential to support monitoring and tracking of additional metrics as they are developed over time. The 2017 FSSR fulfills requirements of California Water Code Section 9120.

Release Summary

- Available December 2016
- All figures have been updated since December 2016. These changes do not affect findings
- Publication title and date adjusted to August 2017 as adopted by CVFPB

2016 CVFPP Conservation Strategy

The 2016 CVFPP Conservation Strategy (Conservation Strategy) is a non-regulatory document that provides measurable ecological objectives and long-term approaches for improving riverine and floodplain ecosystems through multi-benefit projects that include ecosystem restoration and improvements, and operation, maintenance, repair, rehabilitation, and replacement (OMRR&R). The Conservation Strategy provides a wealth of data and information to support 2017 CVFPP Update development by guiding the integration and improvement of ecosystem functions associated with flood-risk-reduction actions, and providing the basis for recommending conservation actions for the SPFC. The Conservation Strategy's measurable ecological objectives guide and support monitoring and tracking of contributions to the CVFPP's supporting goal of promoting ecosystem functions over time.

Release Summary

- Available November 2016
- No updates have been made to adopted content since November 2016. However, updates were made to Appendix D and publication title and date adjusted to August 2017.
- Draft removed from the title, as adopted by CVFPB

3.2 California Environmental Quality Act Documentation

CVFPP Supplemental Program Environmental Impact Report

Adoption of the 2017 CVFPP Update is a discretionary action subject to CEQA. A Program Environmental Impact Report (PEIR) is currently the adopted CVFPP CEQA document, but program refinements and other new information require additional analysis in a *Supplemental* PEIR. For CEQA purposes, the Supplemental PEIR has been circulated for public review together with the 2017 CVFPP Update. Detailed environmental analysis at a *project* level will occur when individual management actions are implemented.

Release Summary

- Public draft available for review December 2016
- The Supplemental PEIR responds to public comments; changes are indicated in the Final Supplemental PEIR
- Publication title and date adjusted to August 2017 as adopted by CVFPB

3.3 2017 CVFPP Supporting Documents

2016 CVFPP Conservation Strategy

The 2016 CVFPP Conservation Strategy is a non-regulatory document that provides measurable ecological objectives and long-term approaches for improving riverine and floodplain ecosystems through multi-benefit projects that include ecosystem restoration and improvements, and OMRR&R. The Conservation Strategy provides a wealth of data and information to support 2017 CVFPP Update development by guiding the integration and improvement of ecosystem functions associated with flood-risk-reduction actions, and providing the basis for recommending conservation actions for the SPFC. The Conservation Strategy's measurable ecological objectives guide and support monitoring and tracking of contributions to the CVFPP's supporting goal of promoting ecosystem functions over time.

Release Summary

- Available November 2016
- No updates have been made to adopted content since November 2016. However, updates were made to Appendix D and publication title and date adjusted to August 2017.

- Draft removed from the title, as adopted by CVFPB

Draft Basin-Wide Feasibility Studies

Basin-Wide Feasibility Studies (BWFSs) were completed in the Sacramento River and San Joaquin River Basins to refine the scale and location of system improvements identified in the 2012 CVFPP SSIA. These studies identified system improvements that can be further developed in ongoing or new federal cost-share feasibility studies; the studies also inform the 2017 CVFPP Update and its Investment Strategy.

Due to their broad program-level scope, the BWFSs do not serve as decision documents for implementation of a specific project, but they do advance the CVFPP planning and implementation process by updating and refining the options for improving the flood management system. Focused, site-specific feasibility studies and environmental documentation, design-level studies, and preparation of plans and specifications will be needed for implementation.

Draft Sacramento River Basin-Wide Feasibility Study

The Draft Sacramento River BWFS primarily evaluates multi-benefit options for improving the Sacramento River bypass system, including potential expansion of the Yolo Bypass, Sacramento Bypass, and Sutter Bypass, as well as the potential for creating a new Feather River bypass. It includes detailed evaluations of various combinations of levee setbacks, weir expansions, new bypass channels, and flood storage opportunities, with integrated ecosystem restoration or enhancement actions to refine the scale and locations of systemwide improvements identified in the 2012 CVFPP.

Release Summary

- Available November 2016
- Some figures have been updated since November 2016. These changes do not affect findings and recommendations
- Publication title and date adjusted to July 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Draft San Joaquin River Basin-Wide Feasibility Study

The Draft San Joaquin River BWFS evaluates potential systemwide multi-benefit improvements, including expansion of Paradise Cut; reservoir management strategies, including conjunctive use, increasing objective release, and operational changes (FI-O, and FC-O); and large-scale conveyance (Cross Valley Canal, conveyance to O'Neil Forebay). Because of the unique characteristics of the San Joaquin River Basin with lower peak flood flows than the Sacramento River Basin, the San Joaquin River BWFS also evaluated large-scale regional management actions such as levee improvements in Stockton, levee and hydraulic structure improvements around Firebaugh, and transitory storage at the Three Amigos and Dos Rios/Hidden Valley Ranch sites.

Release Summary

- Available March 2017
- No updates have been made since March 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Regional Flood Management Plans

DWR launched and funded the Regional Flood Management Planning Program Phase 1 to assist local agencies in developing long-term Regional Flood Management Plans (RFMPs) that address local needs, articulate local and regional flood management priorities, and establish the common vision of regional partners. DWR provided funding and resource support to help develop regional plans consistent with the 2012 CVFPP.

Six RFMPs were completed by 2015 and subsequently reviewed by DWR for development of the 2017 CVFPP Update. The six RFMPs include:

- Draft Final July 2014 – Feather River Region Regional Flood Management Plan
- July 2014 – Lower Sacramento River/Delta North Regional Flood Management Plan
- November 2014 – Mid & Upper Sacramento River Regional Flood Management Plan
- November 2014 – Lower San Joaquin River and Delta South Regional Flood Management Plan
- Draft Final October 2014 – Regional Flood Management Plan for the Mid San Joaquin River Region
- Final February 2015 – Upper San Joaquin River Regional Flood Management Plan

These six plans presented local agencies' perspectives on flood management, priorities, challenges, potential funding mechanisms as well as site-specific improvement needs. These plans provide valuable perspectives from regional and local flood managers that help inform the 2017 CVFPP Update and align CVFPP investment strategies and implementation.

Throughout the 2017 CVFPP Update planning process, DWR met regularly with RFMP representatives to discuss and refine local flood management actions and share technical information and updates about DWR-led CVFPP supporting efforts. These discussions formed the backbone of a Central Valley–wide discussion regarding how both State- and locally-led efforts will contribute to the improvement and long-term success of CVFPP implementation.

Release Summary

- Plans available from 2014 to 2015
- No updates have been made since 2014 to 2015
- These plans are 2017 CVFPP Update supporting documents; they do not require CVFPB adoption

Draft CVFPP Investment Strategy Technical Memorandum

The Draft CVFPP Investment Strategy TM was developed to document existing and potential new funding mechanisms, multiple financing scenarios, and a recommended funding plan for implementation of the CVFPP. It provides justification of the compiled cost estimates, prioritization of investments, and delivery through DWR's implementation programs.

The CVFPP Investment Strategy considers the complete 2017 refined SSIA portfolio for flood management capital and ongoing improvements in the 2017 CVFPP Update. Cost estimates provided by several evaluations of the flood management system served as the foundation for preparing an informed CVFPP Investment Strategy to accompany the 2017 CVFPP Update. The CVFPP Investment Strategy details the existing and potential new State, federal and local funding mechanisms, influential factors, and priorities that vary the timing and level of funding anticipated through multiple scenarios. These scenarios include a range of revenue projections, from existing levels to a level required for full implementation.

In the near term, the CVFPP Investment Strategy will aid financing and funding conversations within the flood management community and the California Legislature. The CVFPP Investment Strategy includes recommendations to the State, Federal, and local participants to support successful implementation of the CVFPP. Key content, including the recommended funding plan, from the Draft CVFPP Investment Strategy TM resides in Chapter 4 of the 2017 CVFPP Update.

Release Summary

- Available March 2017
- This document updated in response to comments since March 2017. These changes do not affect findings and recommendations
- Publication title and date adjusted to August 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum

The Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) Cost Evaluation TM presents the findings of a diverse interagency workgroup which was assembled to estimate the true cost of long-term OMRR&R activities within the SPFC, considering current and proposed urban and non-urban facilities. A fully-funded OMRR&R program is fundamental to sustainable flood management in the Central Valley and the proper function of the SPFC. The workgroup estimated OMRR&R costs for levees, channels, and structures in the Sacramento and San Joaquin basins. A robust outreach effort was undertaken with the six RFMP regions and cost estimates were discussed, documented, modified, and vetted in consultation with experts at the regional level. Recommendations for future action involving State and regional partners are supported by the OMRR&R TM. In addition, the OMRR&R TM informs the ongoing costs described in the CVFPP Investment Strategy.

Release Summary

- Available January 2017
- No updates have been made since January 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Draft CVFPP Scenario Technical Analyses Summary Report

The Draft CVFPP Scenario Technical Analyses Summary Report (Summary Report) provides an overview of the technical analysis approach, tools, and data supporting development of the 2017 CVFPP Update. The Summary Report was created to summarize the scope, extent, process, and results of the various technical evaluations conducted to assess the performance of the system under five scenarios including future with-project. Additionally, the Summary Report describes the development and application of updated tools that leverage DWR investments from other programs. The Summary Report also describes the methodology and results to characterize the following: flood hydrology, reservoir analysis, riverine channel evaluations, estuary channel evaluations, levee performance curves, floodplain hydraulic analysis, flood damage analysis, life risk analysis, regional economic analysis, and cost estimates. Collectively, this information informed Chapter 3 of the 2017 CVFPP Update. Chapter 3 describes the quantitative estimates of expected contribution to desired outcomes using several scenarios with varying hydrologic and flood control system conditions including the flow and stage results of each scenario, and expected annual life losses of each scenario.

Release Summary

- Available February 2017
- No updates have been made since February 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Draft CVFPP Climate Change Analysis Technical Memorandum

The Draft CVFPP Climate Change Analysis TM identifies and evaluates potential future climatic changes in the Central Valley of California for use in this 2017 CVFPP Update. A phased approach to climate change hydrology was applied with early analyses informing the BWFSs. The refined climate change analyses computed potential changes in unregulated flows throughout the Central Valley based on newer climate projections and refined hydrologic modeling and was applied to the CVFPP. These results inform the final hydraulic, flood damage, and life risk analyses that quantify estimates of the expected outcomes from the CVFPP, which are described in Chapter 3 of the 2017 CVFPP Update.

Release Summary

- Available March 2017
- No updates have been made since March 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Urban Levee Design Criteria

The Urban Levee Design Criteria (ULDC) provides engineering design criteria and guidance for the design, evaluation, operation, and maintenance of levees and floodwalls that provide an urban level of flood protection in California, as well as for determining design water surface

elevations along leveed and unleveed streams. Other topics beyond design and evaluation are presented to provide reasonable assurance that, once a levee or floodwall is found to provide an urban level of flood protection, it will continue to do so. The ULDC is limited to engineering design criteria; mitigation and conservation requirements are not discussed.

The purpose of the ULDC is to provide engineering criteria and guidance for civil engineers to follow in meeting the requirements of California's Government Code Sections 65865.5, 65962, and 66474.5 with respect to findings that levees and floodwalls in the Sacramento-San Joaquin Valley provide protection against a flood that has a 1-in-200 chance of occurring in any given year, and to offer this same guidance to civil engineers working on levees and floodwalls anywhere in California. The ULDC also provides engineering criteria and guidance for DWR's urban levee evaluations and participation in urban levee projects.

Release Summary

- Available May 2012
- No updates have been made since May 2012
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Urban Level of Flood Protection Criteria

The Urban Level of Flood Protection Criteria provides criteria for not only physical flood protection, but also administrative and procedural measures reasonably necessary to reduce flood risks. DWR considers that an urban level of flood protection could be achieved by structural and nonstructural means, or a combination of both. Therefore, DWR's ULDC (above) is incorporated by reference in the Urban Level of Flood Protection Criteria to provide additional engineering criteria and guidance to civil engineers and practitioners in situations where levees and floodwalls are used to provide an urban level of flood protection.

The Urban Level of Flood Protection Criteria was developed to strengthen the link between flood management and land use. DWR developed these criteria as a systematic approach to assist affected cities and counties within the Sacramento-San Joaquin Valley in making findings related to an urban level of flood protection before approving certain land-use decisions. DWR developed the Urban Level of Flood Protection Criteria in a manner that would satisfy the legislative requirements without interfering with local land-use authority, provide reasonable details and flexibility for viability, and promote prudent floodplain management in concert with other State law provisions related to smart growth and climate change adaptation strategies.

Release Summary

- Available November 2013
- No updates have been made since November 2013
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

CVFPP Accomplishments Record

The 2012 CVFPP provided a near-term and long-term implementation plan to reduce flood risk for land protected by SPFC facilities. Propositions 1E and 84 bond laws provided funding for near-term implementation. The 2012 CVFPP near-term implementation plan recommended specific actions, along with a clear and rational implementation policy framework that DWR has followed since its adoption. The CVFPP Accomplishments Record documents the near-term

actions recommended by the 2012 CVFPP and their implementation status, as well as progress made toward planning and feasibility evaluation processes that were recommended in the 2012 CVFPP. The CVFPP program's accomplishments will be collected and tracked by through the CVFPP Accomplishments Record, will be updated with every cycle of the CVFPP, and will inform future cycles of the CVFPP.

Release Summary

- Available April 2017
- No updates have been made since April 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

CVFPP Engagement Record

The CVFPP Engagement Record catalogues and describes the communication and engagement activities to support and complement technical and planning processes implemented through the Flood Management Planning Program. The CVFPP Engagement Record's central focus is on the program's efforts to complete the 2017 CVFPP Update and all the supporting documents for the 2017 CVFPP Update. The CVFPP Engagement Record includes a comprehensive list of all events, meetings, and other activities that supported gaining the input and participation necessary to produce a plan that reflects the needs and desires of those affected by and responsible for managing flood risk in the Sacramento and San Joaquin valleys of California's Central Valley. Finally, the CVFPP Engagement Record summarizes engagement activities from release of the 2012 CVFPP through the adoption of the 2017 CVFPP Update by the CVFPB.

Release Summary

- Available August 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Contributing Authors and Workgroup Members List

The Contributing Authors and Workgroup Members List documents all of the authors that contributed to the 2017 CVFPP Update, including DWR management, legal and staff, and consultant staff. The Contributing Authors and Workgroup Members List also documents the DWR and consultant authors for each appendix and each supporting document. Finally, the Contributing Authors and Workgroup Members List documents all of the participants in the various workgroups convened to help inform the development of the 2017 CVFPP Update such as the OMRR&R Workgroup, Conservation Strategy Measurable Objectives Technical Advisory Workgroup, and the Agricultural Floodplain Ordinance Task Force etc.

Release Summary

- Available August 2017
- This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

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4.0 Document Release Summary

The tables below list the current status of each 2017 CVFPP Update attachment or supporting document.

Table 4-1. 2017 CVFPP Update Adopted Documents

Title	Release Summary
2017 State Plan of Flood Control Descriptive Document Update	• Available December 2016 • Some web addresses, links, and text have been updated. These changes do not affect findings • Publication title and date adjusted to August 2017 as adopted by CVFPB
2017 Flood System Status Report	• Available December 2016 • All figures have been updated since December 2016. These changes do not affect findings • Publication title and date adjusted to August 2017 as adopted by CVFPB
2016 CVFPP Conservation Strategy	• Available November 2016 • No updates have been made to adopted content since November 2016. However, updates were made to Appendix D and publication title and date adjusted to August 2017. • Draft removed from the title, as adopted by CVFPB

Table 4-2. California Environmental Quality Act Documentation

Title	Release Summary
CVFPP Supplemental Program Environmental Impact Report	• Public draft available for review December 2016 • The Supplemental PEIR responds to public comments; changes are indicated in the Final Supplemental PEIR • Publication title and date adjusted to August 2017 as adopted by CVFPB

Table 4-3. 2017 CVFPP Update Supporting Documents

Title	Release Summary
2016 CVFPP Conservation Strategy	• Available November 2016 • No updates have been made to adopted content since November 2016. However, updates were made to Appendix D and publication title and date adjusted to August 2017. • Draft removed from the title, as adopted by CVFPB
Draft Sacramento River Basin-Wide Feasibility Study	• Available November 2016 • Some figures have been updated since November 2016. These changes do not affect findings and recommendations • Publication title and date adjusted to July 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

Table 4-3. 2017 CVFPP Update Supporting Documents

Title	Release Summary
Draft San Joaquin River Basin-Wide Feasibility Study	• Available March 2017 • No updates have been made since March 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Regional Flood Management Plans	• Plans available from 2014 to 2015 • No updates have been made since 2014 to 2015 • These plans are 2017 CVFPP Update supporting documents; they do not require CVFPB adoption
Draft CVFPP Investment Strategy Technical Memorandum	• Available March 2017 • This document updated in response to comments since March 2017. These changes do not affect findings and recommendations • Publication title and date adjusted to August 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum	• Available January 2017 • No updates have been made since January 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Draft CVFPP Scenario Technical Analyses Summary Report	• Available February 2017 • No updates have been made since February 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Draft CVFPP Climate Change Analysis Technical Memorandum	• Available March 2017 • No updates have been made since March 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Urban Levee Design Criteria	• Available May 2012 • No updates have been made since May 2012 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Urban Level of Protection Criteria	• Available November 2013 • No updates have been made since November 2013 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
CVFPP Accomplishments Record	• Available April 2017 • No updates have been made since April 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
CVFPP Engagement Record	• Available August 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption
Contributing Authors and Workgroup Members List	• Available August 2017 • This is a 2017 CVFPP Update supporting document; it does not require CVFPB adoption

5.0 Acronyms and Abbreviations

BWFS..... Basin-Wide Feasibility Study
CEQA..... California Environmental Quality Act
CVFPB ..... Central Valley Flood Protection Board
CVFPP ..... Central Valley Flood Protection Plan
DWR ..... California Department of Water Resources
EIR..... Environmental Impact Report
FCSSR ..... Flood Control System Status Report
FSSR ..... Flood System Status Report
GIS..... geographic information system
OMRR&R..... operations, maintenance, repair, rehabilitation, replacement
PEIR..... Program Environmental Impact Report
RFMP..... Regional Flood Management Plan
SPFC ..... State Plan of Flood Control
SSIA..... State Systemwide Investment Approach
TM..... technical memorandum
ULDC ..... Urban Levee Design Criteria
USACE..... United States Army Corps of Engineers

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MICHAEL D. MIERZWA
CHIEF, FLOOD PLANNING OFFICE
MICHAEL.MIERZWA@WATER.CA.GOV

DEPARTMENT OF WATER RESOURCES
3464 EL CAMINO AVENUE, SUITE 200
SACRAMENTO, CA 95821

EDMUND G. BROWN JR.
GOVERNOR
STATE OF CALIFORNIA

JOHN LAIRD
SECRETARY
THE CALIFORNIA NATURAL RESOURCES AGENCY

GRANT DAVIS
DIRECTOR
DEPARTMENT OF WATER RESOURCES

DEPARTMENT OF WATER RESOURCES
THE CALIFORNIA NATURAL RESOURCES AGENCY
STATE OF CALIFORNIA

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