

Technical Briefing to the CVFPB:

2012 Central Valley Flood Protection Plan

March 22, 2012

Sacramento

PUBLIC SAFETY

ENVIRONMENTAL STEWARDSHIP

ECONOMIC STABILITY

Technical Briefing Outline

- Overview of Plan Formulation & Supporting Technical Evaluations
- Approach Formulation & Key Findings:
 - 🔄 Achieve SPFC Design Flow Capacity
 - 👥 Protect High Risk Communities
 - 📈 Enhance Flood System Capacity
 - 🏡 State Systemwide Investment Approach
- Approach Comparison & Summary

Overview of Plan Formulation & Supporting Technical Evaluations

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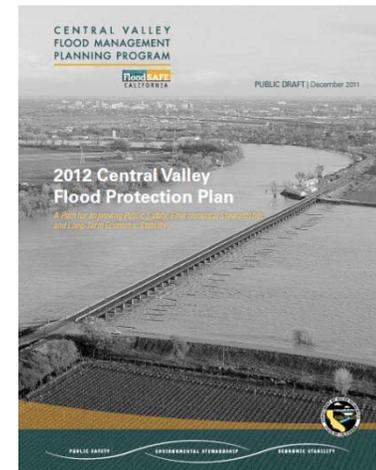
ENVIRONMENTAL STEWARDSHIP

ECONOMIC STABILITY

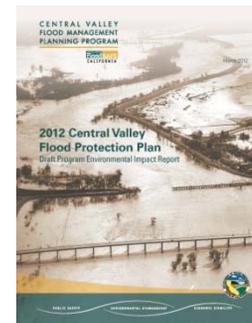
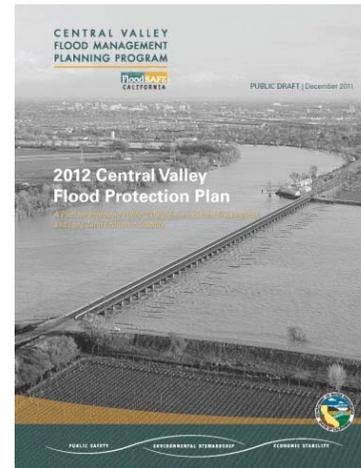
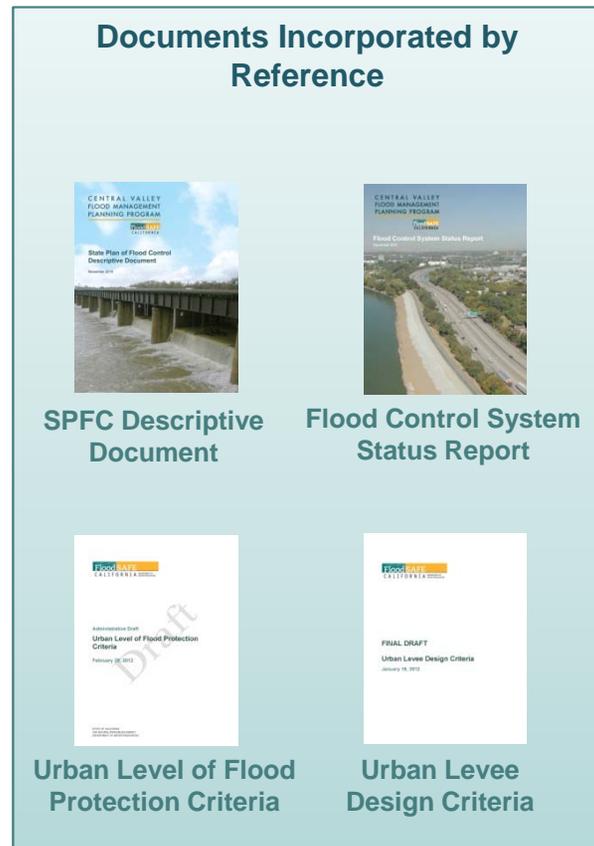
2012 CVFPP

The 2012 CVFPP reflects the State's systemwide investment approach for flood management improvements in the Central Valley

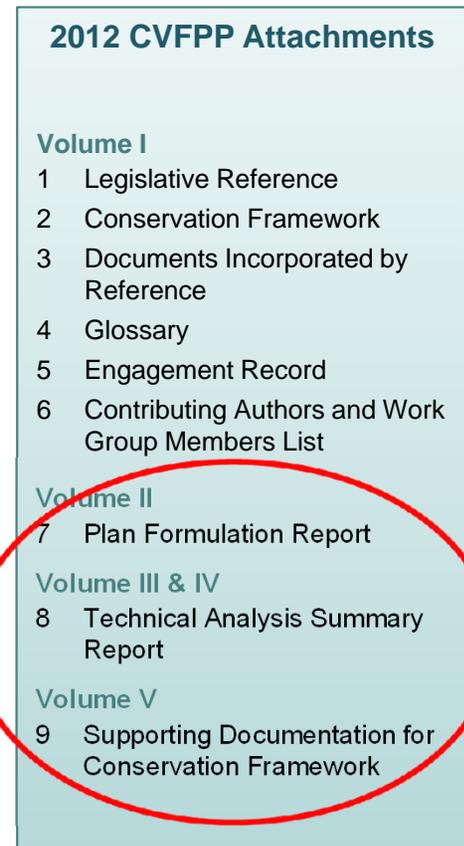
- High level vision
- Long implementation timeframe
- Will evolve and be refined over time
- Emphasis on State interests



2012 CVFPP Organization



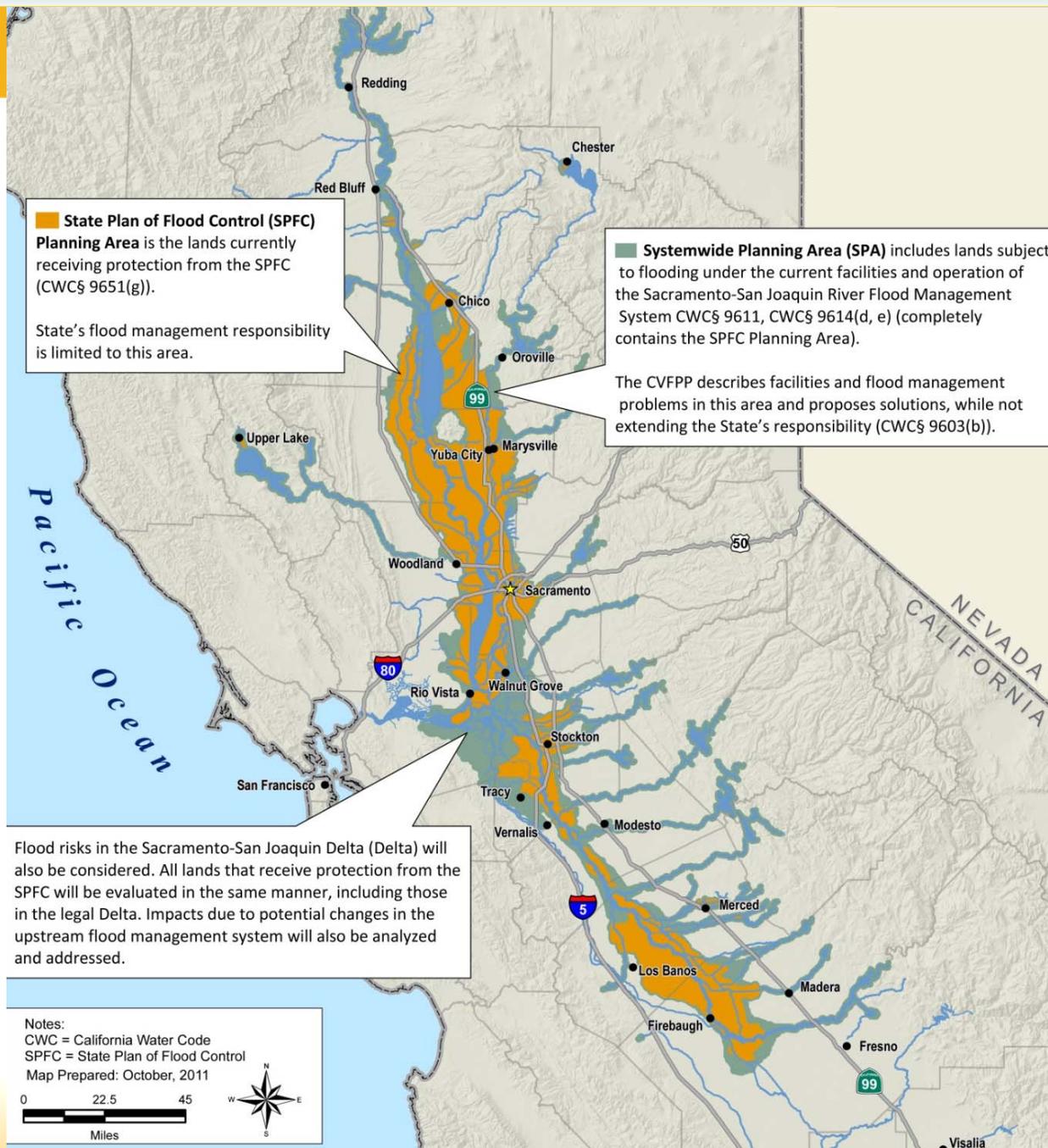
Program Environmental Impact Report



Geographic Scope

State Plan of Flood Control Planning Area

Systemwide Planning Area



Need for Improved Flood Management

State Plan of Flood Control:

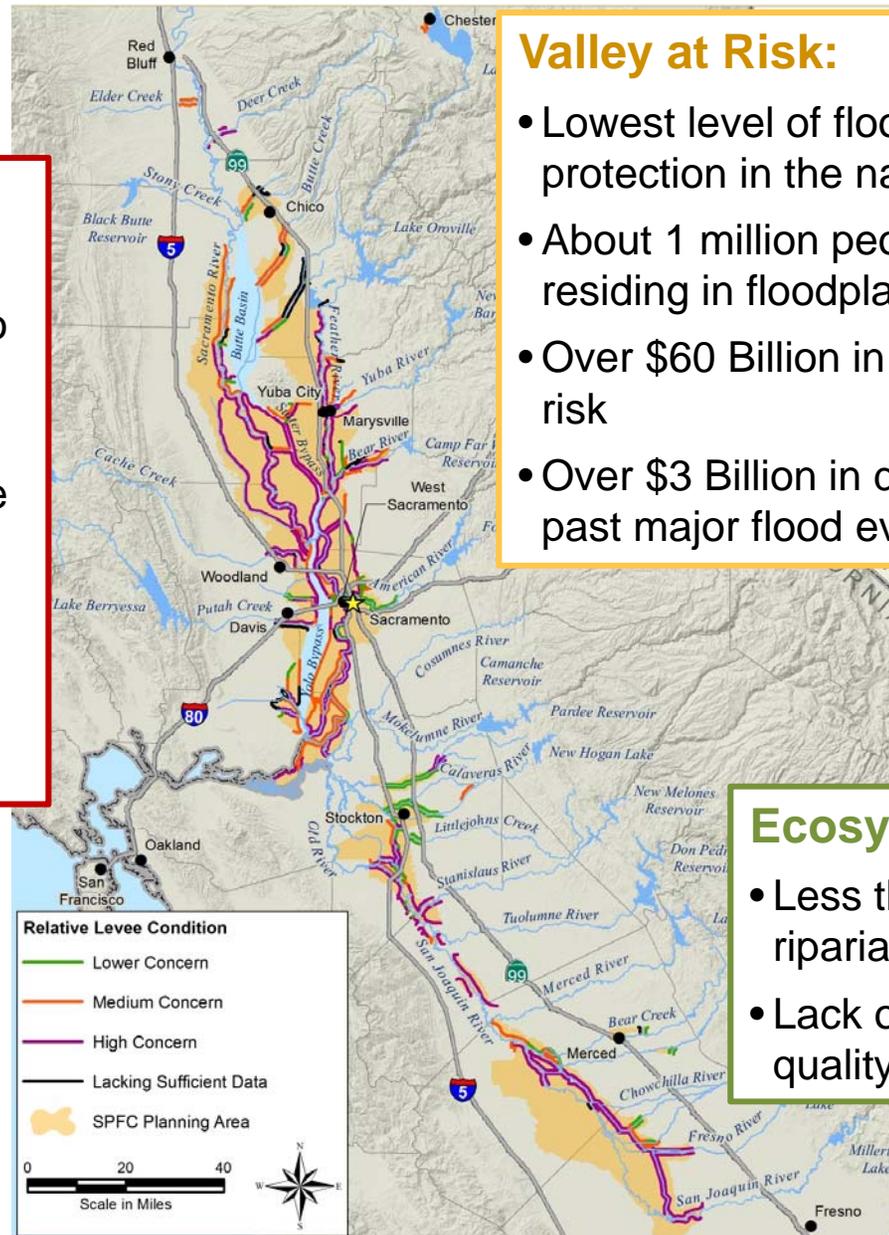
- Half of urban levees do not meet current engineering criteria
- 60% of nonurban levee have high potential for failure
- Half of evaluated channels cannot pass design flows

Valley at Risk:

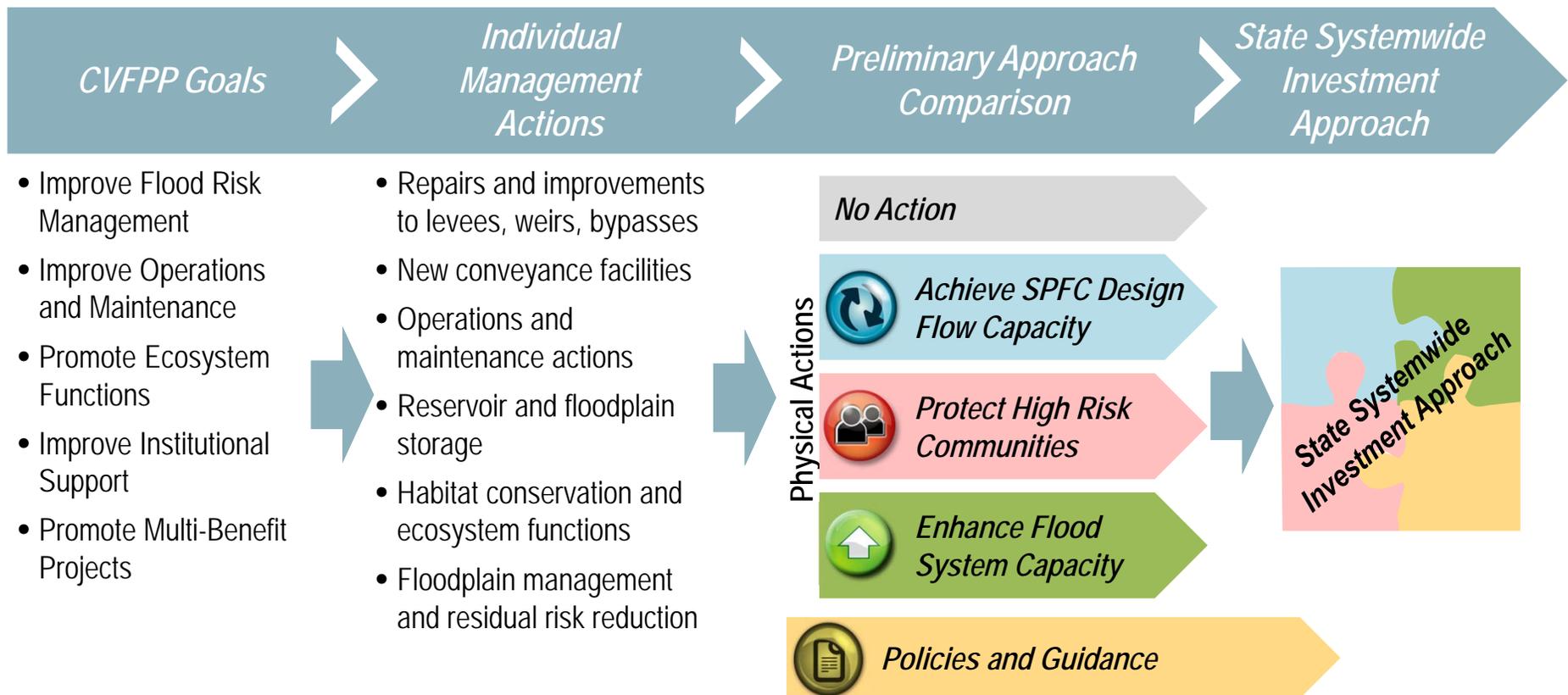
- Lowest level of flood protection in the nation
- About 1 million people residing in floodplains
- Over \$60 Billion in assets at risk
- Over \$3 Billion in damages in past major flood events

Ecosystem:

- Less than 4% of historic riparian forest remains
- Lack of habitat quantity, quality, and connectivity



Formulating Systemwide Approaches



Performance Criteria

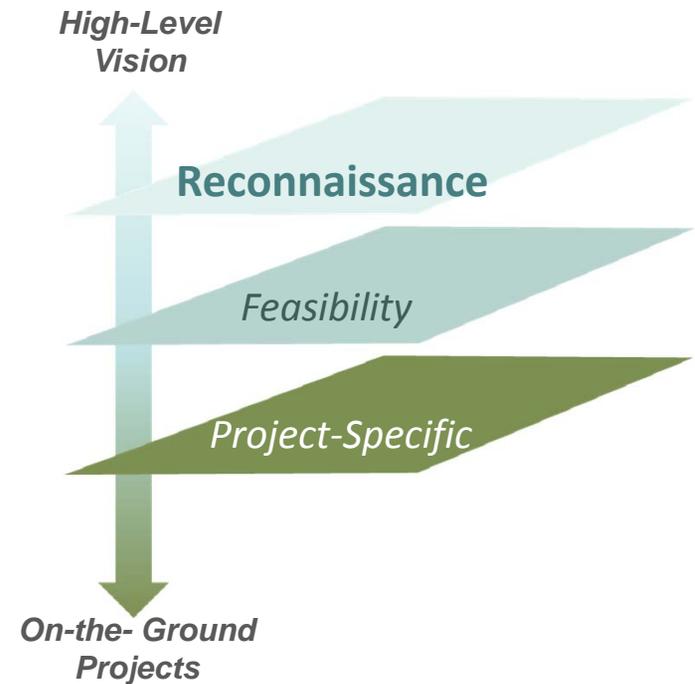
Category	Performance Criteria	Supporting Analyses
Flood Risk Reduction Benefit	Level of Flood Protection	■
	Life Risk	■
	Economic Damages	■
	Regional Economics	■
Integration & Sustainability	Promote Ecosystem Functions	□
	Promote Multi-Benefit Projects	□
	Socioeconomic Considerations	□
	Climate Change Adaptability	□
Cost	Capital Cost	■
	Operation and Maintenance	□
Completeness	Ability to Meet Objectives in Flood Legislation	□

■ Quantitative analysis using available tools and data

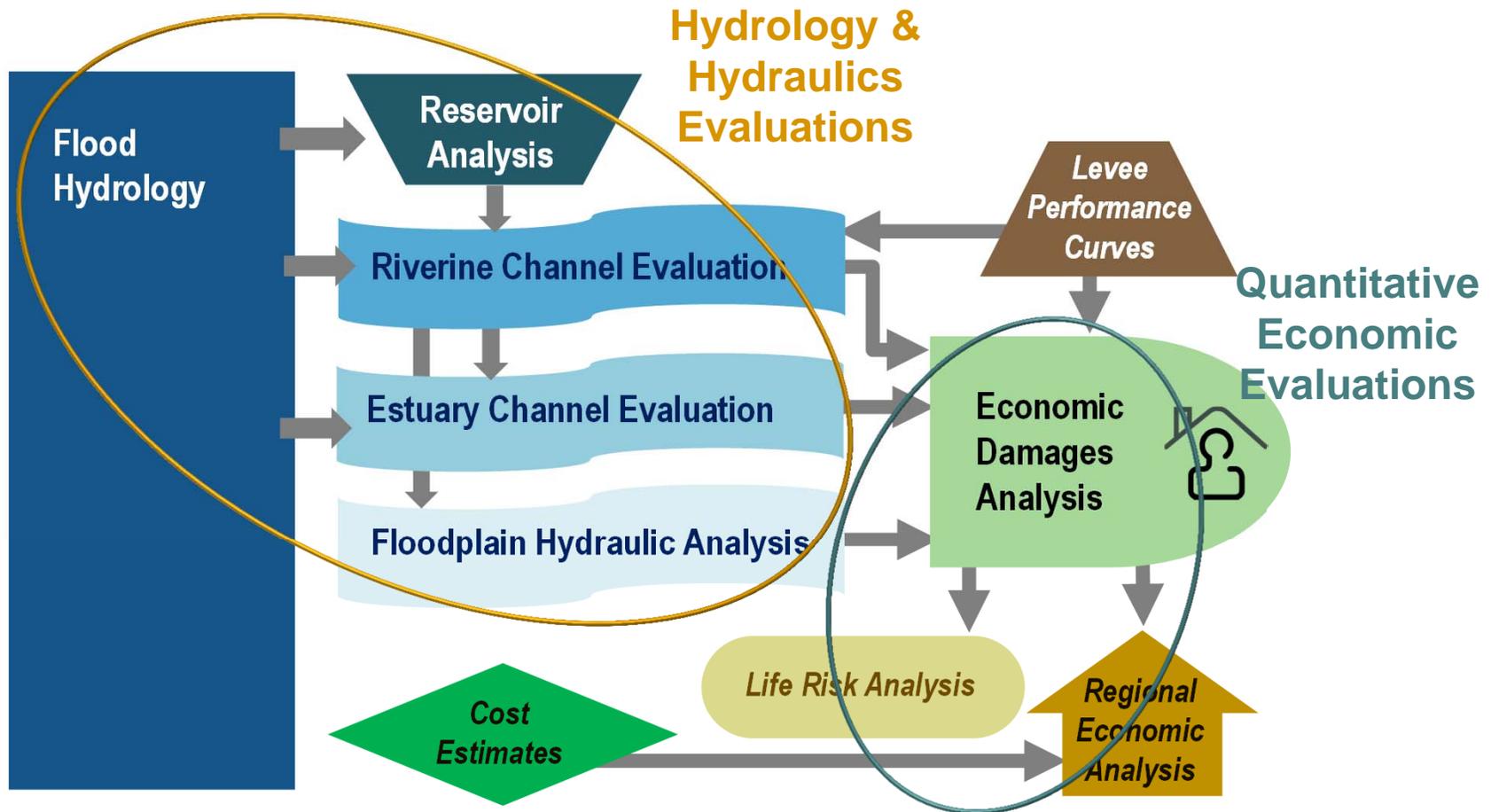
□ Qualitative analysis

Scope of Technical Evaluation

- Reconnaissance level of detail
- Focus on system as whole, rather than local conditions
- Existing and available data and tools, with critical updates to:
 - Reflect current conditions
 - Incorporate new information



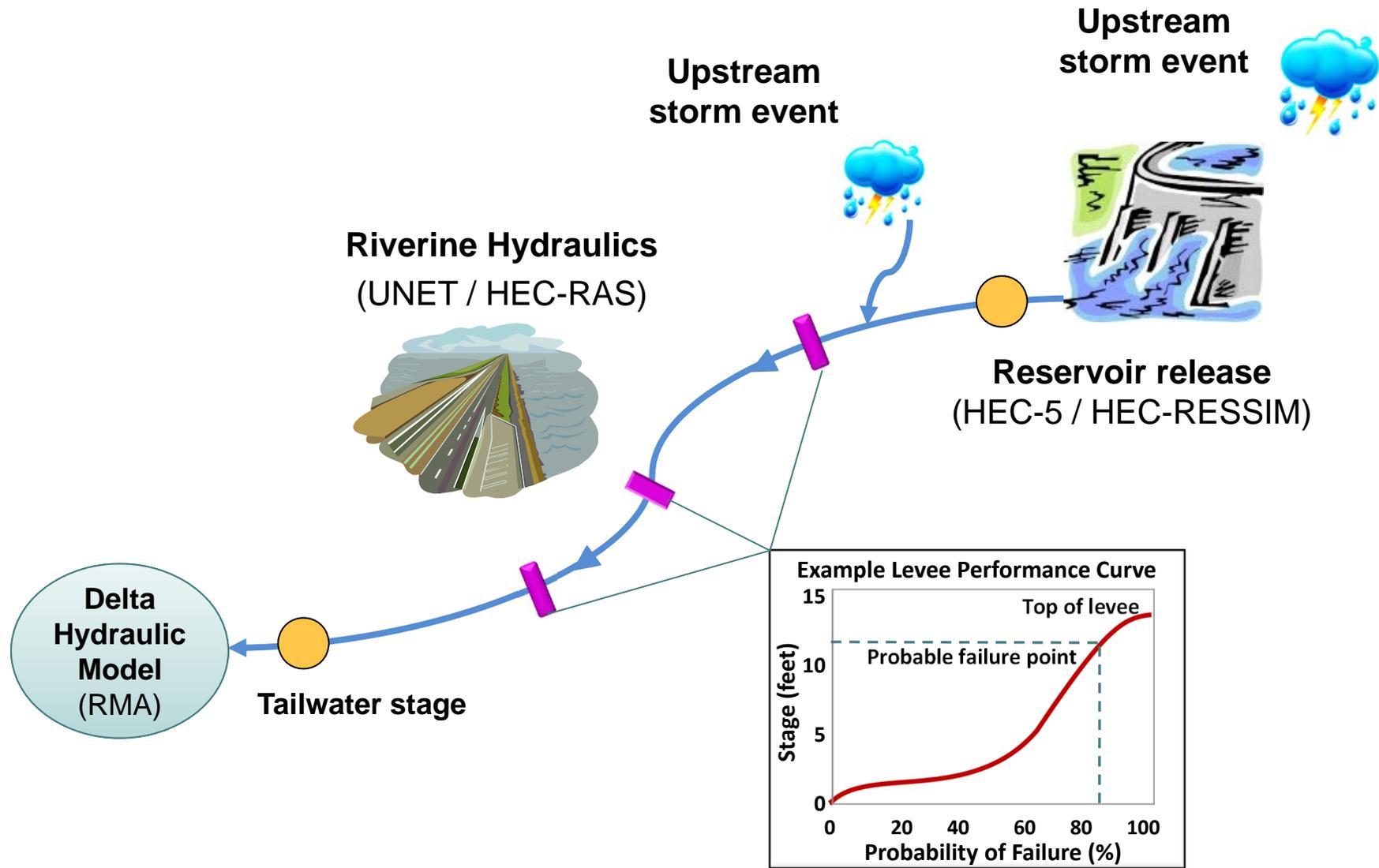
Systemwide Analysis Tools & Data



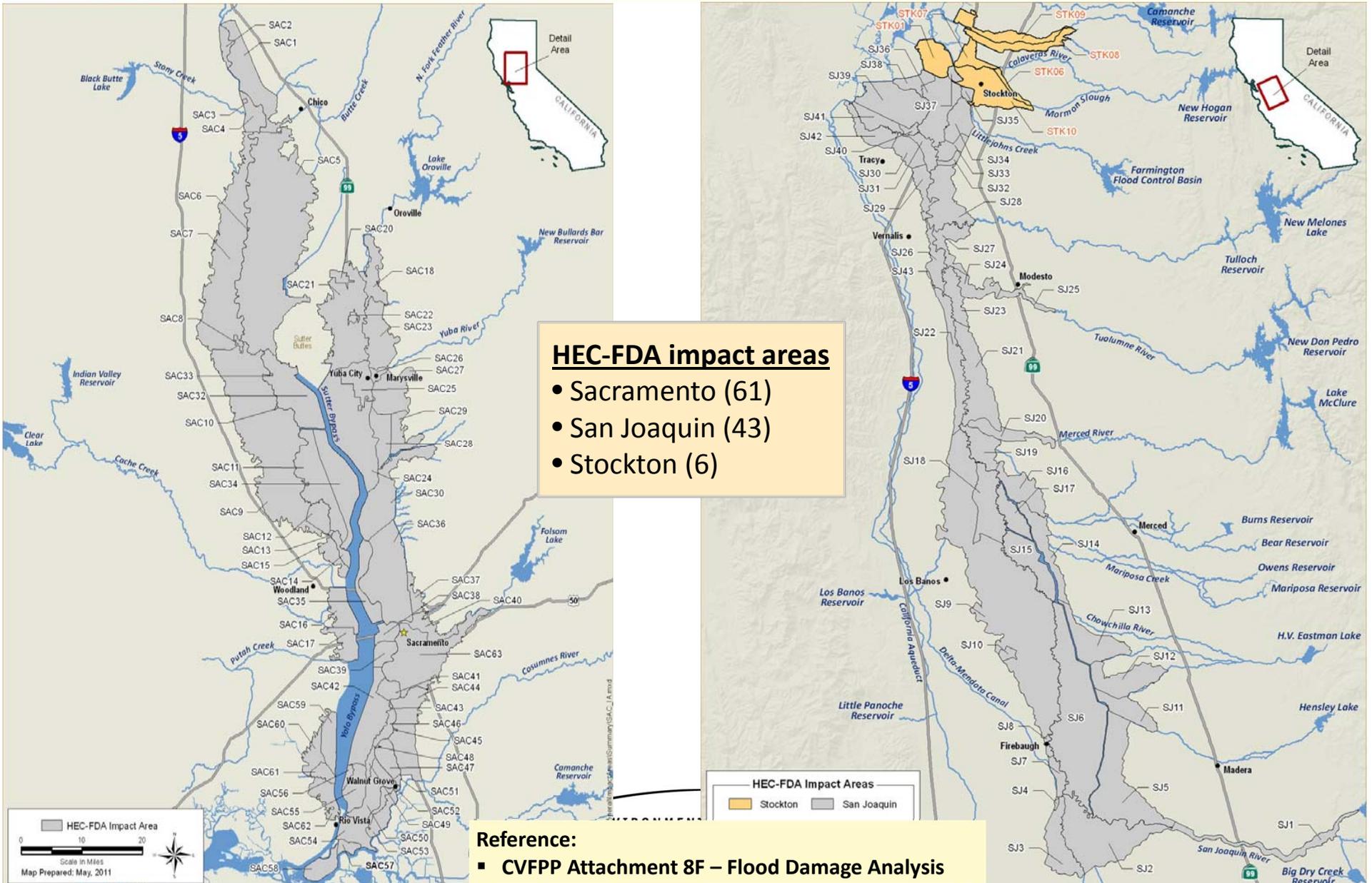
Reference:

- CVFPP Attachment 8 – Technical Analysis Summary Report
- Briefing Handout # 2 – CVFPP Technical Data, Tools, and Analyses

Hydrology & Hydraulics Evaluations

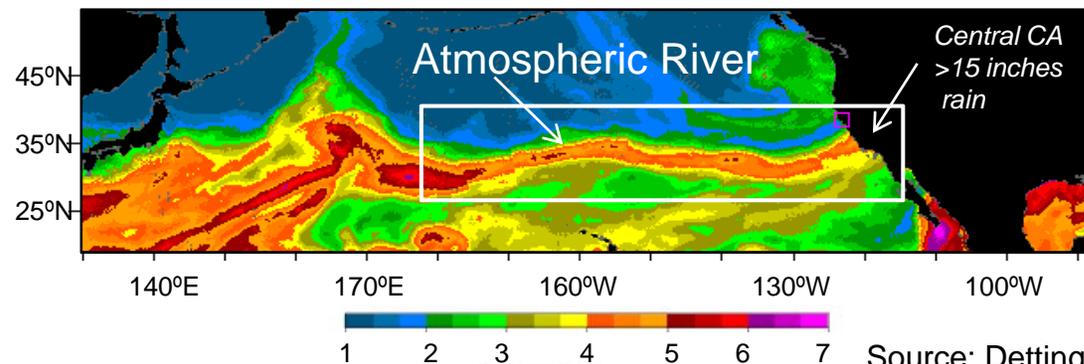


Economic Analysis Coverage



Climate Change Considerations

- SB 5 requires DWR to consider climate change in CVFPP
- Data/Tools/Research not complete for extreme events
- 2012 CVFPP
 - “Threshold Analysis” Pilot Study
 - Program level adaptation strategy



Source: Dettinger, 2011

Board Questions

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Achieve SPFC Design Flow Capacity Approach



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Approach Overview

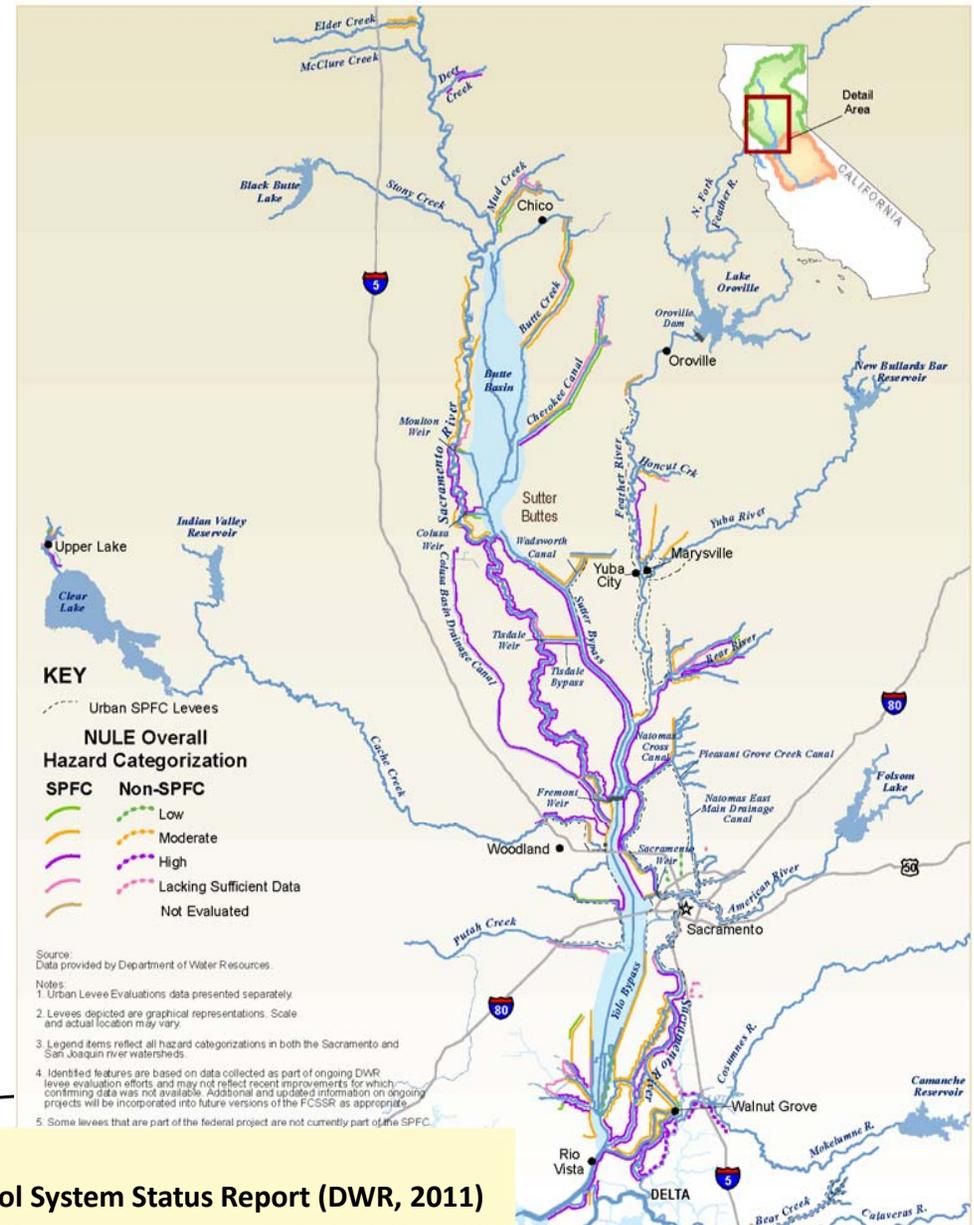
- Address legislative direction CWC 9614 (g):
“the CVFPP shall include an evaluation of the structural improvements and repairs necessary to bring each State Plan of Flood Control facility to within its design standard”
- Correct identified hazards and reconstruct (but not enhance) SPFC facilities to safely pass design flow
- Evaluate reconstruction of the system in its current footprint to within its original intended design





Evaluation of SPFC Facility Conditions

- The Flood Control System Status Report evaluated conditions of SPFC Facilities
- Identified facilities that do not meet current standards for:
 - Geometry (height, width, slope, etc) and freeboard
 - Stability and seepage design criteria
 - Capacity to convey design flows





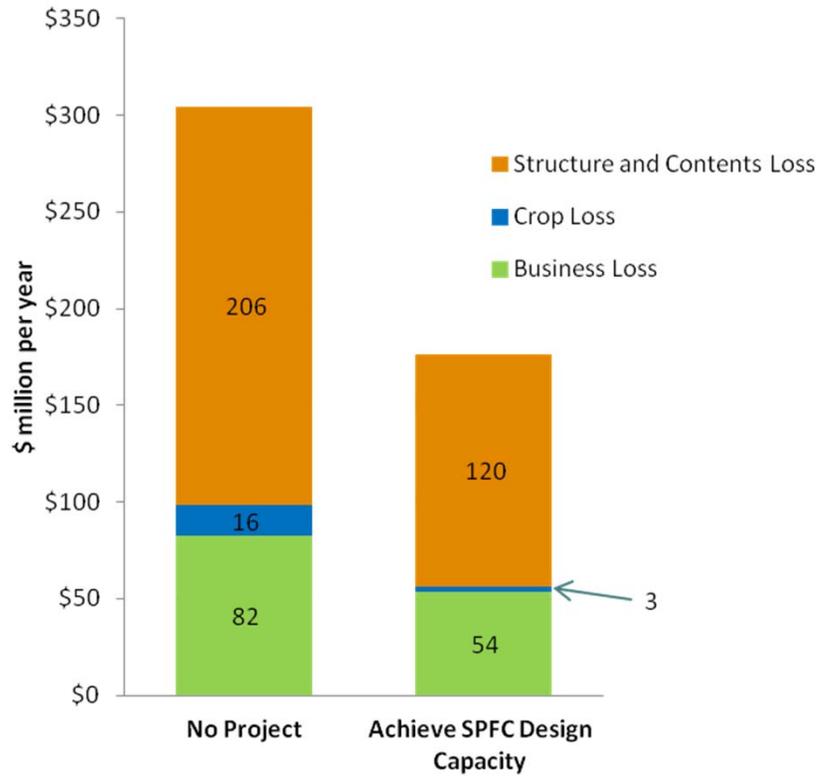
Approach Elements

- In-place reconstruction and/or levee raise to address identified levee hazard conditions
- Bypass and weir rehab to achieve design conveyance
- No change to reservoir storage & operations
- This approach would involve action along
 - About 180 miles of urban SPFC levees
 - About 1,200 miles of non-urban SPFC levees
 - 200 miles of appurtenant non-project levees

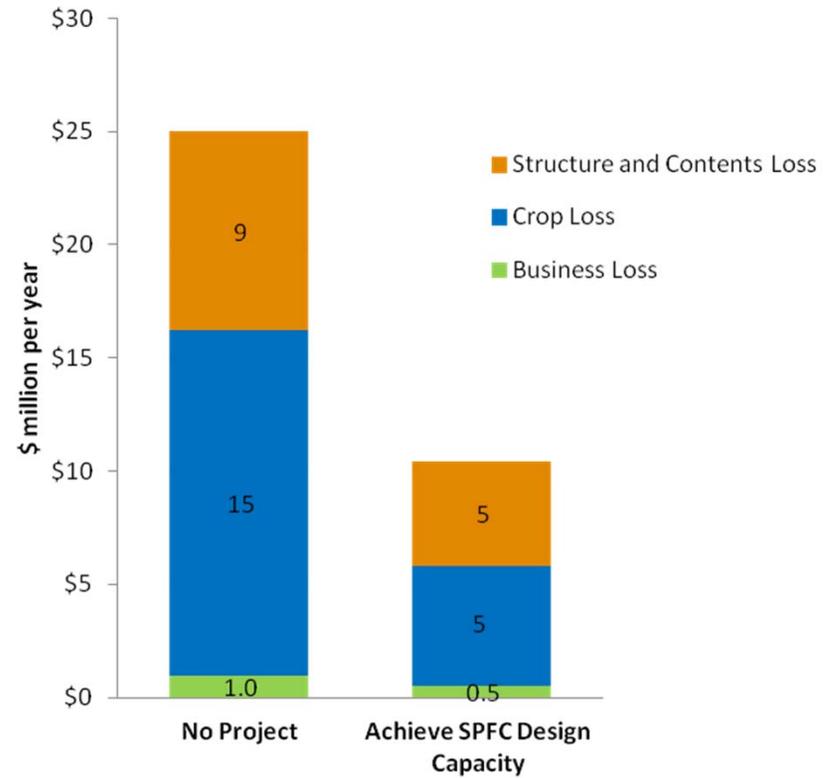




Flood Damage



Sacramento River Basin



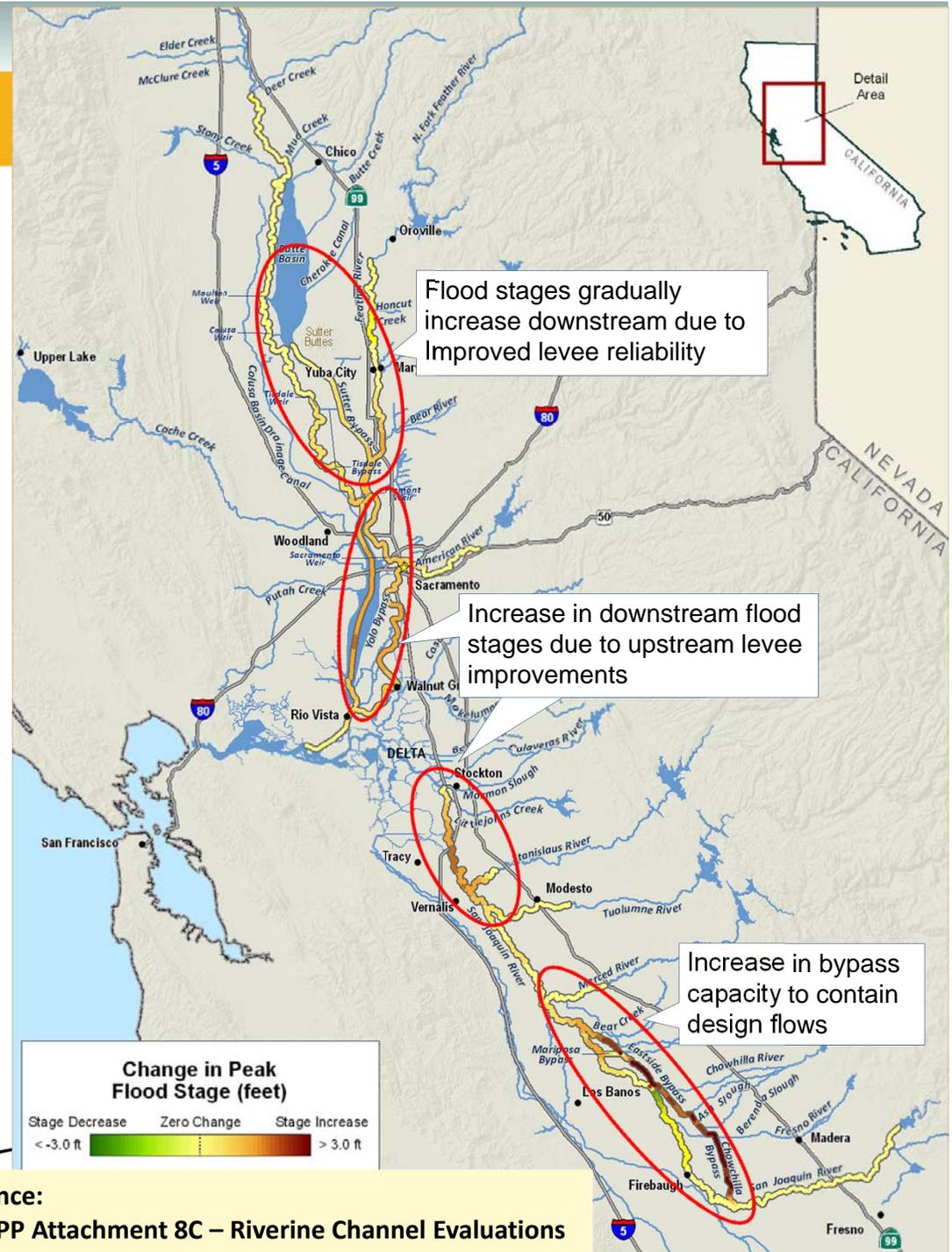
San Joaquin River Basin





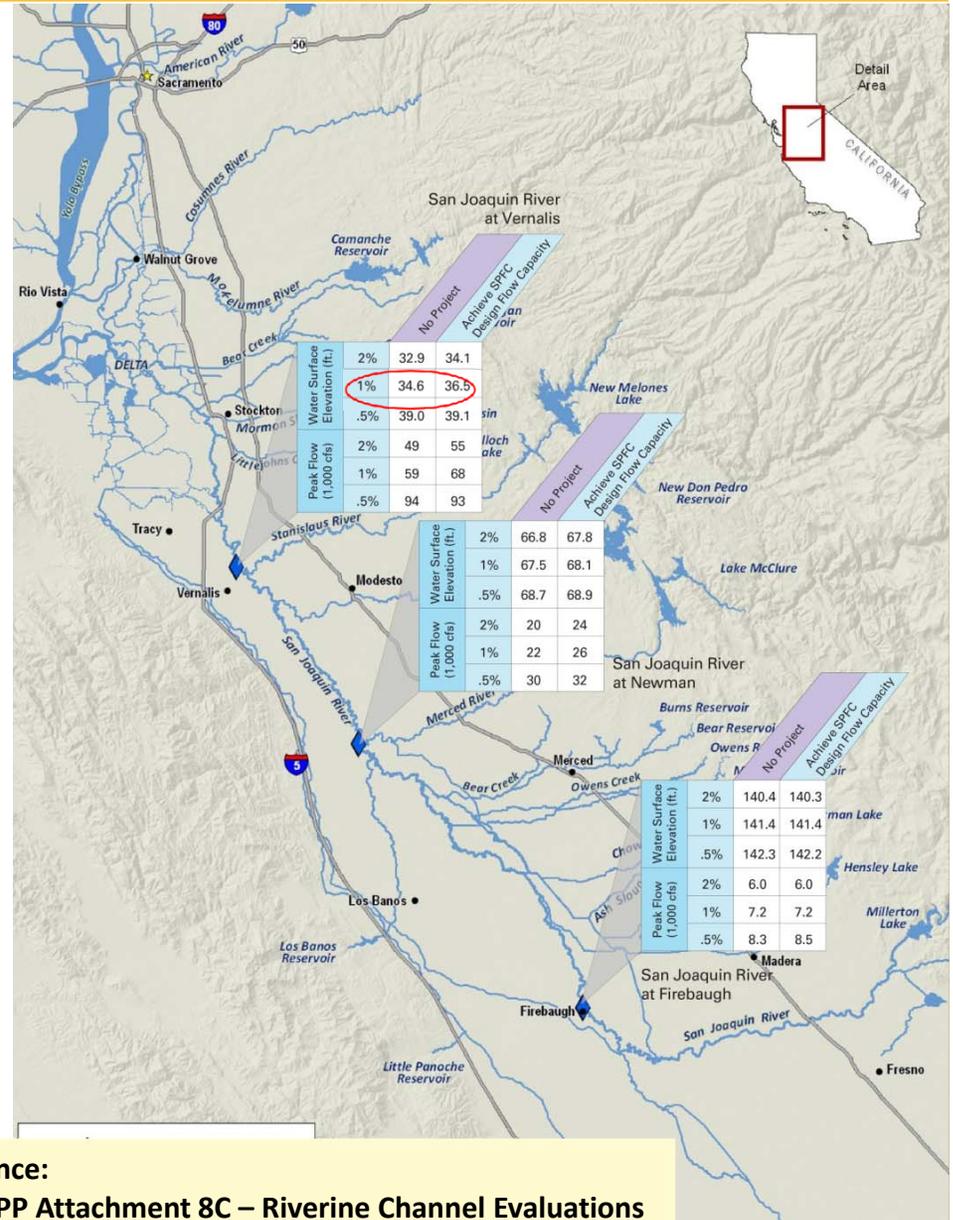
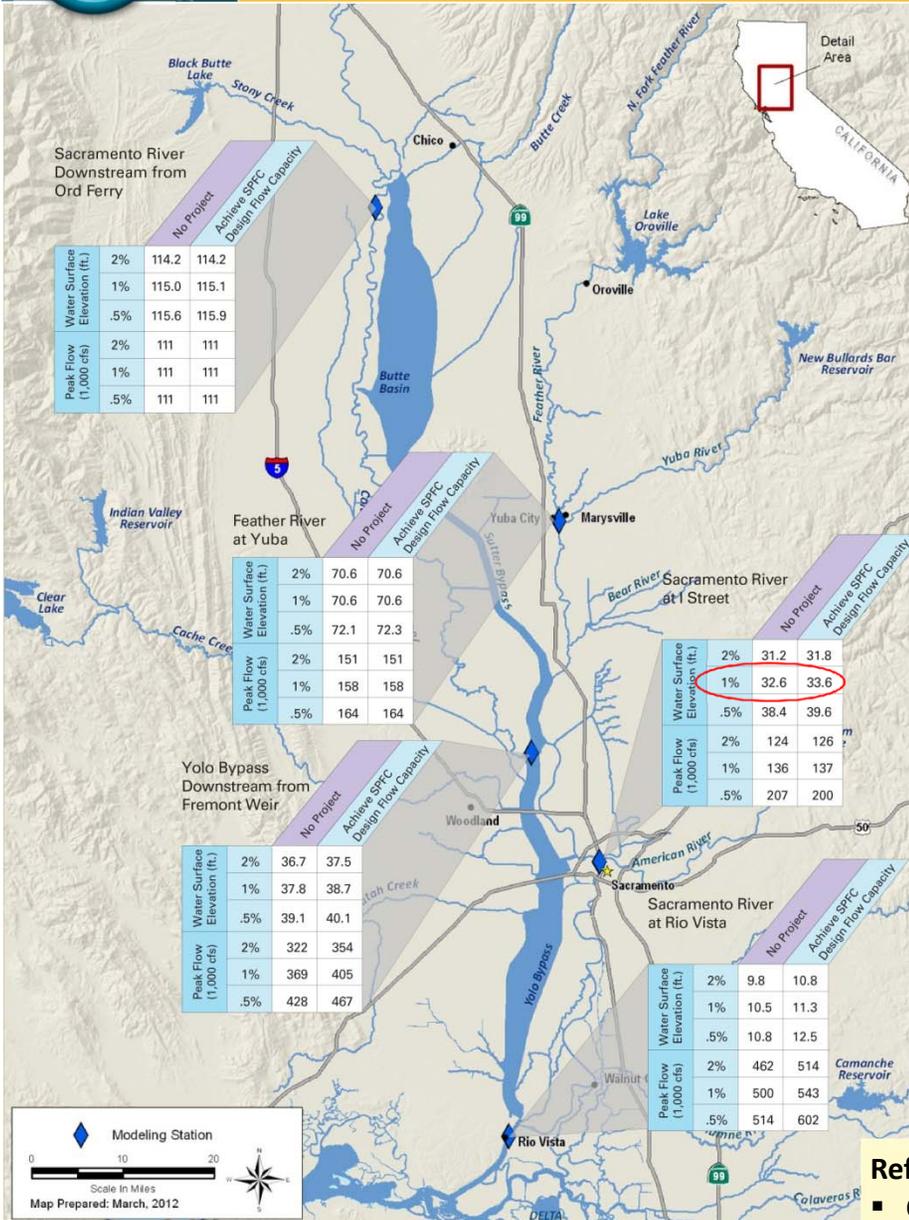
Flood Stage

- Higher river stages than under existing conditions because of improved levee reliability
- Potential downstream impacts because of improved reliability of upstream levees





Peak Stage & Flow at Key Locations





Key Findings

- Cost: \$19 to \$23 billion
- Reduces economic damages by 43% and life risk by 6%
- Levels of flood protection would improve overall, but would vary throughout the system:
 - Does not provide all urban areas with protection from a 0.5% annual chance (200-year) event
 - Provides increased level of protection to some small communities and rural areas, but varies regionally
- Improving the reliability of upstream levees may create system impacts during certain frequency floods

Reference: CVFPP Attachments:

- 7 – Plan Formulation
- 8C – Riverine Channel Evaluations
- 8D – Estuary Channel Evaluations
- 8F – Flood Damage Analysis
- 8G – Life Risk Analysis
- 8J – Cost Estimates





Key Findings (cont.)

- Fixing SPFC levees in-place provides limited opportunities to:
 - Improve ecosystem functions
 - Integrate other benefits (water supply, recreation)
 - Address erosion and other chronic O&M challenges related to conflicts with natural geomorphic processes
- Does not change system resiliency or ability to adapt to future changes

Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8I – Benefit Assessment Framework



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Protect High Risk Communities Approach



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Approach Overview

- Focuses on the threats flooding poses to life safety
- Investments prioritized to address identified facility hazards and improve level of flood protection in:
 - Urban areas
 - Small communities subject to frequent, deep, and/or rapid flooding
- Other SPFC facilities continue to be operated, maintained and repaired as under existing conditions



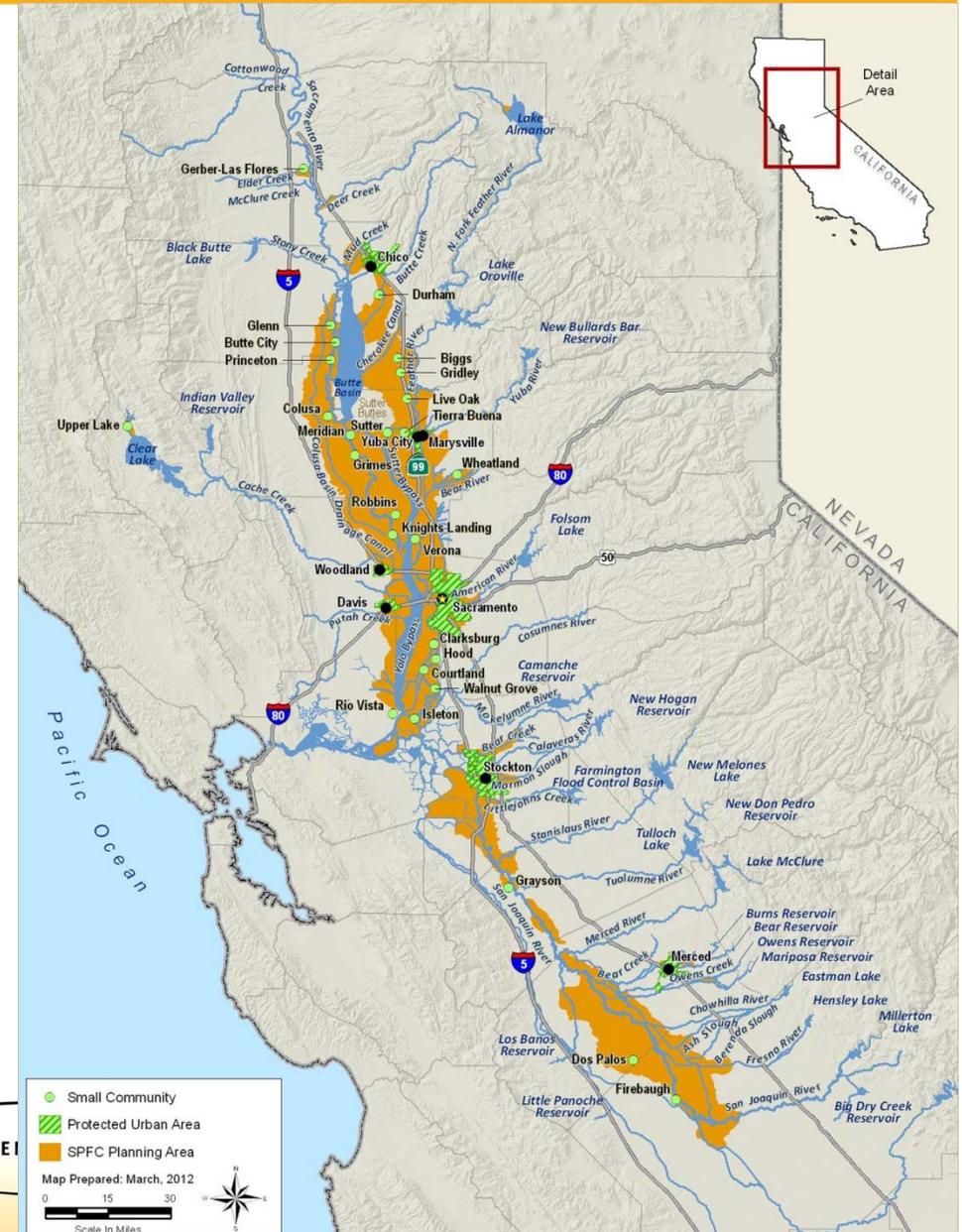
Communities Protected

■ Urban Areas

- Population >10,000
- Includes small communities contiguous with urban areas (13)
- Target 200-year level of protection
- In-place levee improvements

■ Small Communities

- Population <10,000
- 27 communities within the SPFC Planning Area (total population 66,000)
- Target 100-year level of protection
- In-place fix of adjacent SPFC facilities and/or new levee (e.g., ring levee)





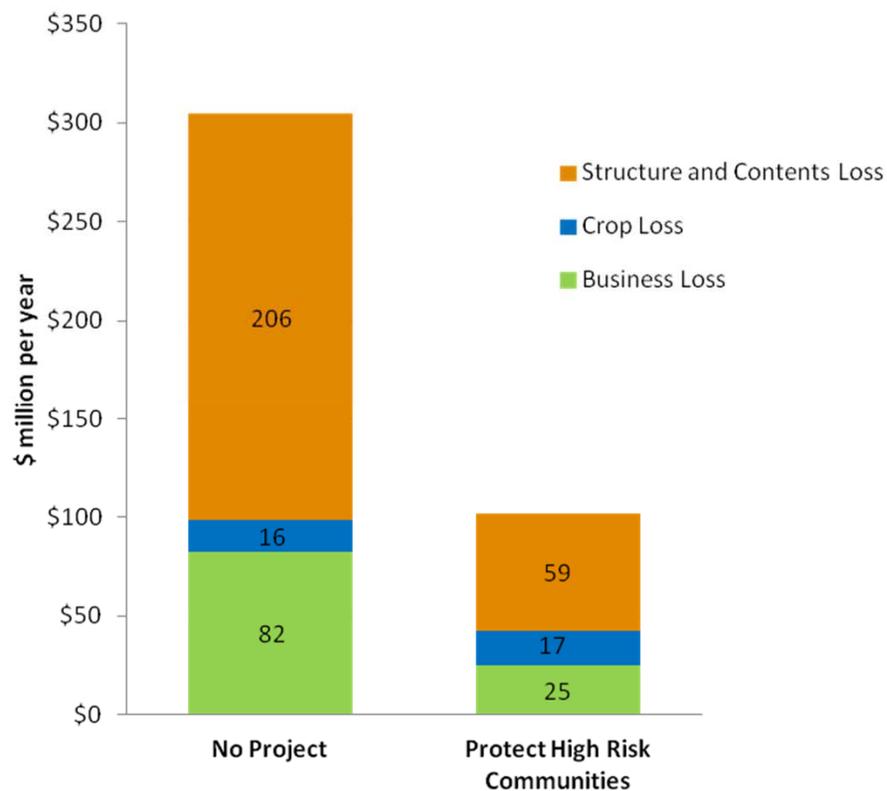
Flood Threat of Small Communities

Flood Threat Level	High Flood Frequency?	Deep Floodplain?	Rapid Flooding?
	Frequency < 100-year	Average Depth > 3 feet	Proximity to Major Flood Source < 2 miles
High	Yes	Yes	Yes
Moderate-high	Yes	No	Yes
Low-moderate	Yes	No	No
Low	No	-	-

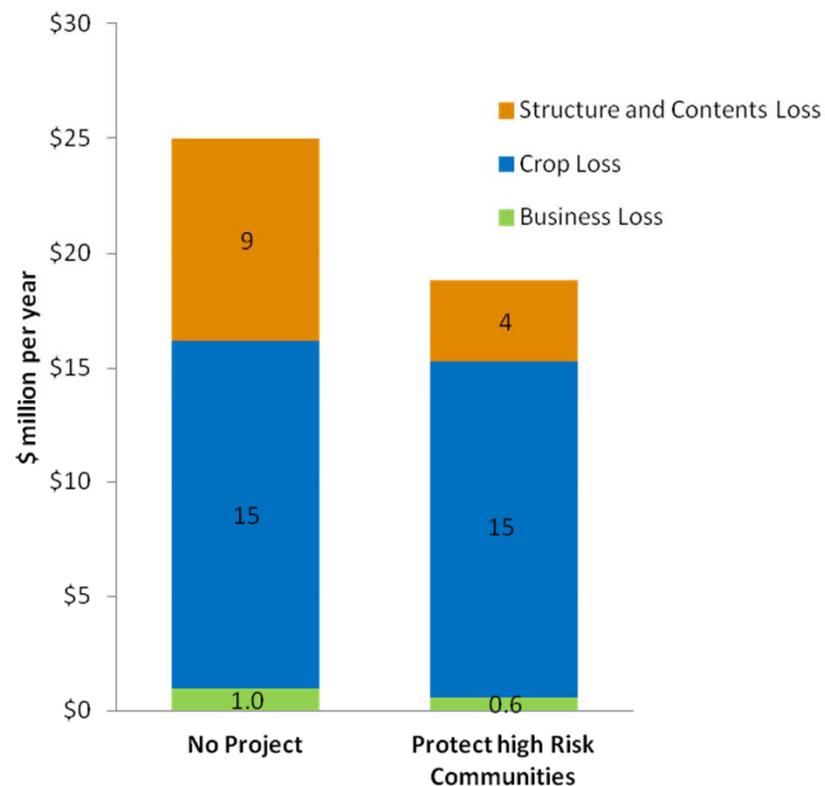




Flood Damage



Sacramento River Basin



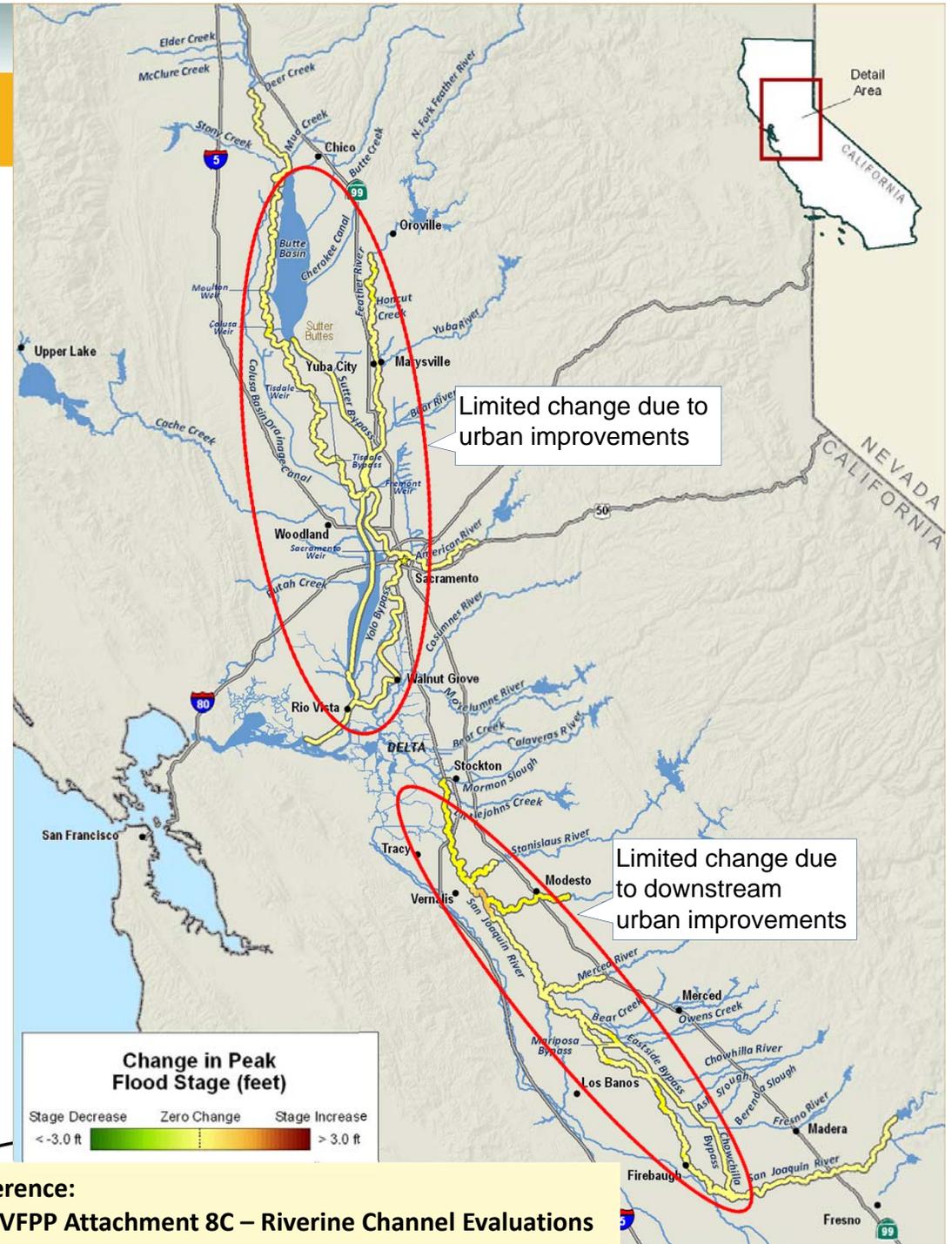
San Joaquin River Basin





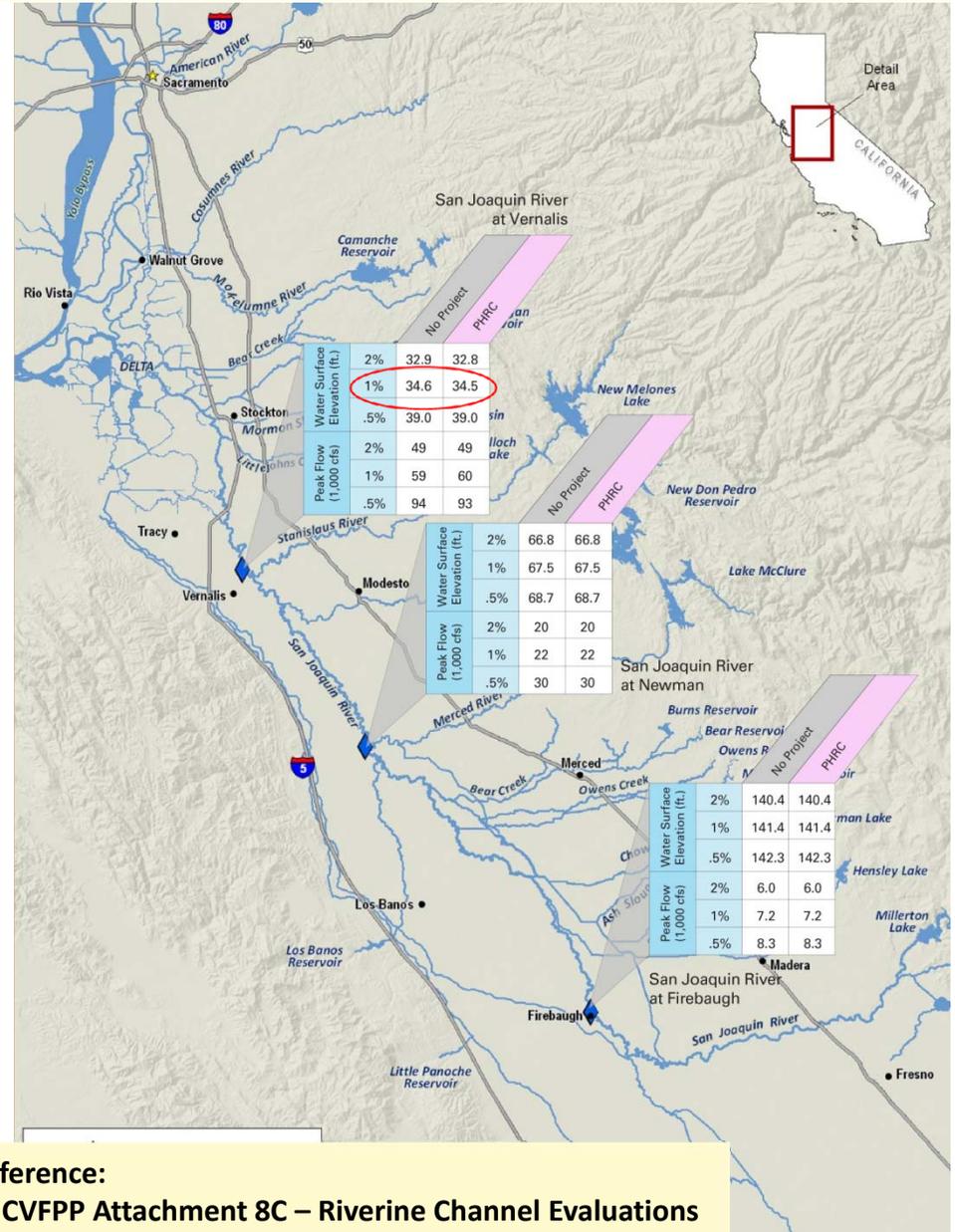
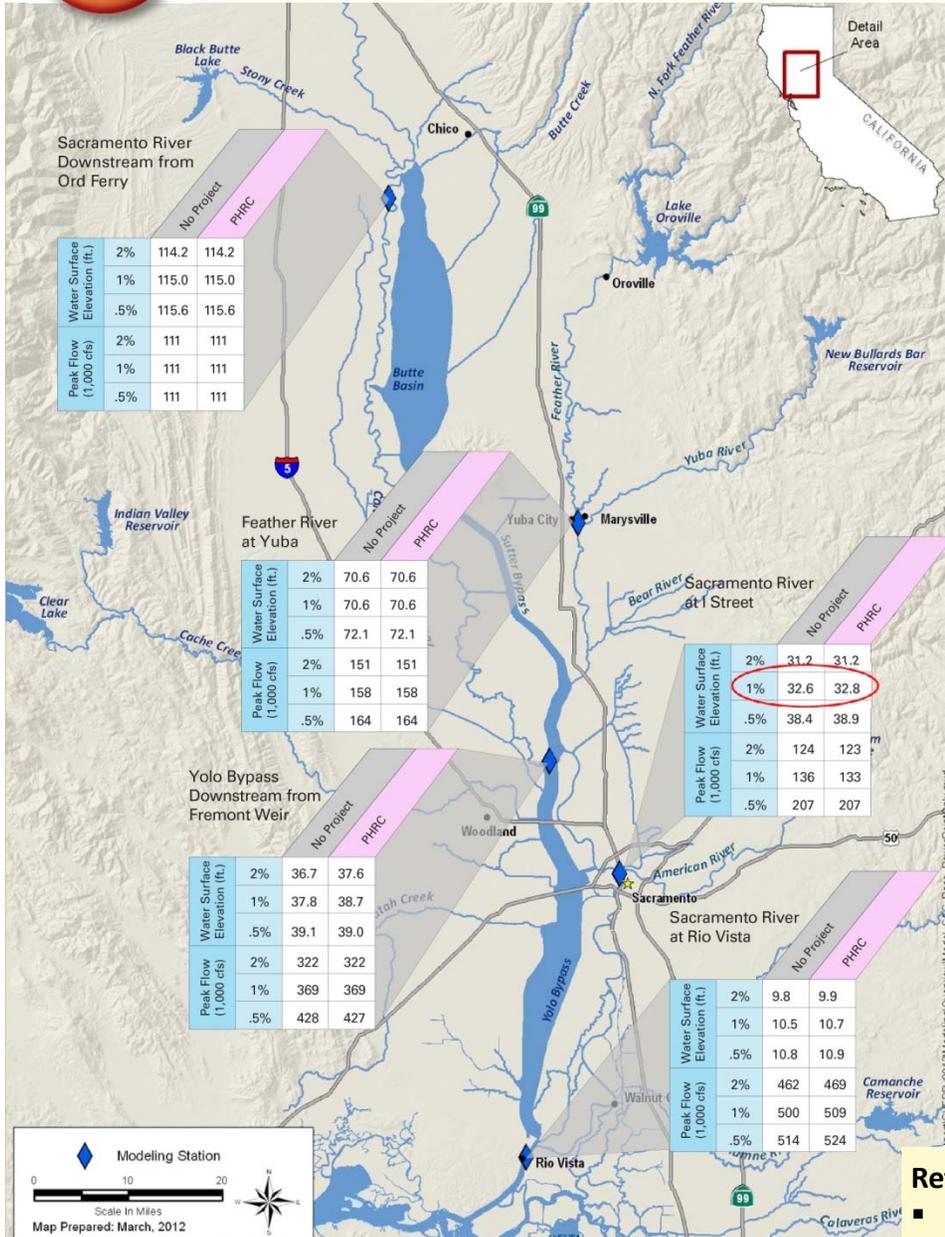
Flood Stage

- Limited stage change compared with existing conditions because levee improvements are focused in small areas
- The levee system outside urban areas largely remains in its current condition





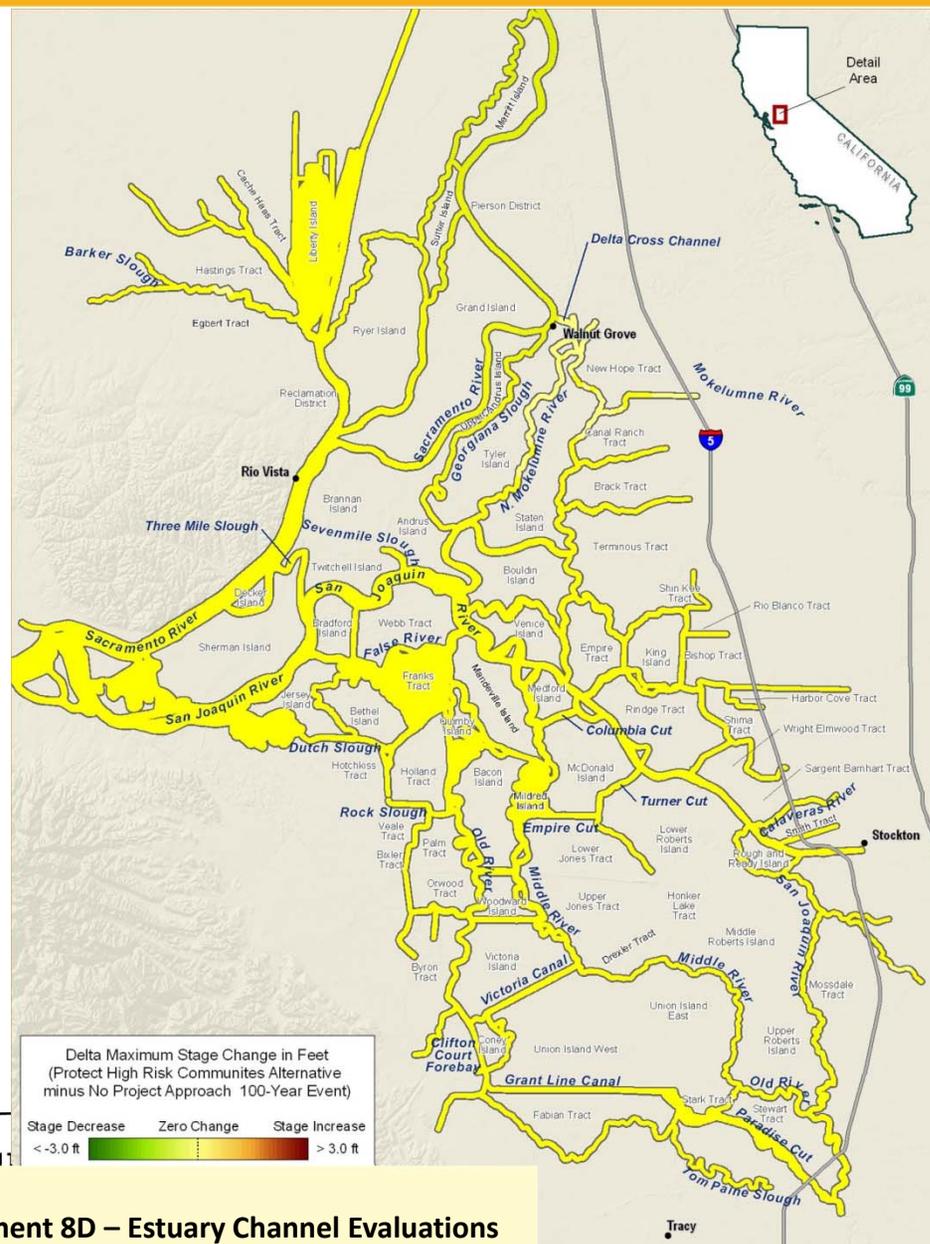
Peak Stage & Flow at Key Locations





Delta Stage

- Limited change in Delta peak flood stage compared to No Project
- Extent of Levee improvements are focused in small areas





Key Findings

- Cost: \$9 to \$11 billion
- Reduce economic flood damages by 63% and life risk by 44%
- Urban areas achieve protection from a 0.5% annual-chance (200-year) flood
- Small communities achieve protection from a 1% annual-chance (100-year) flood
- No change in level of flood protection in other areas of the system

Reference: CVFPP Attachments:

- 7 – Plan Formulation
- 8C – Riverine Channel Evaluations
- 8D – Estuary Channel Evaluations
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- 8J – Cost Estimates





Key Findings (cont.)

- Focusing only on populations at risk provides limited opportunities to:
 - Improve ecosystem functions
 - Integrate other benefits (water supply, recreation)
 - Address erosion and other chronic O&M challenges related to conflicts with natural geomorphic processes
- No improvement in system resiliency or ability to adapt to future changes

Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8I – Benefit Assessment Framework



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Enhance Flood System Capacity Approach



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Approach Overview

- Seeks opportunities to achieve multiple benefits and address all objectives and needs
- Incorporates Protect High Risk Communities Approach
- Incorporates Achieve SPFC Design Flow Capacity Approach
- Incorporates additional system elements:
 - Increases storage in reservoirs and floodplains
 - Expands conveyance through improvements to channels, bypasses, and control structures
 - Integrates environmental restoration





Formulation of System Elements

- Assessed capacity enhancement needs for each river reach
- Assessed the effectiveness of various storage and conveyance improvements in reducing peak flood stages systemwide :
 - A. Reservoir storage and operations
 - B. Managed floodplain storage
 - C. Bypass expansion and weirs modifications
 - D. Floodway expansion
- Assessed ability to meet multiple objectives and contribute to the CVFPP supporting goals





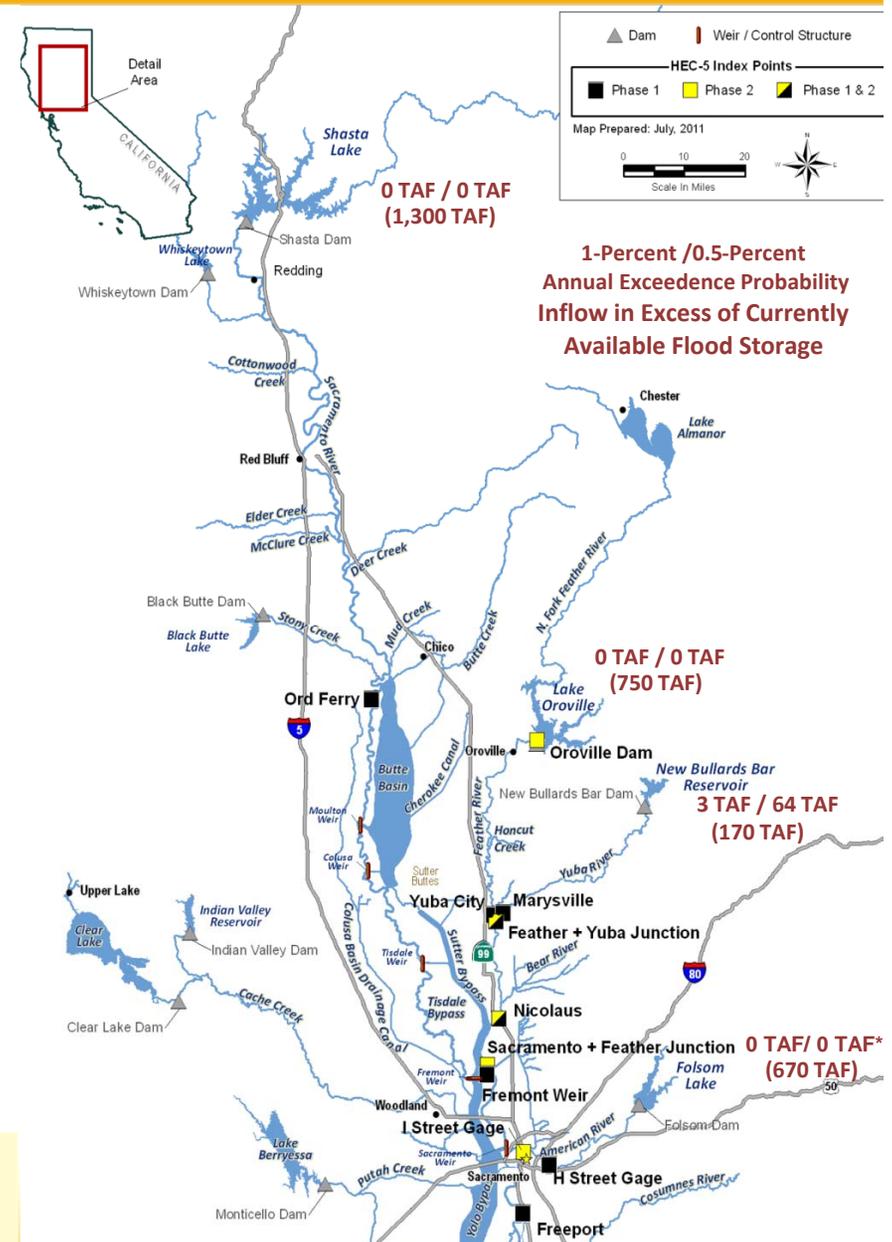
A. Reservoir Storage & Operations

Sacramento River Basin

- Evaluated 4 multi-purpose reservoirs:
 - Shasta, Oroville, New Bullards Bar, and Folsom
 - Considered 100- and 200-year storms
- Opportunities to reduce flood peaks on the Feather River through modified flood storage allocations at Oroville & coordinated operations with New Bullards Bar

Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8B – Reservoir Analysis





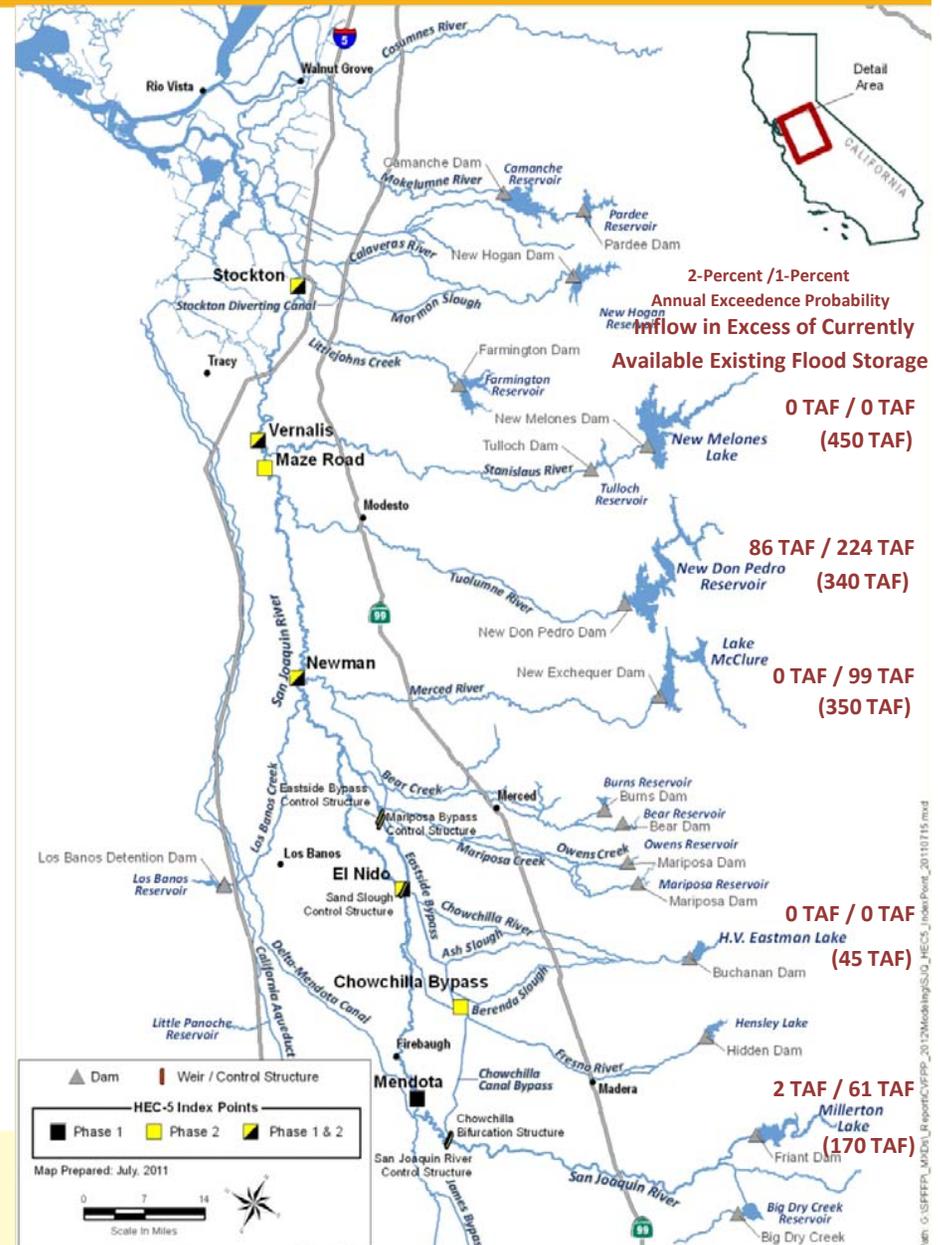
A. Reservoir Storage & Operations (cont.)

San Joaquin River Basin

- Evaluated 5 multi-purpose reservoirs:
 - New Melones, New Don Pedro, Lake McClure, H.V Eastman, and Millerton
 - Considered 50- and 100-year storms
- Opportunities to reduce flood peaks on the San Joaquin River through modified flood storage allocation in New Don Pedro, McClure, and Millerton
- Implementation Challenges:
 - Jurisdictional & ownership constraints
 - Potential impacts to multiple uses

Reference:

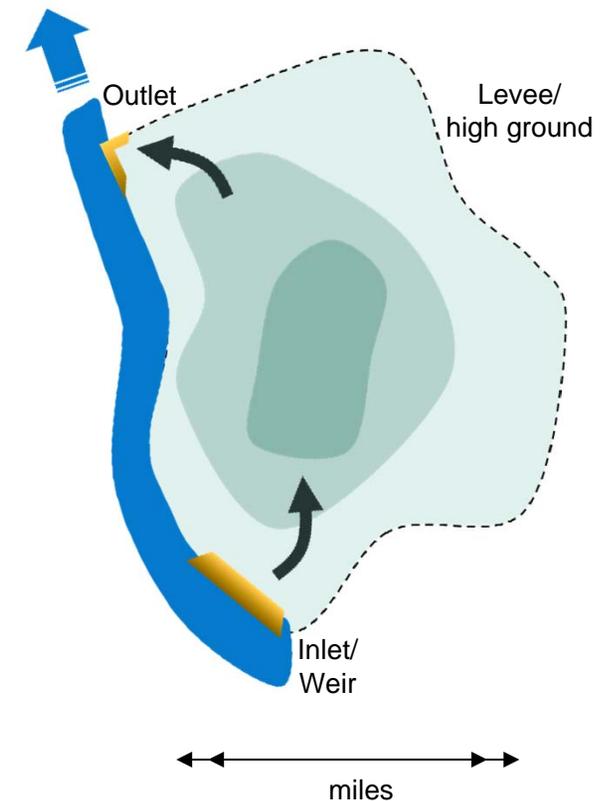
- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8B – Reservoir Analysis





B. Managed Floodplain Storage

- Considered potential benefits of operable floodplain storage in Sacramento and San Joaquin River basins
- Provides local and regional flood peak reduction benefits
- Implementation Challenges
 - Compatibility with existing land uses
 - Effects on infrastructure
 - Floodwater storage capacity



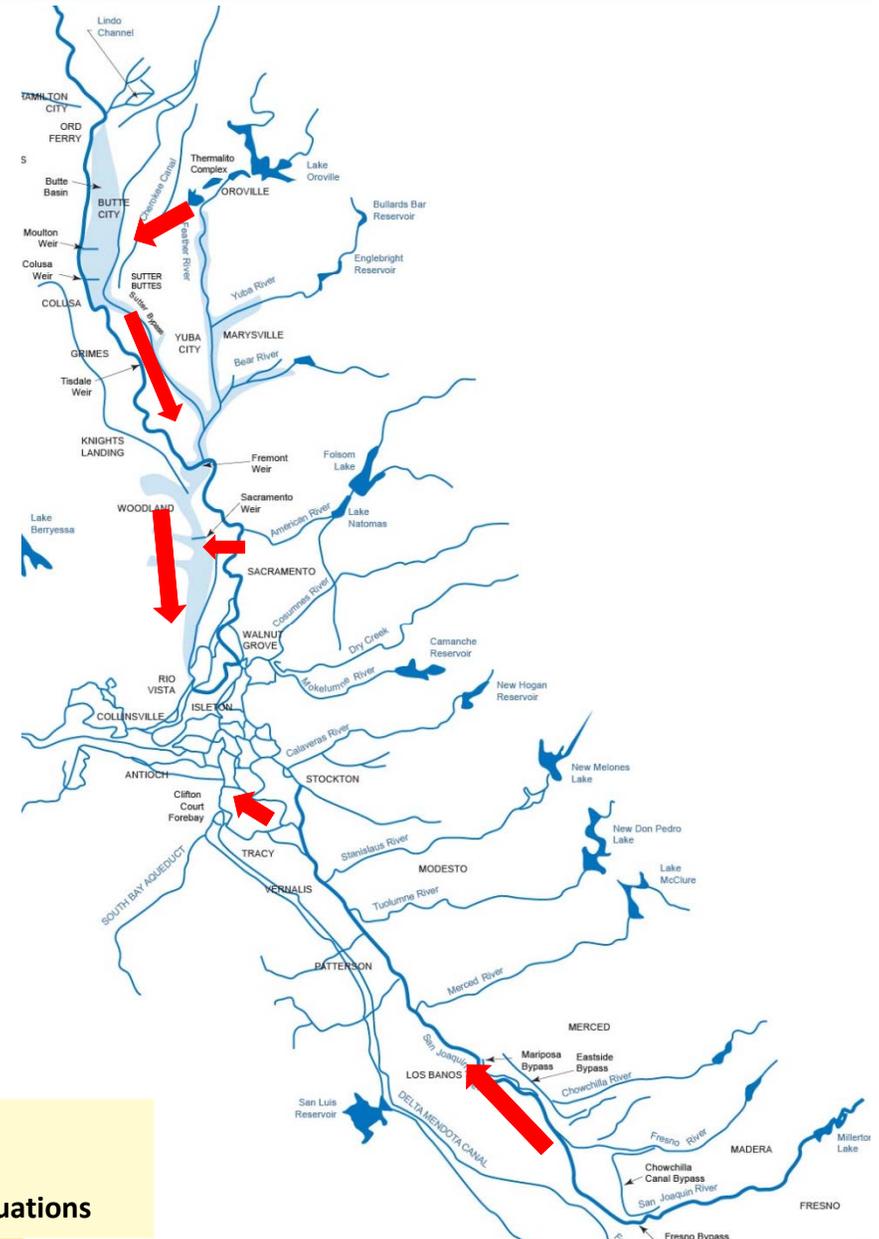
Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8C – Riverine Channel Evaluations



C. Bypass Expansion & Weir Modification

- Bypass modifications considered
 - New bypass and bypass widening
 - Weir modifications
 - Restoring bypass design capacity
- Bypass expansions provide regional & systemwide flood peak reduction and attenuation
- Implementation Challenges
 - Compatibility with existing land uses
 - Effects on infrastructure



Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8C – Riverine Channel Evaluations



D. Floodway Expansion

- Setback levees along the Sacramento, Feather, and San Joaquin rivers are considered in short reaches to address:
 - Chronic O&M sites
 - Ecosystem restoration opportunities
- Provides only local flood peak stage reduction
- Opportunities for improved habitat connectivity (riparian & fishery)
- Implementation Challenges:
 - Perched river system
 - Infrastructure and existing land uses
 - Localized flood management benefits

Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8C – Riverine Channel Evaluations
- CVFPP Attachment 9F – Floodplain Restoration Opportunities Analysis





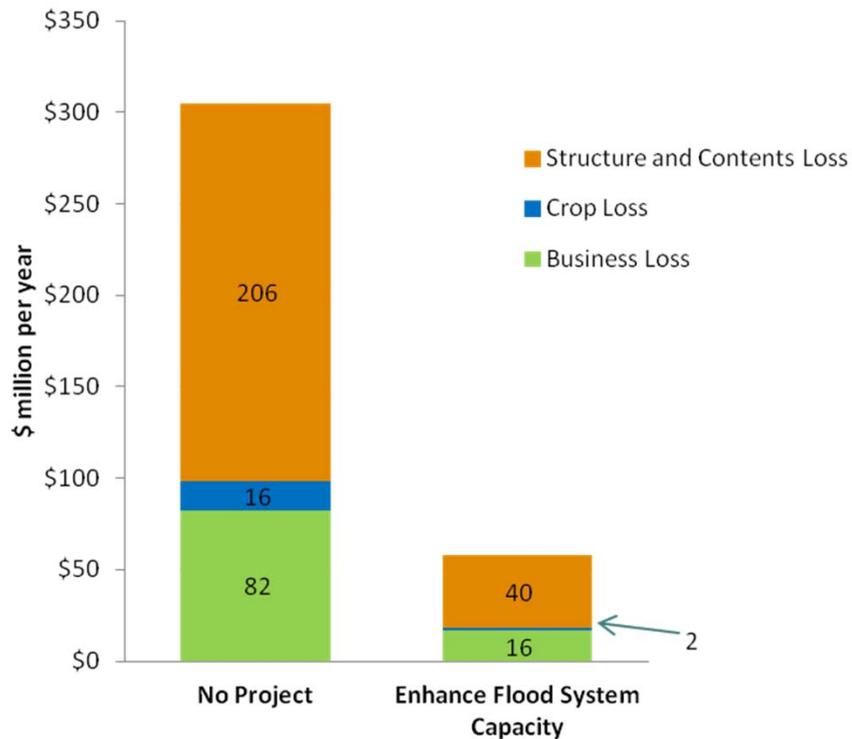
Summary of Approach Elements

Flood Management Element	Sacramento River Basin	San Joaquin River Basin
Achieve SPFC Design Flow Capacity Approach Elements		
Protect High Risk Communities Approach Elements		
System Elements:		
A. Reservoir storage and operations	<ul style="list-style-type: none"> ○ Oroville ○ New Bullards Bar 	<ul style="list-style-type: none"> ○ Don Pedro ○ McClure ○ Millerton
B. Managed floodplain storage	<ul style="list-style-type: none"> ○ Up to 200,000 acre-feet 	<ul style="list-style-type: none"> ○ Up to 100,000 acre-feet
C. Bypass expansion and weir modifications	<ul style="list-style-type: none"> ■ Feather River Bypass ■ Sutter, Yolo, Sacramento Bypass expansion ■ Fremont weir widening 	<ul style="list-style-type: none"> ■ Paradise Cut Expansion ○ Upper San Joaquin Bypass Reconstruction
D. Floodway expansion	<ul style="list-style-type: none"> ○ 45 miles 	<ul style="list-style-type: none"> ○ 55 miles
Conservation Elements	Integrated with above	

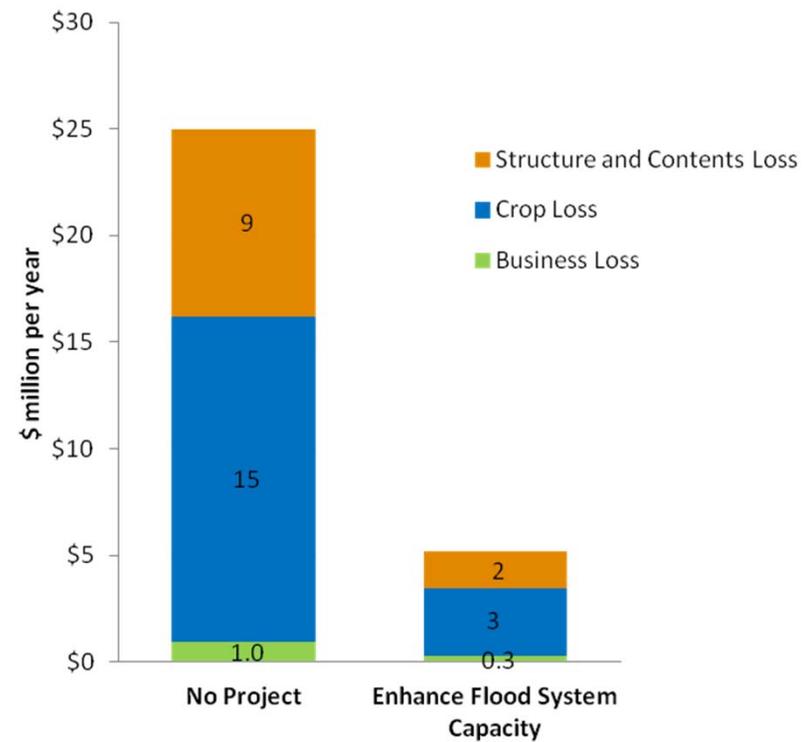
■ System elements also considered in the State Systemwide Investment Approach



Flood Damage



Sacramento River Basin



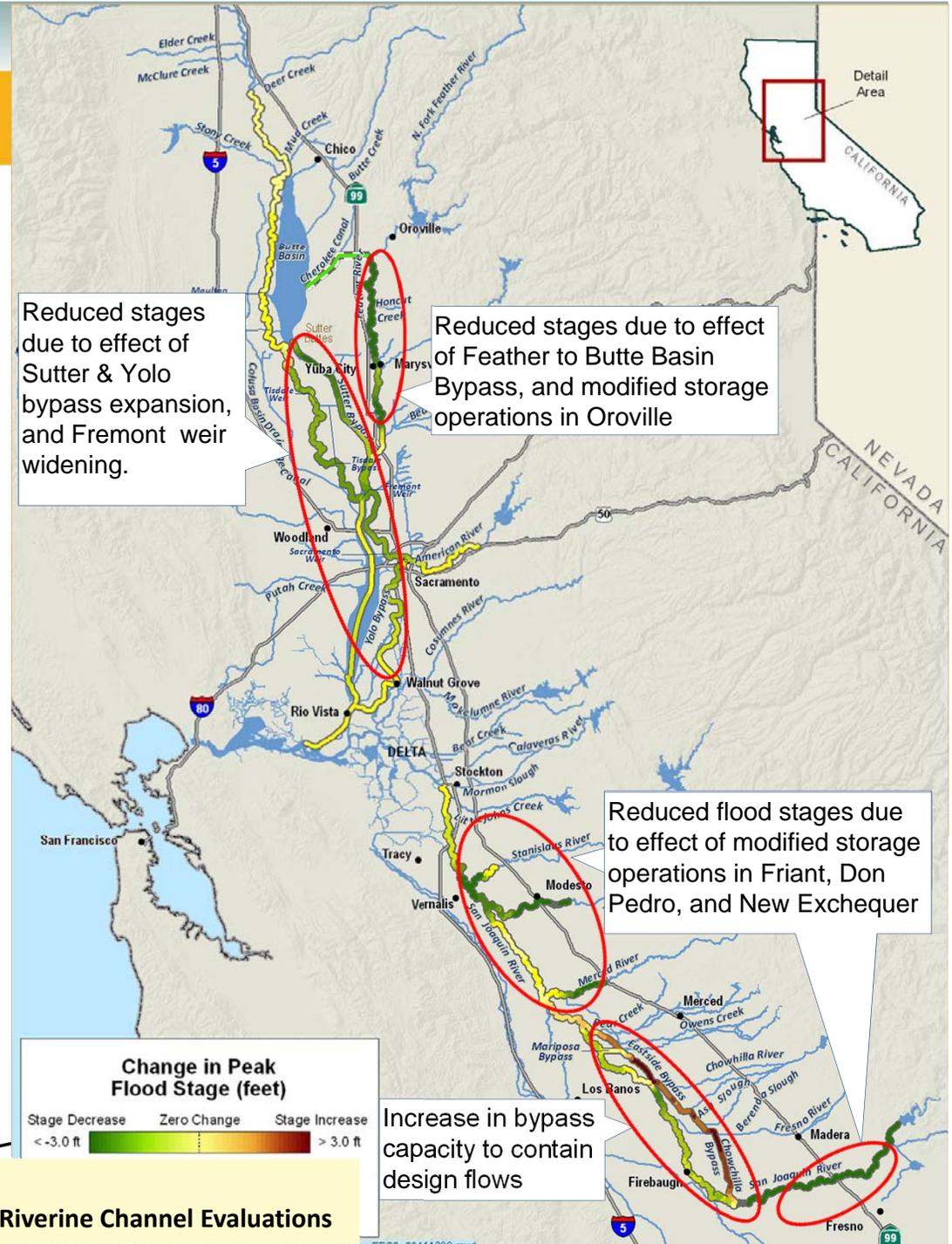
San Joaquin River Basin





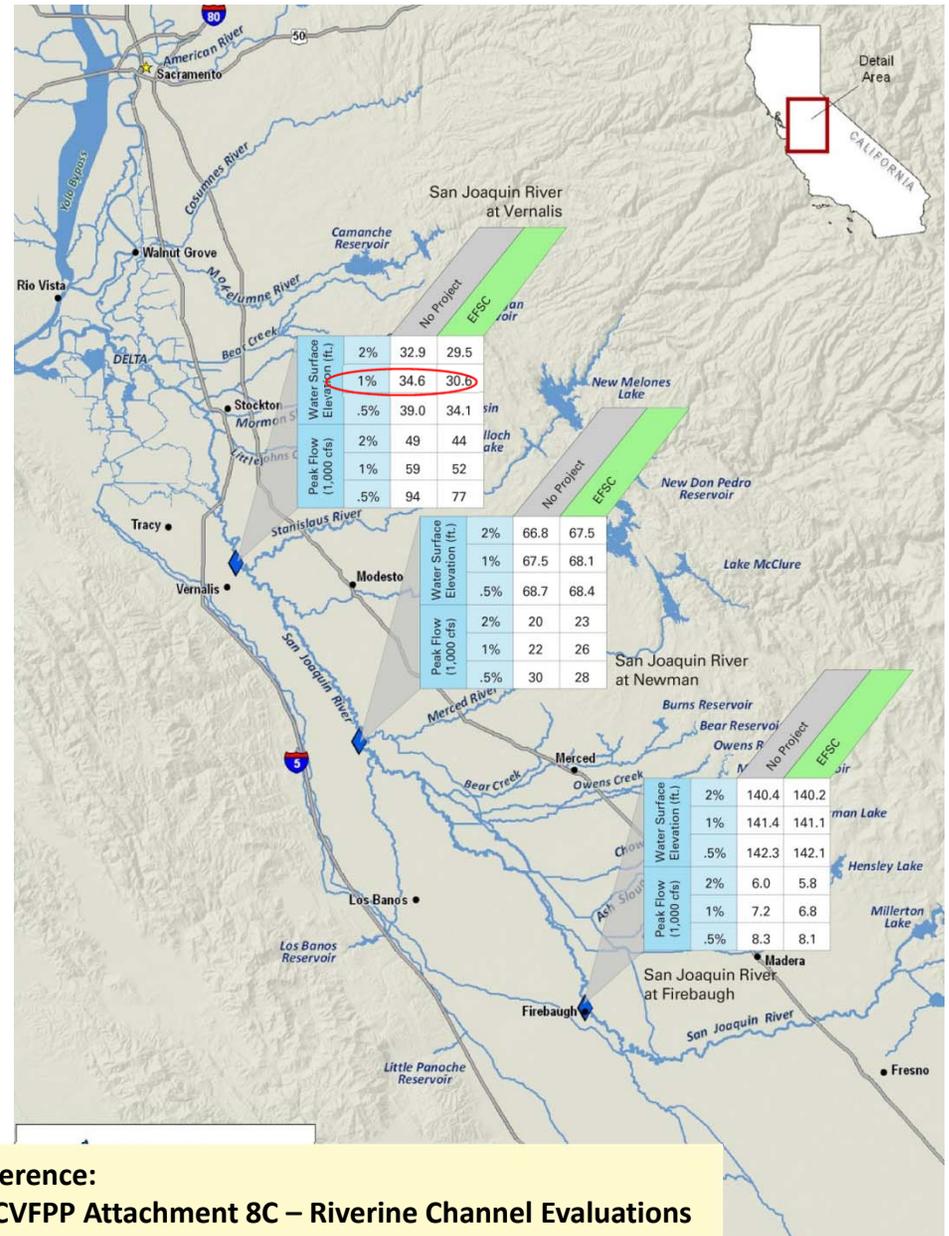
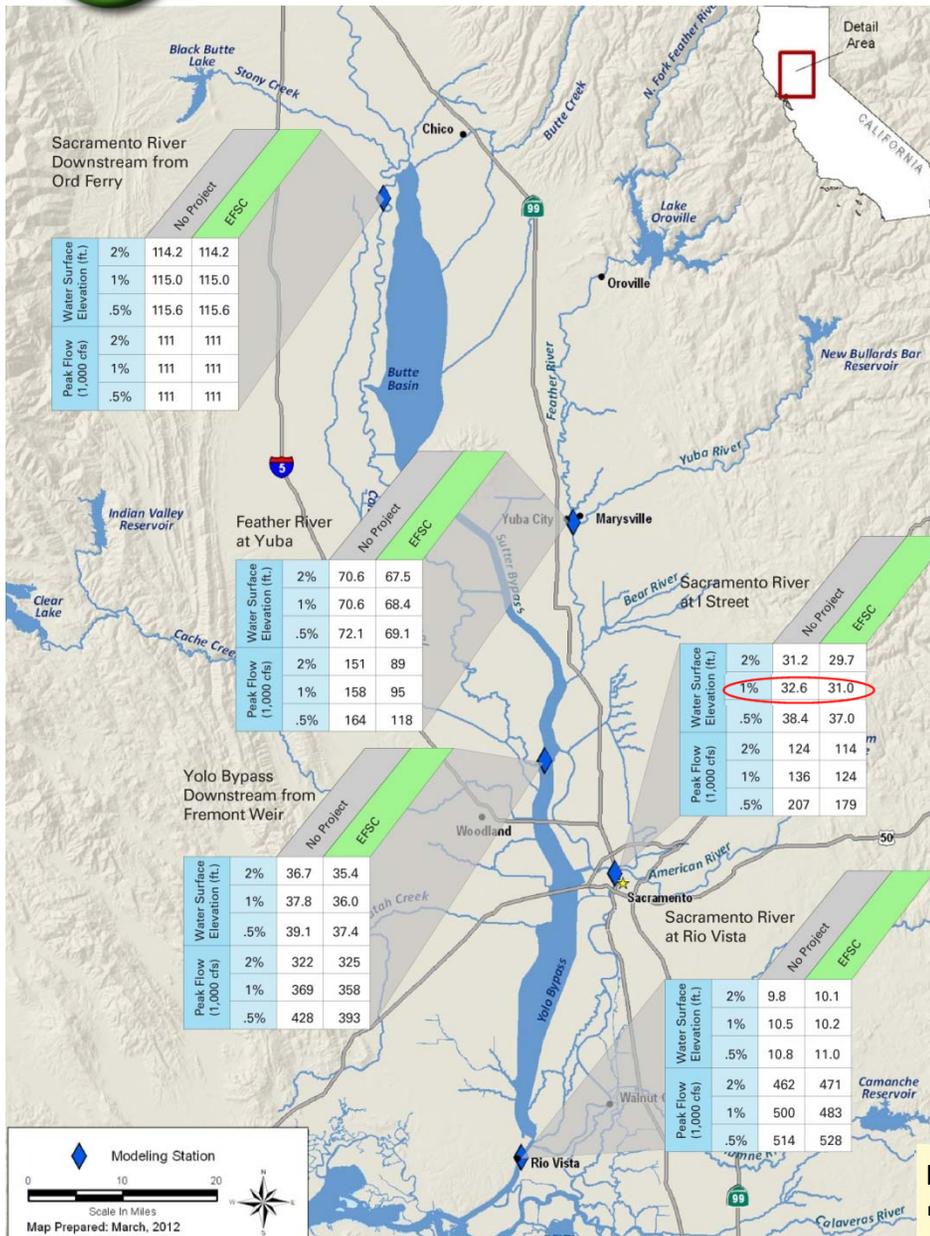
Flood Stage

- Lower flood stages systemwide because flood peaks are lowered by storage and bypass expansion
- Increased flood stages in Upper San Joaquin River Bypass system because of improved levee reliability





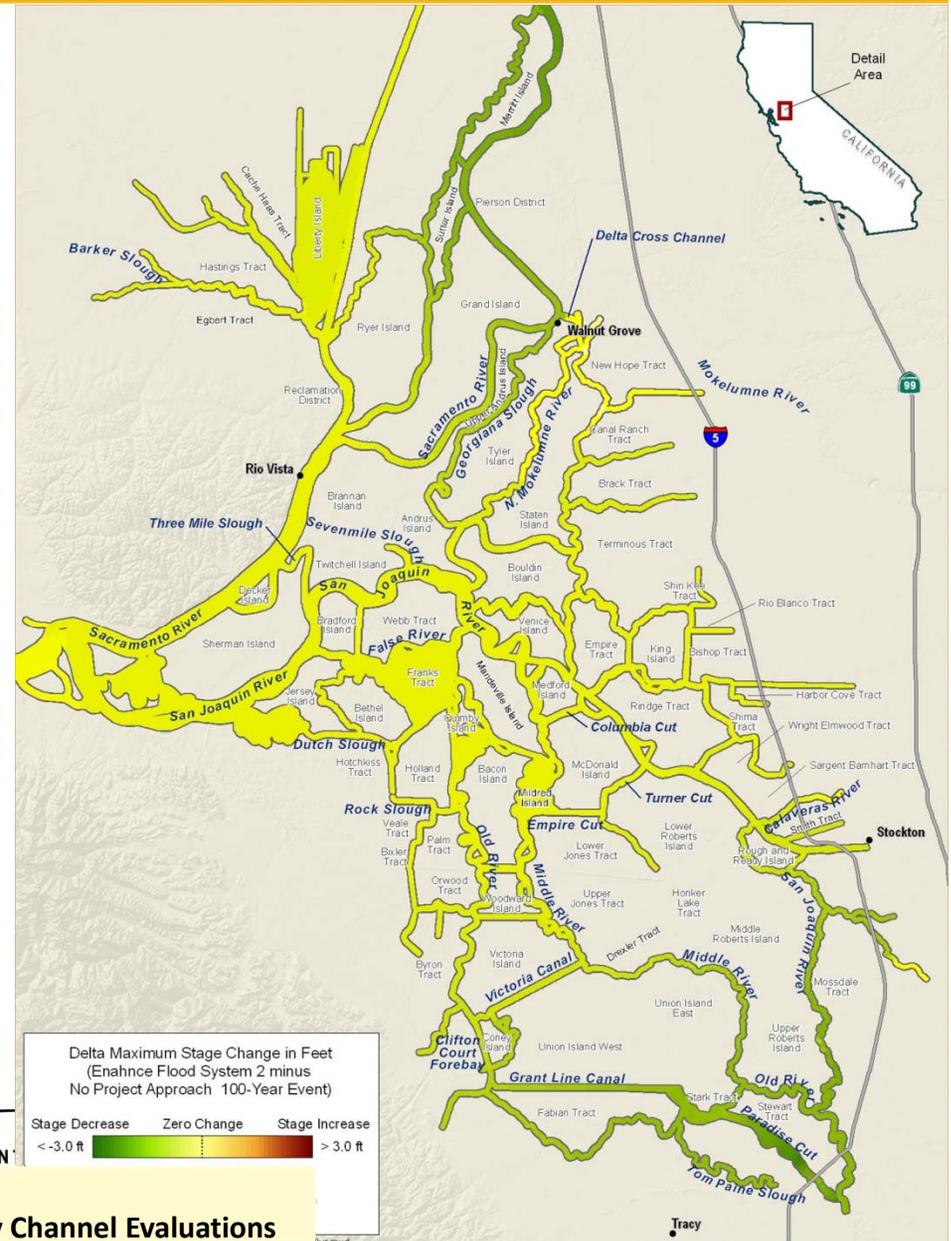
Peak Stage & Flow at Key Locations





Delta Stage

- Reduction in Delta peak flood stage compared to No Project
- Increased storage and bypass expansions attenuate and shift flood peak timing and magnitude





Key Findings

- Very high costs: \$32 to \$41 billion
- Reduce economic flood damages by 81% and life risk by 60%
- Improved levels of flood protection systemwide:
 - Urban areas meet and exceed 200-year (0.5% annual chance) level of flood protection
 - Many small communities meet 100-year (1% annual chance) level of flood protection
 - Most areas, including rural-agricultural areas, benefit from lower flood stages and improved levee conditions

Reference: CVFPP Attachments:

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- 8D – Estuary Channel Evaluations
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Key Findings (cont.)

- Includes significant ecosystem features and opportunities for multipurpose projects:
 - Improve ecosystem functions
 - Integrate other benefits (water supply, recreation)
 - Address erosion and other chronic O&M challenges related to conflicts with natural geomorphic processes
- Improve system resiliency and ability to adapt to future changes

Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8I – Benefit Assessment Framework



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The State Systemwide Investment Approach



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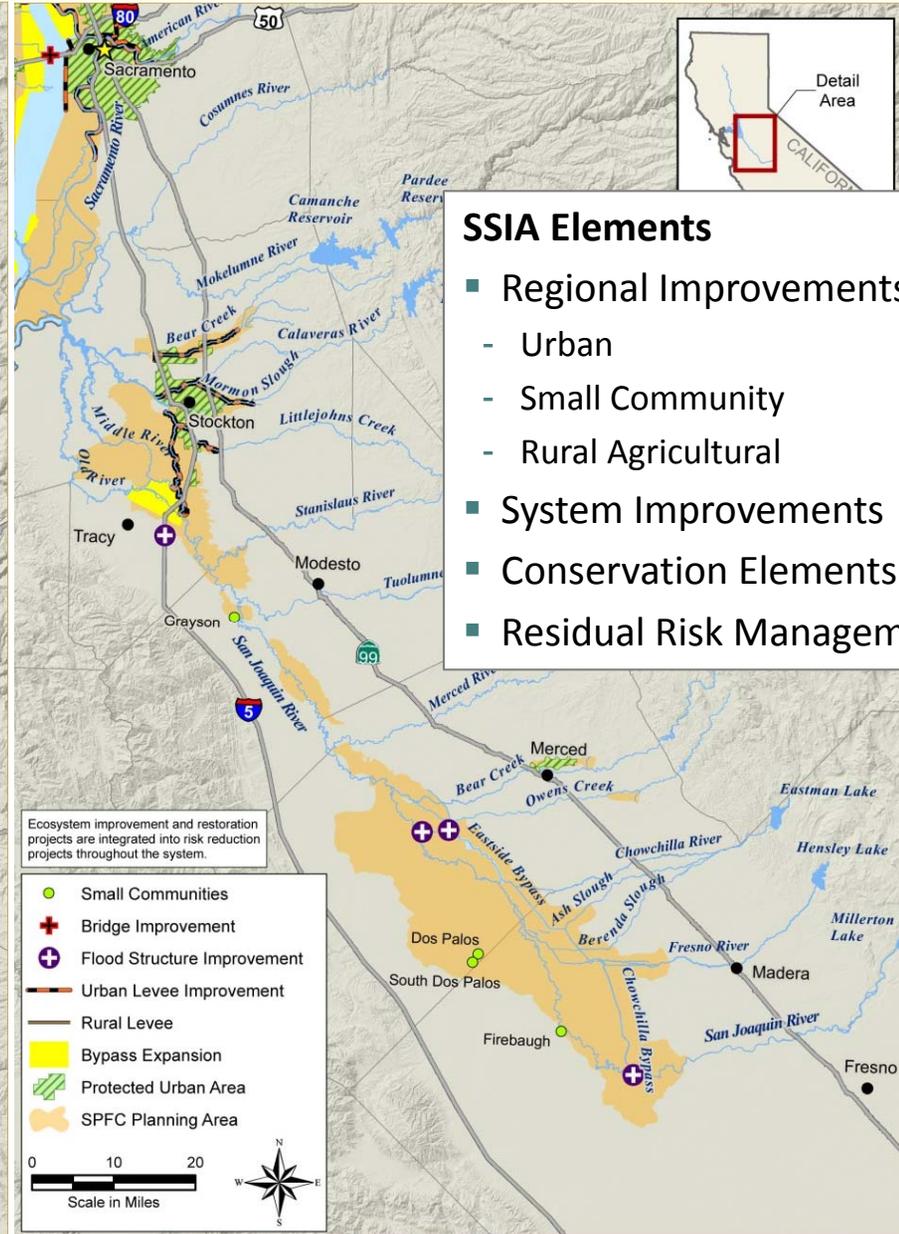
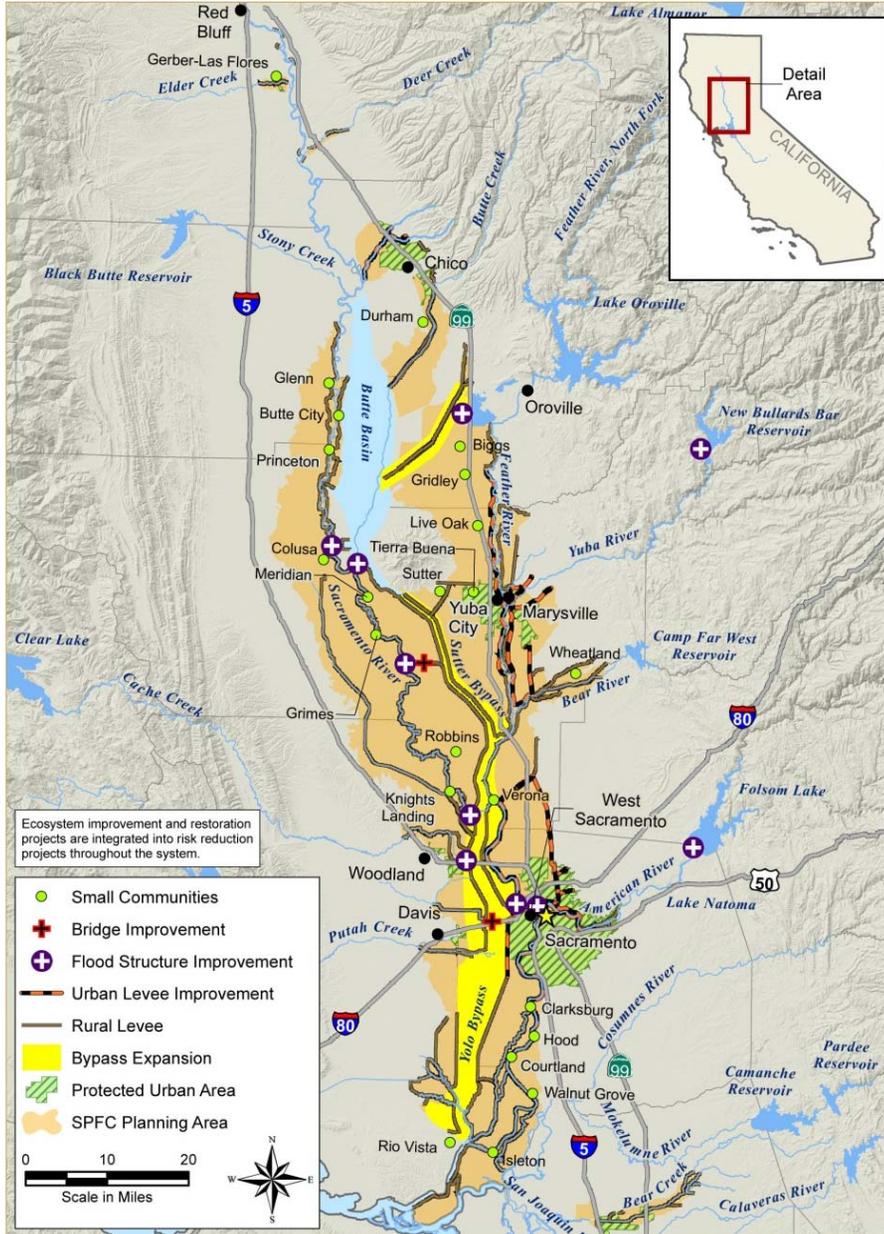
Approach Overview

- Emphasis on State interests, systemwide benefits, and sustainability
- Protection commensurate with level of risk
- Promote actions that increase system flexibility and adaptability
- Integration of ecosystem restoration opportunities





Physical Features of the SSIA



SSIA Elements

- Regional Improvements
 - Urban
 - Small Community
 - Rural Agricultural
- System Improvements
- Conservation Elements
- Residual Risk Management



Regional Improvements

Flood Management Element	Achieve SPFC Design Flow Capacity	Protect High Risk Communities	Enhance Flood System Capacity		SSIA
Urban Improvements					
Target 200-Year Level of Protection		■	■	→	■
Target SPFC Design Capacity	■				
Non-SPFC Urban Levee Improvements	■	■	■	→	■
Small Community Improvements					
Target 100-Year Level of Protection		■	■	→	□
Target SPFC Design Capacity	■		■		
Rural-Agricultural Improvements					
Site-Specific Rural-Agricultural Improvements				→	■
Target Design Capacity	■		■		

□ Structural or nonstructural improvements will be considered based on a case by case assessment





System Improvements

Flood Management Element	Achieve SPFC Design Flow Capacity	Protect High Risk Communities	Enhance Flood System Capacity		SSIA
Bypasses					
New Bypass Construction and Existing Bypass Expansion			■	→	■
Reservoir Storage and Operations					
Forecast-Coordinated Operations/ Forecast- Based Operations	■	■	■	→	■
Reservoir Storage/Enlarge Flood Pool			■		
Easements			■		
Flood Structure Improvements					
Major Structures			■	→	■
System Erosion and Bypass Sediment Removal Project			■	→	■





Conservation Elements

Flood Management Element	Achieve SPFC Design Flow Capacity	Protect High Risk Communities	Enhance Flood System Capacity		SSIA
Ecosystem Restoration					
Fish Passage Improvements			■	→	■
Ecosystem Restoration & Enhancement (for areas within new or expanded bypasses, contributing to or incorporated with flood risk reduction projects)			■	→	■
River Meandering and Other Ecosystem Restoration Activities			■	→	□

□ No specific project sites are identified and actions will be considered on case by case basis assessment





Residual Risk Management

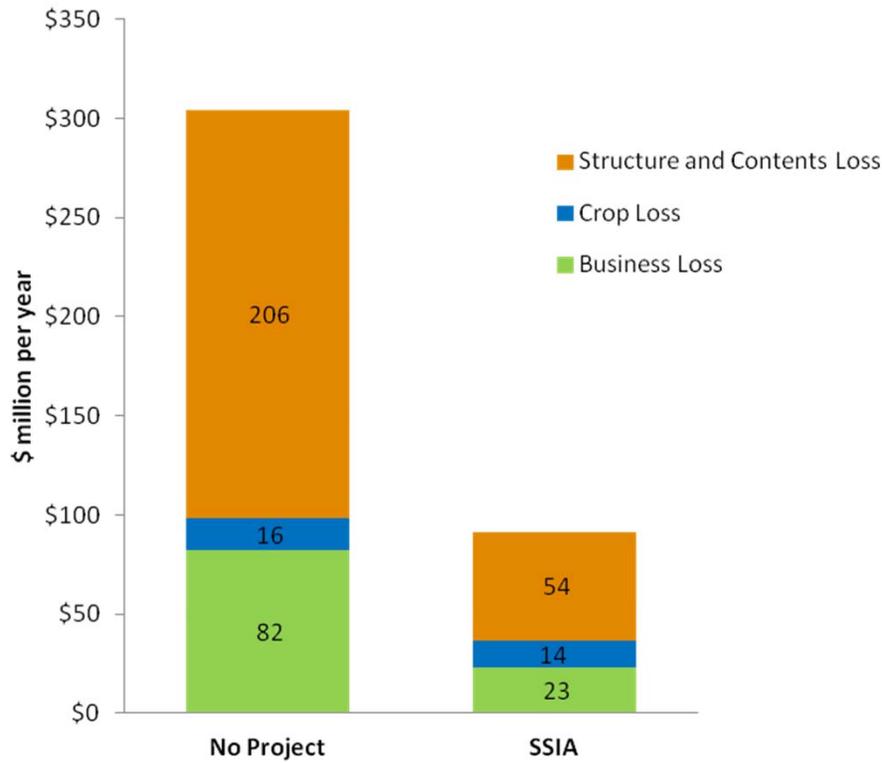
- Enhanced Flood Emergency Response
- Enhanced Operations and Maintenance
- Floodplain Management



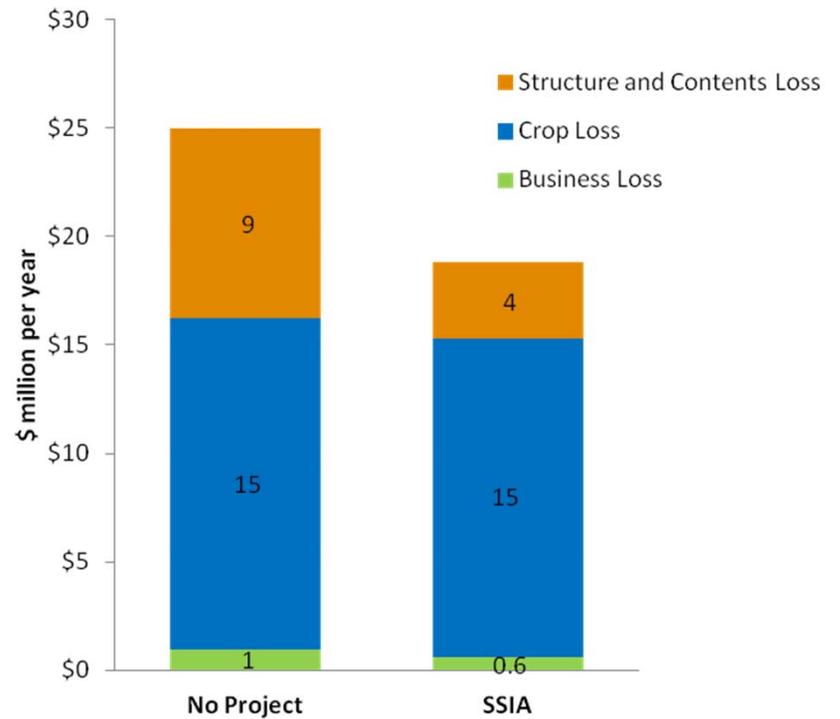
All-weather access roads on levee crowns for quick response to flood emergencies



Flood Damage



Sacramento River Basin

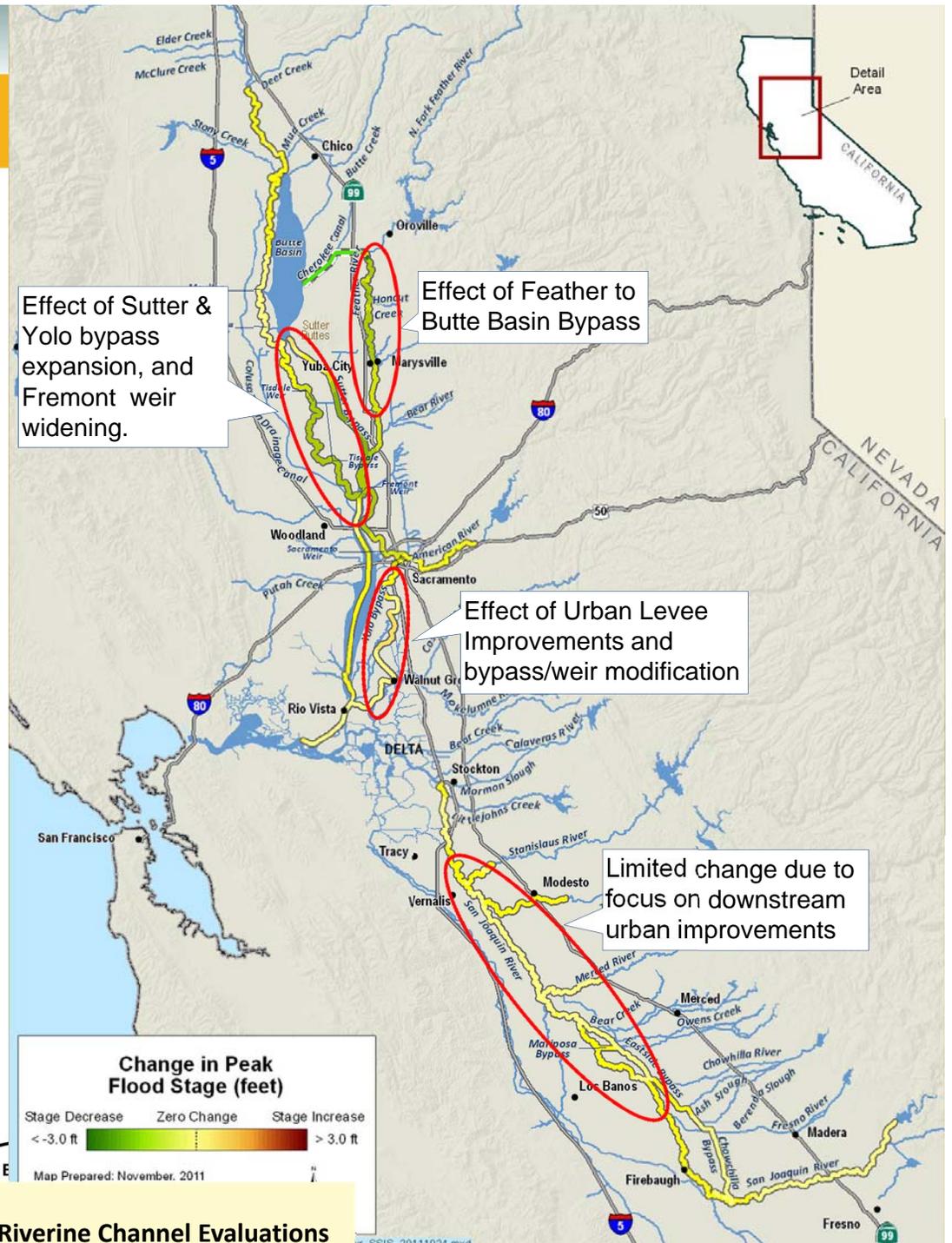


San Joaquin River Basin



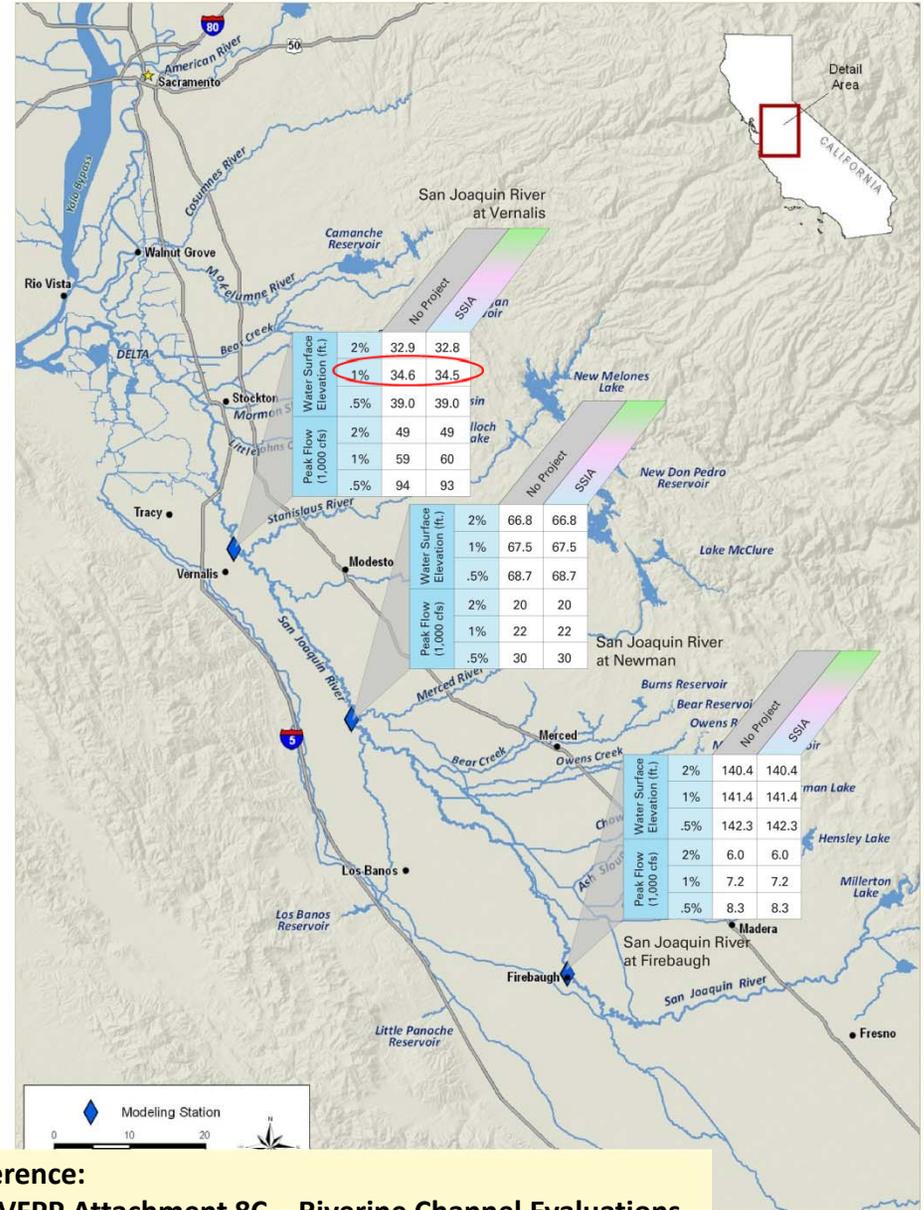
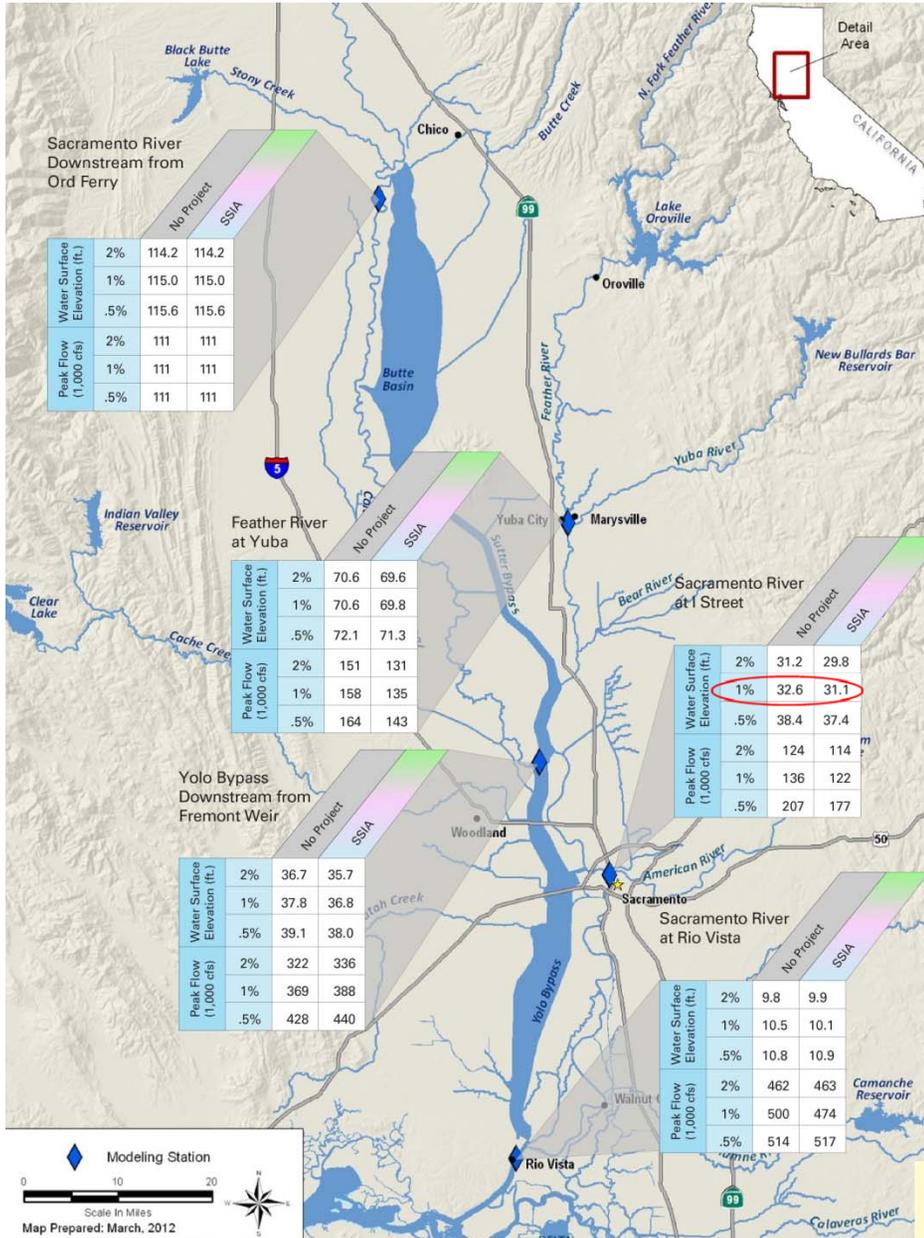
Flood Stage

- Overall reduced peak flood stages systemwide because of bypass expansions
- Flood stages may increase locally in certain reaches





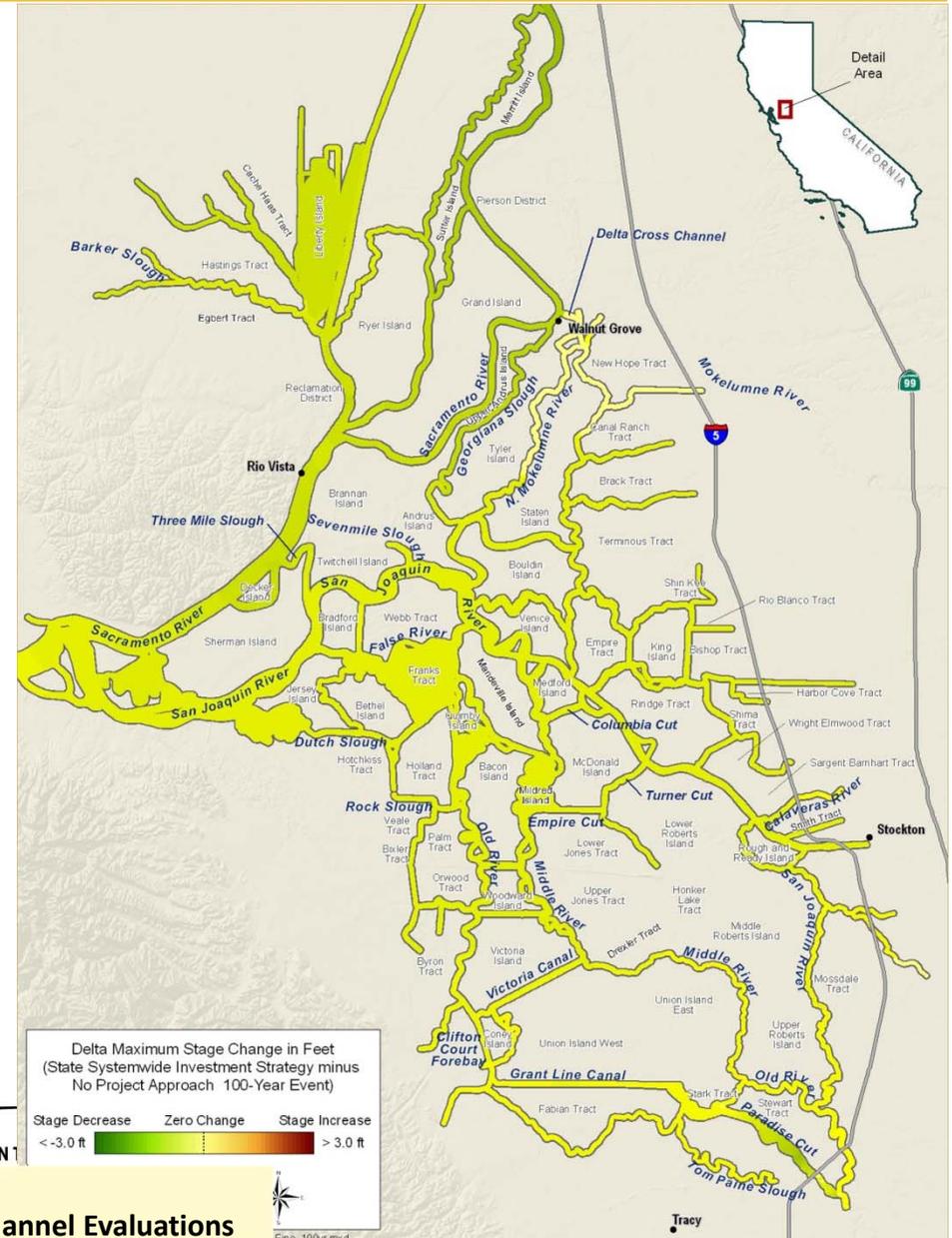
Peak Stage & Flow at Key Locations





Delta Stage

- Limited change in Delta peak flood stage between No Project and SSIA
- Bypass expansions enhance in-system storage and shift peak flood timing and magnitude





Key Findings

- Cost: \$14 to \$17 billion
- Reduce economic flood damages by 66% and life risk by 50%
- Levels of flood protection would improve throughout the system:
 - Urban areas meet 200-year (0.5% annual chance) level of flood protection
 - Many small communities meet 100-year (1% annual chance) level of flood protection
 - Most areas, including rural-agricultural areas, benefit from lower flood stages due to system improvements

Reference: CVFPP Attachments:

- 7 – Plan Formulation
- 8C – Riverine Channel Evaluations
- 8D – Estuary Channel Evaluations
- 8F – Flood Damage Analysis
- 8G – Life Risk Analysis
- 8J – Cost Estimates





Key Findings (cont.)

- Addresses erosion and other chronic O&M challenges and reduces long-term flood system O&M costs
- Integrate other benefits (water supply, recreation)
- Improve system resiliency and ability to adapt to future changes
- Implementation of improvements will contribute to regional economy
 - 6,500 annual equivalent jobs
 - \$850 to \$1,000 million annual economic “ripple” effects

Reference:

- CVFPP Attachment 7 – Plan Formulation
- CVFPP Attachment 8H – Regional Economic Analysis
- CVFPP Attachment 8I – Benefit Assessment Framework





Key Findings - Environmental Benefits

- Enhance opportunities to integrate ecosystem functions in planning and designs for all flood risk reduction projects:
 - Fish passage improvements at SPFC weirs, bypasses, and other flood management facilities
 - Preserve shaded riparian aquatic habitat and improve connectivity
 - Opportunities for habitat restoration (e.g., wetlands) within bypasses
- Achieve overall habitat improvement and reduce ecosystem impacts

Reference:

- CVFPP Attachment 2 – Conservation Framework
- CVFPP Attachment 9 – Conservation Framework Supporting Documentation



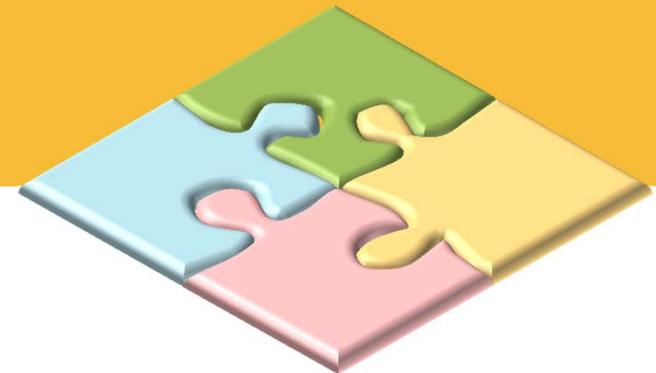
Board Questions

PUBLIC SAFETY

ENVIRONMENTAL STEWARDSHIP

ECONOMIC STABILITY

Approach Comparison & Summary

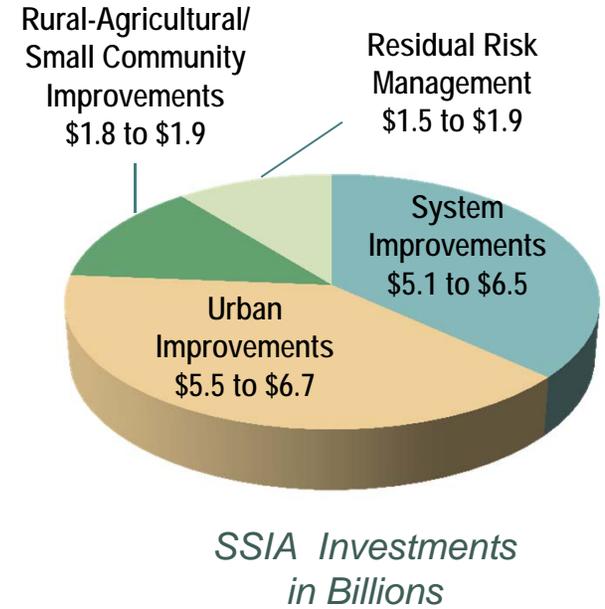
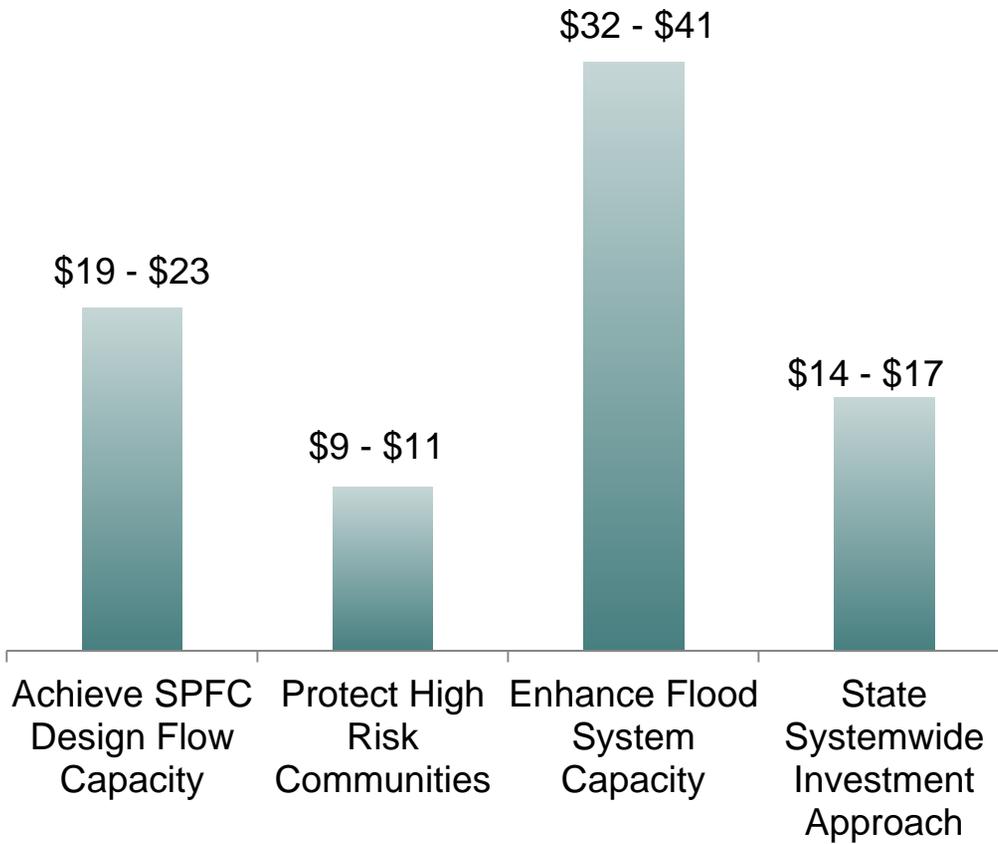


PUBLIC SAFETY

ENVIRONMENTAL STEWARDSHIP

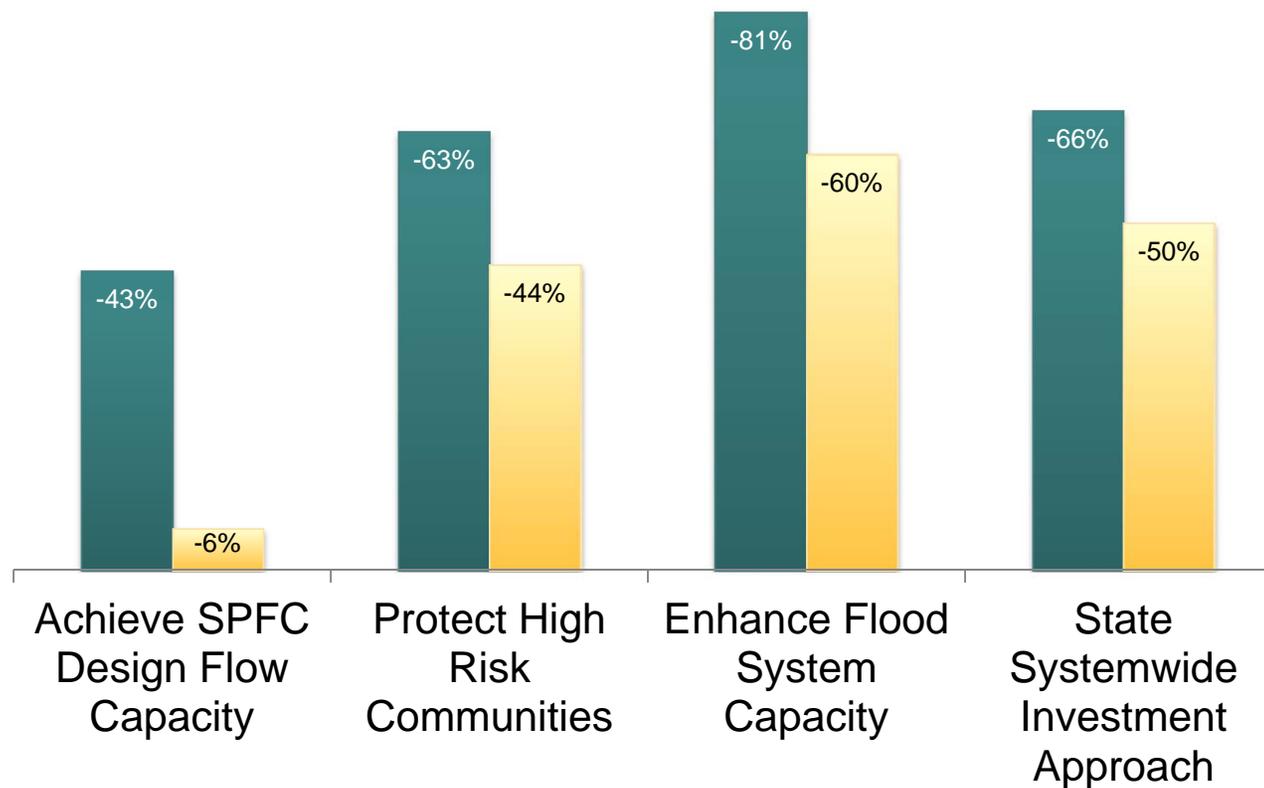
ECONOMIC STABILITY

Approach Comparison – Cost



Approach Comparison - Risk Reduction

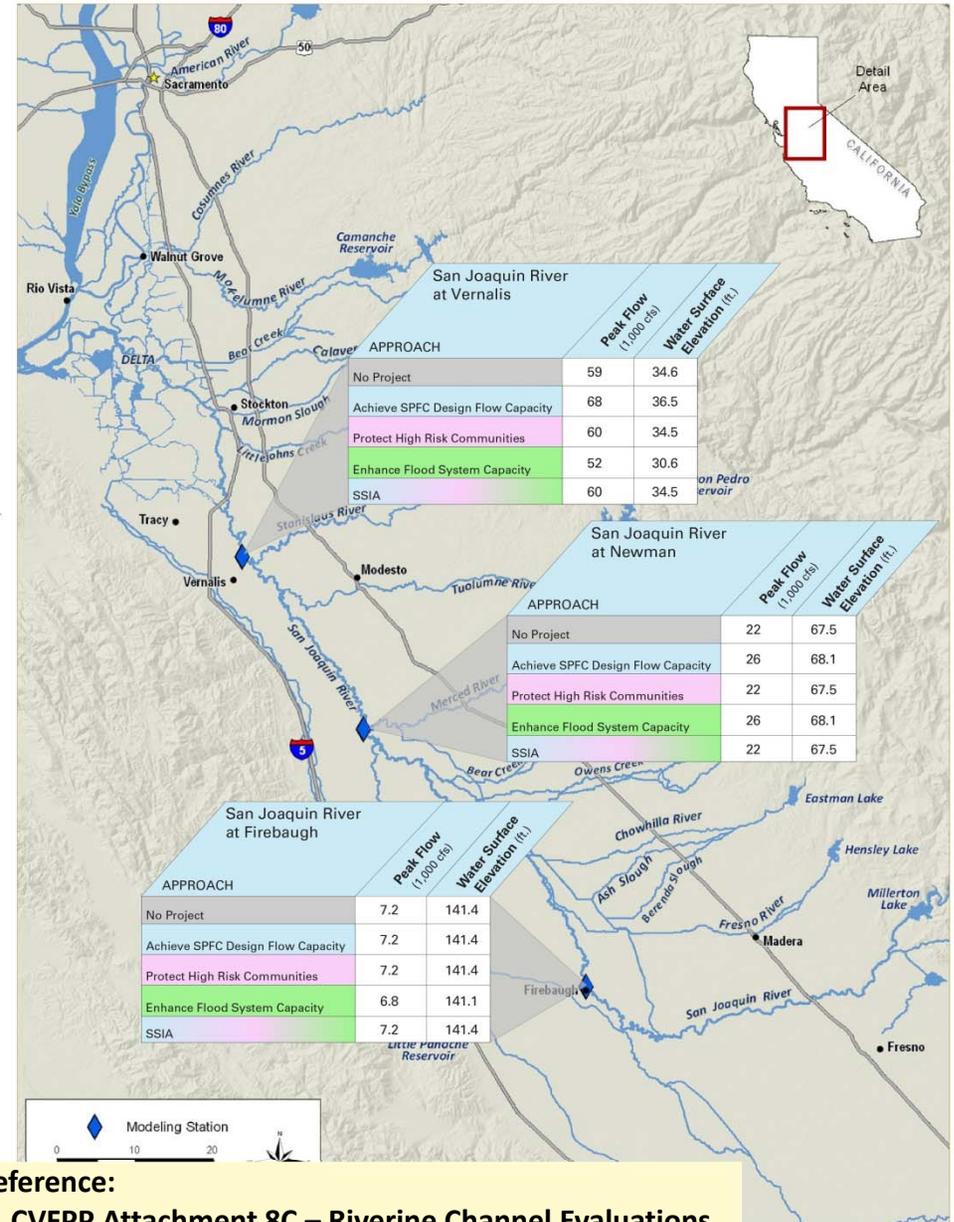
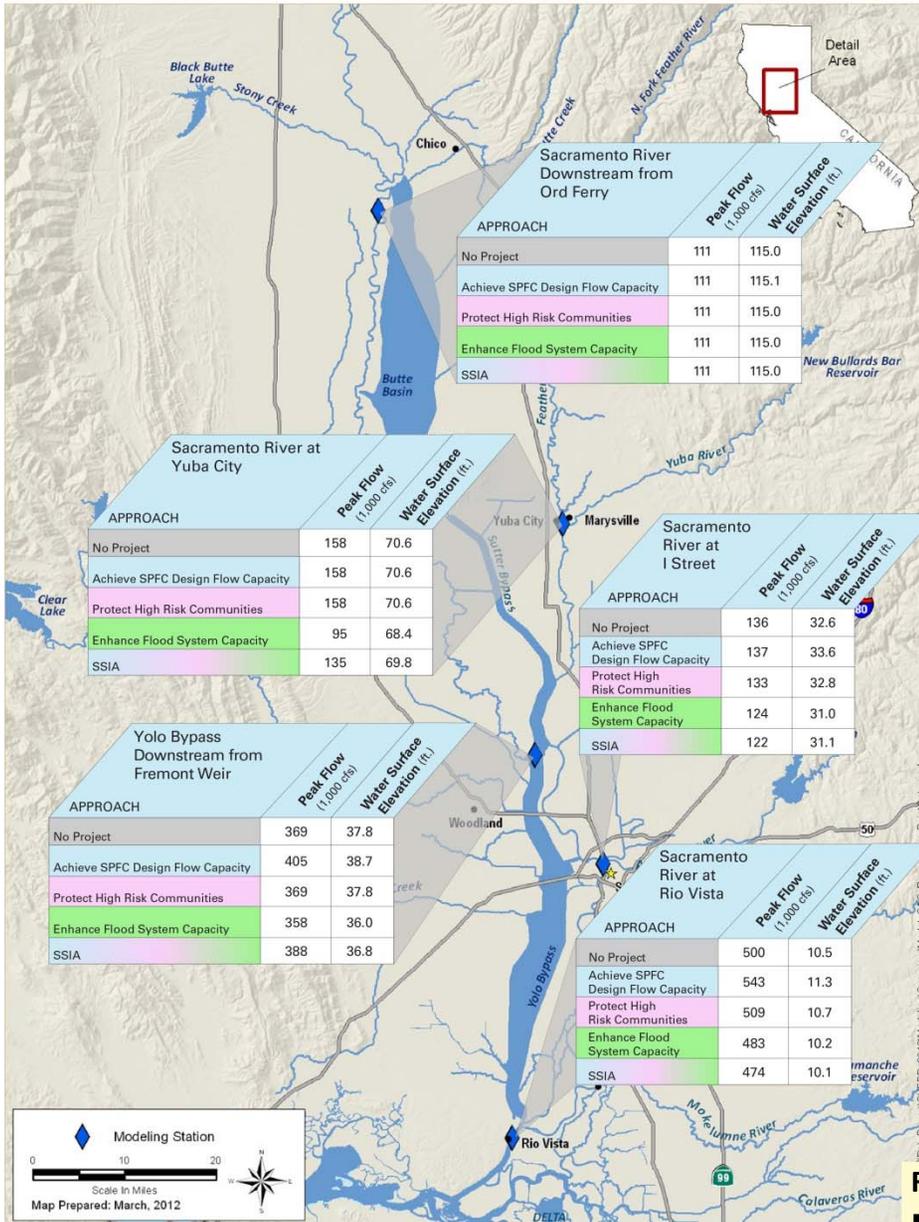
■ Flood Damage ■ Life Risk



Reference:

- CVFPP Attachment 8F – Flood Damage Analysis
- CVFPP Attachment 8G– Life Risk Analysis

Approach Comparison – Stage & Flow



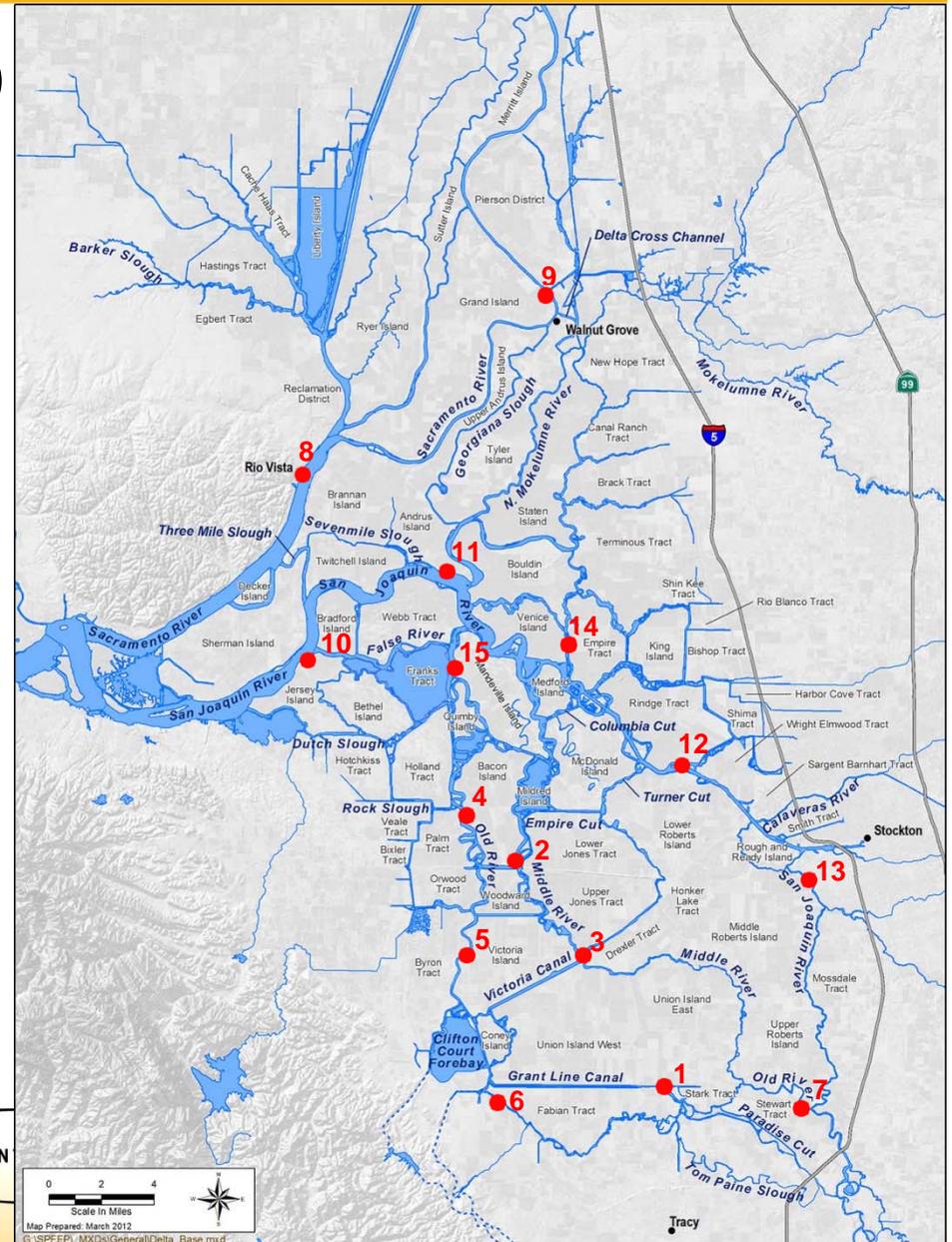
Reference:

- CVFPP Attachment 8C – Riverine Channel Evaluations

Approach Comparison – Delta Stage

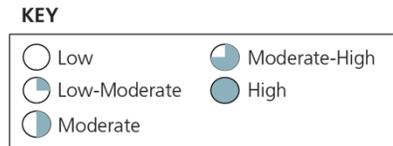
Change in stages for 100-year event (feet)

Location	Achieve SPFC Design Flow Capacity	Protect High Risk Communities	Enhance Flood System Capacity	State Systemwide Investment Approach
1	1.71	-0.09	-1.13	-0.18
2	0.17	-0.02	-0.29	-0.35
3	0.28	-0.02	-0.45	-0.29
4	0.17	-0.01	-0.26	-0.34
5	0.26	-0.02	-0.45	-0.29
6	1.00	-0.06	-0.81	-0.17
7	2.04	-0.07	-1.27	-0.13
8	1.18	-0.02	-0.22	-0.61
9	0.86	-0.23	-1.08	-0.87
10	0.16	-0.01	-0.22	-0.35
11	0.21	-0.01	-0.22	-0.33
12	0.28	-0.02	-0.28	-0.32
13	0.81	-0.06	-0.78	-0.27
14	0.26	-0.01	-0.21	-0.30
15	0.2	-0.01	-0.23	-0.33



Performance Comparison

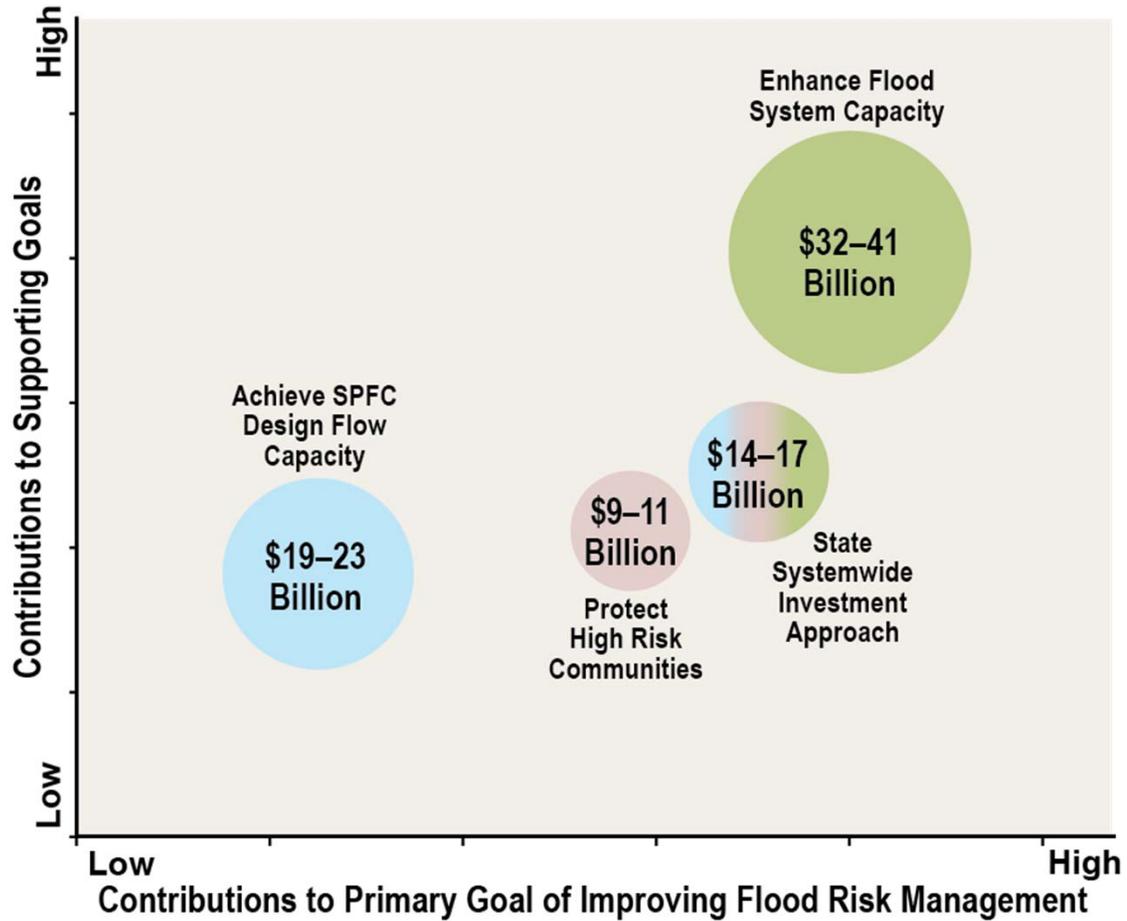
PERFORMANCE CATEGORY	ACHIEVE SPFC DESIGN FLOW CAPACITY	PROTECT HIGH RISK COMMUNITIES	ENHANCE FLOOD SYSTEM CAPACITY	STATE SYSTEMWIDE INVESTMENT APPROACH
★ Flood Risk Reduction Benefit	Low-Moderate	Low-Moderate	High	Moderate
Level of Flood Protection	Low-Moderate	Low-Moderate	High	Low-Moderate
Life Safety	Low-Moderate	Low-Moderate	Low-Moderate	Low-Moderate
Economic Damages	Low-Moderate	Low-Moderate	Low-Moderate	Moderate
Regional Economics	Low-Moderate	Low-Moderate	High	Moderate
★ Cost Efficiency	Low-Moderate	Low-Moderate	Low-Moderate	Low-Moderate
Capital Costs Efficiency	Low-Moderate	High	Low	Low-Moderate
Improve Operations & Maintenance	Low	Low-Moderate	High	Low-Moderate
★ Integration & Sustainability	Low	Low-Moderate	High	Low-Moderate
Promote Ecosystem Functions	Low	Low	High	Low-Moderate
Promote Multi-Benefit Projects	Low	Low-Moderate	High	Low-Moderate
Sustainable Land Uses	Low	Low-Moderate	High	Moderate



- CVFPP Attachment 7 – Plan Formulation
- Briefing Handout #4



Relative Cost and Performance

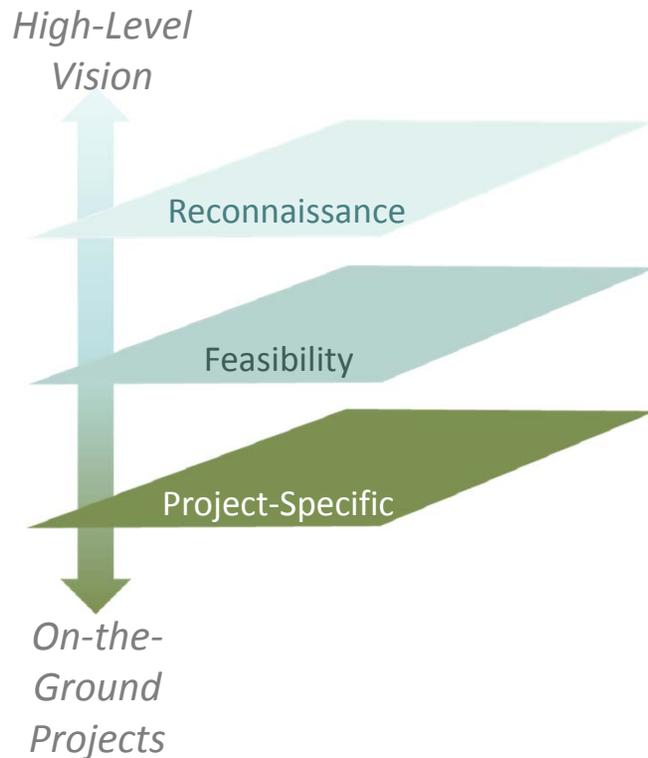


KEY: SPFC = State Plan of Flood Control

Summary

- Reconnaissance level at systemwide scale
 - Not local/reach-specific
 - Existing and available tools and data
- Analyses informed development of SSIA
 - Identified most promising elements
 - Focus investments on
 - People and assets at risk
 - System resiliency and multi-benefit projects
 - Residual risk management

NEXT Steps



- Additional work to do to refine plan elements:
 - **Regional Planning** - DWR will work with local agencies in nine regions to develop regional plans
 - **Basin-wide Feasibility Studies** – DWR will prepare two basin-wide feasibility studies to define State interest in system improvements
- Continue implementing ongoing flood management programs

Board Questions

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