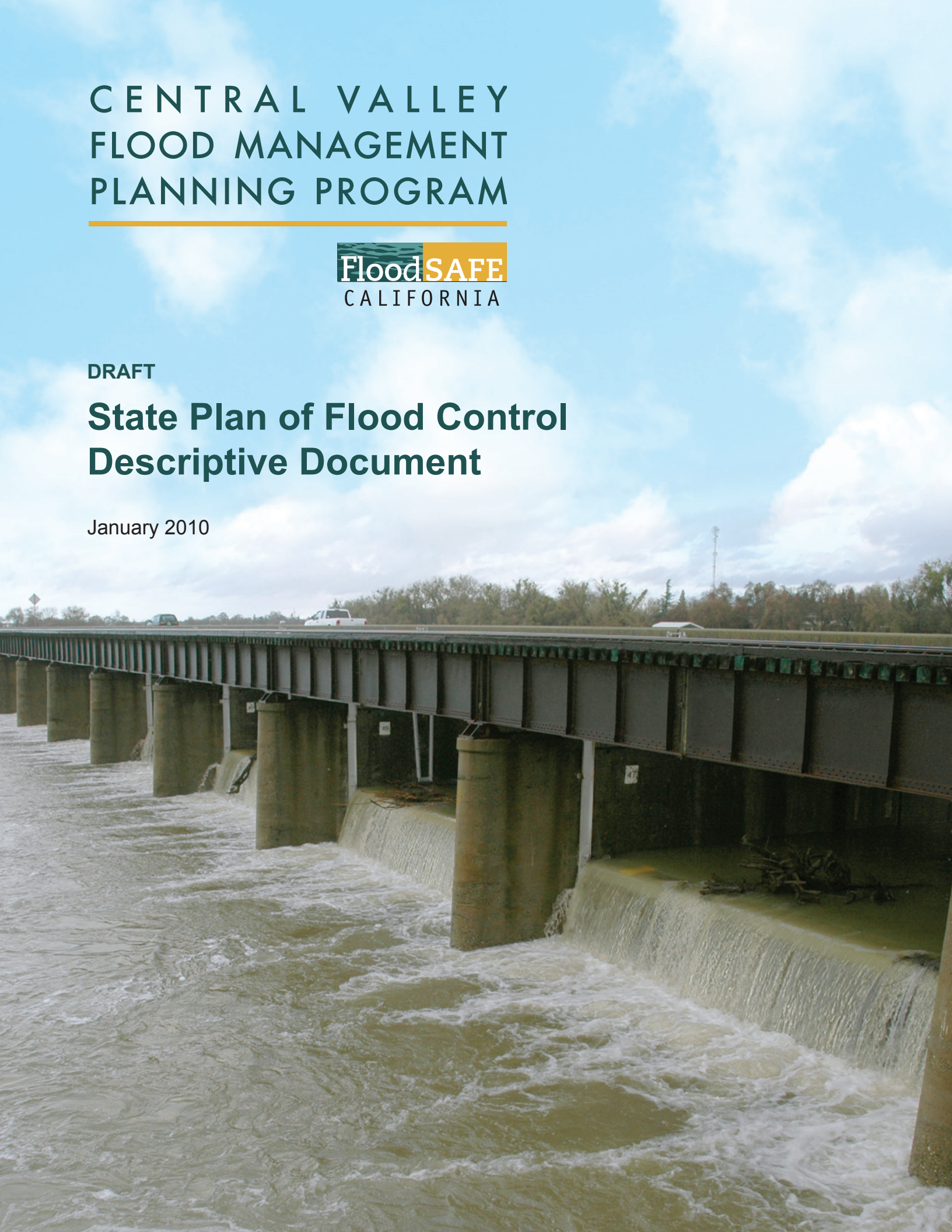
CENTRAL VALLEY
FLOOD MANAGEMENT
PLANNING PROGRAM

FloodSAFE
CALIFORNIA

DRAFT

State Plan of Flood Control Descriptive Document

January 2010



Cover Photo:

Sacramento Weir is part of the
State Plan of Flood Control.

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Guide to Report

This report provides an inventory and description of the existing flood control works (facilities), lands, programs, plans, conditions, and mode of operations and maintenance (O&M) for the State-federal flood protection system in the Central Valley of California. This flood protection system is composed of federally authorized project levees and related facilities for which the State has provided assurances[1] of cooperation to the federal government. These State-provided assurances are an important distinction for what constitutes the State-federal flood protection system since other flood protection facilities in the Central Valley are not covered by State assurances and are not part of the State-federal system.

The Sacramento Weir provided flood protection for the City of Sacramento in1995

Collectively, the facilities, lands, programs, conditions, and mode of O&M for the State-federal flood protection system in the Central Valley are referred to as the State Plan of Flood Control (SPFC). This SPFC Descriptive Document is the first time that an inventory of the SPFC has been compiled or referenced in a single document. Until now, much of the information on the SPFC has been individually maintained for each of the many flood protection projects that constitute State-federal flood protection along the Sacramento and San Joaquin rivers and tributaries. For example, much of the information contained in sections of this report originates in 118 individual project (unit-specific) O&M manuals. The O&M manuals provide key information about each project and how it should be operated and maintained (see reference digital versatile disc (DVD) at the back of this report). In addition, since the individual projects for the system were implemented over almost a century, some information may have been lost or never obtained. In those cases, gaps exist in the information presented in this report and further research is required.

[1] The assurances include that the State provide without cost to the United States, all lands, easements, and rights-of-way necessary for the completion of the project; bear the expense of necessary highway, railroad, and bridge alterations; hold and save the United States free from claims for damages resulting from construction of the works; and maintain and operate all works after they are completed.

It is important to note that the SPFC is only a portion of the larger system that provides flood protection for the Central Valley. The SPFC relies on many other features that do not meet the definition of the SPFC. For example, non-SPFC reservoirs provide substantial regulation of flows to levels that SPFC facilities can mostly handle. Private levees, locally operated drainage systems, and other facilities work in conjunction with SPFC facilities. Management practices such as emergency response, floodplain management, and other practices are part of the overall flood protection system. All parts of the system, including the SPFC, depend on other parts of the system to operate as a unit.

This report is structured as a reference document for the SPFC. It includes narrative descriptions, tables, and figures, especially maps, to help the reader find information for this complex flood management system. Some sections include summary sections for readers who only need an overview of the subject. Figure G-1 shows a geographic overview of the SPFC facilities. The document is organized in the following sections:

1. **Introduction.** Provides overview information about why this reference document has been prepared.

2. **Existing Projects**. Presents the federal authorization for each of the projects that together constitute the SPFC.

3. **SPFC Facilities**. Describes SPFC project works, or facilities, located along the various reaches of the Sacramento and San Joaquin rivers and tributaries. This description of the functional layout of the system follows the flow path of floodwaters. It is intended to complement the information contained in the many unit-specific O&M manuals.

4. **SPFC Lands**. Describes property rights held for the SPFC.

Overview of SPFC

Project Works (Facilities)

- Approximately 1,600 miles of levees
- Five major weirs spilling floodwaters from the Sacramento River to bypass channels
- Five control structures directing flow in bypass channels along the San Joaquin River
- Six major pumping plants
- Channel improvements
- Bank protection
- Associated facilities, such as stream gages, drainage facilities.

Lands

- Fee title, easements, and agreements for project works and mitigation areas
- Approximately 18,000 parcels

Operations and Maintenance

- Two standard O&M manuals
- 118 unit-specific manuals
- Maintenance by State and local maintaining agencies

Conditions (terms)

- Assurances
- Flood Control Regulations, Part 208.10 of 33, Code of Federal Regulations
- Requirements of standard and unit-specific O&M manuals
- Design profiles (1955 and 1957)
- Project Cooperation Agreements

Programs and Plans

- Historical documents and processes
- As-constructed drawings
- Oversight and management

Figure G-1. Geographic Overview of the State Plan of Flood Control

5. **SPFC Operations and Maintenance**. Describes the O&M responsibilities and activities that the State and local maintaining agencies have and implement.

6. **SPFC Conditions**. Describes conditions (terms) under which the State has agreed to abide by for long-term O&M of the SPFC facilities.

7. **Programs and Plans Related to the SPFC**. Describes existing programs and plans that support the SPFC and ongoing evaluations and processes that will affect the SPFC in the future.

8. **SPFC Updates**. Describes how this document will be updated. While much of the information contained in the report is not expected to change, report updates or supplements will be necessary to keep the description of the SPFC current as new projects are implemented, as changes in O&M are made, or as other changes occur.

9. **Observations**. Contains observations about the material encountered during work on this document. While material pertaining to the SPFC was being compiled, the California Department of Water Resources drafting team made several observations that may warrant additional work or research to fill data gaps, may require that information be managed differently than under current conditions, or may provide the basis for future SPFC updates.

10. **Acronyms and Abbreviations.** Provides list of acronyms and abbreviations used in this SPFC Descriptive Document.

11. **References.** Contains a list of references used in this SPFC Descriptive Document.

Because of the voluminous material available to describe the SPFC, a DVD located in the pocket at the back of the report includes important base information and reference material. The DVD includes O&M manuals, O&M Map Book, data tables, design water surface profiles, and other supporting documents.

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1.0 Introduction

With few exceptions, the largest and most damaging floods in California have occurred in the Central Valley. A complex system of dams and reservoirs, levees, weirs, bypasses, and other features constructed piecemeal over the last 150 years protects urban and rural areas against most flooding and has prevented billions of dollars in damages. Still, only small portions of the system provide protection from rare and substantially large flows that cause severe damage when they occur. Portions of the system can be damaged and fail during floods that happen as frequently as once every 5 to 10 years.

A portion of this complex flood protection system includes federally authorized project levees and related facilities for which the State of California has provided assurances[2] (see Section 1.3) of continued cooperation to the federal government. This portion of the flood management system is known as the State-federal flood protection system.

This report describes the existing flood control works of the State-federal flood protection system in the Central Valley, together with lands, modes of operations and maintenance (O&M) necessary for the system to function, conditions, and programs and plans for the system. Collectively, these are the State Plan of Flood Control (SPFC). While recognizing that the SPFC is only a part of the larger flood protection system for the Central Valley, this report focuses on the SPFC and does not attempt to provide detailed information on non-SPFC facilities.

This section presents introductory information, including the legislative requirement, purpose and scope for the document, a description of State assurances to the federal government, local assurances to the State, the geographic focus area covered by the SPFC, and a brief acknowledgement of the importance of the entire flood system.

[2] The assurances include that the State provide without cost to the United States, all lands, easements, and rights-of-way necessary for the completion of the project; bear the expense of necessary highway, railroad, and bridge alterations; hold and save the United States free from claims for damages resulting from construction of the works; and maintain and operate all works after they are completed.

1.1 Legislative Requirement

Proposition 1E (Disaster Preparedness and Flood Prevention Act of 2006), approved by California voters on November 7, 2006, requires that information on the SPFC be compiled into a single document. Proposition 1E and Public Resources Code (PRC) Section 5096.805 (j) define the SPFC as follows:

"State Plan of Flood Control" means the state and federal flood control works, lands, programs, plans, conditions, and mode of maintenance and operations of the Sacramento River Flood Control Project described in Section 8350 of the Water Code, and of flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Section 12648) of Chapter 2 of Part 6 of Division 6 of the Water Code for which the board or the department has provided the assurances of nonfederal cooperation to the United States, which shall be updated by the department and compiled into a single document entitled "The State Plan of Flood Control."

California Water Code Section 8350

The approval and adoption, by and on behalf of the State of California, of the conditions, plans, construction, and mode of maintenance and operation of works within the Sacramento River Flood Control Project, set forth in Senate Committee Print, Seventy-fifth Congress, First Session, as authorized and approved by Act of Congress, Public No. 392, Seventy-fifth Congress, approved August 26, 1937, including the holding and saving the United States from damages because of construction works, are continued in effect.

Chapter 2, Part 6, Division 6 of California Water Code Commencing with Section 12648

See http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=12001-13000&file=12648-12670.20

Note: The State did not provide assurances to the Federal government for all projects, commencing with Section 12648.

1.2 Purpose and Scope

The purpose of this report is to serve as the reference document required by Proposition 1E for the project works, lands, programs, plans, conditions, and mode of O&M that encompass the SPFC. This report is not a plan for the future, but a description of what is known about the existing SPFC, with future updates to be prepared as changes are made to the SPFC. The nature of the SPFC makes this compilation of information especially important:

- The State-federal flood protection system in the Central Valley is composed of numerous separate projects along the Sacramento and San Joaquin rivers and tributaries.

- The system has been assembled incrementally since before the first federal authorization for projects in 1917.

- Many of the project levees and the Sacramento Weir predate the first federally authorized projects and were either accepted as meeting federal standards or modified to meet federal standards.

- Two standard O&M manuals, one for the Sacramento River and tributaries and one for the San Joaquin River and tributaries, describe O&M requirements for the entire flood system.

- There are 118 separate unit-specific O&M manuals describe projects that make up the State-federal system and specific O&M requirements applicable to each unit of the system.

- Thousands of individual land records define the State's property rights in the SPFC.

- State and local agencies perform O&M in 110 jurisdictional areas.

- Numerous plans and programs have evolved during the life of the State-federal flood protection system in the Central Valley.

- In some cases, responsibility for individual projects has changed and the State no longer provides assurances of cooperation to the federal government – local agencies may have provided assurances directly to the federal government.

Because of the incremental nature of building the system over many decades and the system's evolution, all available information was not available in a single location, prompting preparation of this report. The following sections describe the major elements of the SPFC, but only in a level of detail necessary to orient the reader to the SPFC and reference where more details can be found. For example, a given mile reach of levee may have many other associated features such as pipes that cross under, through, or over the levee. In addition, a given river reach may have associated bridges, stream gages, drainage facilities, etc. No attempt was made to itemize all these associated facilities in this SPFC Descriptive Document. Because of the volume of this available information, a reference digital versatile disc (DVD) is located in a pocket at the end of this report. The DVD provides more details than can be contained directly in the following sections.

1.3 State Assurances to the Federal Government

An important distinction of the SPFC is that the State, as the lead nonfederal sponsor, has given assurances of cooperation to the federal

government. At a minimum, the assurances include that the State provide without cost to the United States, all lands, easements, and rights-of-way necessary for the completion of the project; bear the expense of necessary highway, railroad, and bridge alterations; hold and save the United States free from claims for damages resulting from construction of the works; and maintain and operate all works after they are completed. Depending on when a facility was authorized (Congressional authorization) and constructed, there could be additional assurances (see unit-specific O&M manuals in the reference DVD).

The acceptance of projects and assurances of cooperation are included in the unit-specific O&M manuals (see reference DVD), and are provided by State legislation, as contained in various portions of the California Water Code (CWC). Each O&M manual for a project shows when the project was transferred from the federal government to the State. Most manuals include a letter, or letters, of acceptance of the project by The Reclamation Board (now the Central Valley Flood Protection Board, or Board).

The State has not provided assurances for all parts of the flood protection system in the Central Valley. This SPFC Descriptive Document does not include details on local projects, multipurpose projects, or other projects without State assurances because those projects are not part of the SPFC. It does, however, provide a brief overview of those existing facilities in Sections 2.3 and 2.4 as context that the flood protection system includes more than the SPFC facilities. In cases when local entities have given assurances directly to the federal government, the projects are not considered part of the SPFC.

The State's authorities and responsibilities for providing O&M are codified in the CWC, Sections 8350 through 9577 and Sections 12878 through 12878.45, inclusive.

1.4 Local Assurances to the State

For most units of the flood protection system, the responsibility for O&M has been transferred from the State to local maintaining agencies by way of a letter from the State (The Reclamation Board or Board, depending on when the transfer occurred). The transfer letter generally refers to a local project cooperation agreement that outlines what the local agency agrees to for the project, including its nonfederal cost share, O&M responsibilities, hold harmless provisions, and other cooperation.

1.5 SPFC Planning Area and Systemwide Planning Area

The SPFC Planning Area, defined as the geographic area that includes the lands currently receiving protection from the SPFC, encompasses the watershed areas of the two major river systems of the Central Valley – the Sacramento and the San Joaquin rivers with a combined drainage area of more than 45,000 square miles (see Figure 1-1). Areas outside the watersheds of the Sacramento and San Joaquin rivers are excluded from the SPFC. The planning area does not include lands or features within the Tulare Lake Basin, such as the Kings River watershed, but intermittent flood flows from this area enter the San Joaquin River when Pine Flat Dam makes flood releases.

The existing State-federal flood management system in the SPFC Planning Area influences flooding and flood management on more than 2.2 million acres (3,400 square miles) of land within the Central Valley. Local and regional flood management facilities and projects reduce flooding to additional valley land in both urban and rural areas. The geographic area that includes land subject to flooding under the current facilities and operation of the Sacramento-San Joaquin River Flood Management System[3] is referred to as the Systemwide Planning Area.

[3] California Water Code Section 9611 defines the Sacramento-San Joaquin River Flood Management System as the system that includes the facilities of the State Plan of Flood Control, as amended, and any existing dam, levee, or other flood management facility that is not part of the State Plan of Flood Control if the board determines, upon recommendation of the department, that the facility does one or more of the following: (1) Provides significant systemwide benefits for managing flood risks within the Sacramento-San Joaquin Valley; and (2) Protects urban areas within the Sacramento-San Joaquin Valley (where urban area herein is defined as "*any contiguous area in which more than 10,000 residents are protected by project levees*").

Figure 1-1. Sacramento and San Joaquin River Basins Planning Area for the State Plan of Flood Control

1.6 Flood Protection System

The SPFC is only a portion of the larger system that provides flood protection for the Central Valley. In addition, the State and federal governments have invested in California flood protection projects outside of the Central Valley.

The SPFC relies on many other features that do not technically meet the definition of the SPFC (Section 1.1). For example, non-SPFC reservoirs provide substantial regulation of flows to levels that SPFC facilities can mostly handle – without these reservoirs, flows could overwhelm SPFC facilities frequently. In addition, private levees, locally operated drainage systems, and other State, federal, and local facilities work in conjunction with SPFC facilities. Management practices such as emergency response, floodplain management, and other practices are part of the overall flood protection system. All parts of the system, including the SPFC and other facilities and management practices, depend on all parts of the system to operate as a unit.

Since this report is structured as a reference document for the SPFC, it does not provide detailed information on non-SPFC facilities of the system. However, it does provide short descriptions of other non-SPFC flood protection projects in Sections 2.3 and 2.4. More detailed system descriptions, including the interrelation among SPFC facilities and non-SPFC facilities, can be found in the Flood Control System Status Report (FCSSR) and the Central Valley Flood Protection Plan (CVFPP).

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2.0 Existing Projects

Within the Central Valley watershed, numerous reservoirs, channels, levees, bypasses, and related facilities reduce the threat of major flooding along the Sacramento and San Joaquin rivers and tributaries. As early as the 1850s, the first levees were constructed by local landowners in the Central Valley. Some of these early levees eventually became part of a State-federal flood protection project that began when Congress authorized the Sacramento River Flood Control Project (SRFCP) in the Flood Control Act of 1917.

This section presents federal authorizations for the existing State-federal flood protection projects included in the SPFC. Also mentioned are other portions of the flood management system (see Sections 2.3 and 2.4) that are important for overall flood management, but are not part of the SPFC because they do not carry State assurances of cooperation to the federal government. However, successful operation of these non-SPFC facilities is essential for successful operation of the SPFC.

This section is not a description of the history of the SPFC, but instead it describes the legal basis for the flood protection projects. A more extensive history of the flood system is included in the Technical Memorandum, Draft Historical Reference Document for the State Plan of Flood Control (DWR, 2009a).

2.1 Summary

The SPFC is composed of many different projects authorized in federal legislation. Table 2-1 summarizes these projects, organized under the Sacramento River and San Joaquin River watersheds. The table includes the federal acts, public law numbers, and Chief of Engineers Report (generally printed as U.S. House documents (HD) or U.S. Senate documents (SD)) numbers pertaining to each SPFC project. The table also indicates whether the project (or portions thereof) is included in the SPFC. Figure 2-1 shows general project locations.

In addition, there have been authorizations for other flood management projects that are not listed in this chapter because the projects have not been officially incorporated in the SPFC at the time of this writing. Some of these projects may be include as SPFC facilities in the future.

Table 2-1. Summary of Federal Authorized and Constructed State Plan of Flood Control Projects

Project	Federal Act	Public Law	Chief of Engineers Report	Included in the State Plan of Flood Control
Sacramento River Flood Control Project				**yes**
	FCA 1917	64-367	HD 62-81 RHCD 63-5	
	FCA 1928	70-391	SD 69-23	
	RHA 1937	75-352	SCCD 75th Congress	
	FCA 1941	77-205	HD 77-205	
Sacramento River and Major and Minor Tributaries Project				**yes**
	FCA 1944	78-534	HD 78-649	
	FCA 1950	81-516		
American River Flood Control Project				**yes**
	FCA 1954			
Sacramento River – Chico Landing to Red Bluff				**yes**
	FCA 1950	81-516		
	FCA 1958	85-500	HD 84-272	
Adin Project				**yes**
	FCA 1937	75-352		
	FCA 1954			
Middle Creek Project				**yes**
	FCA 1954		HD 81-367	
McClure Creek Project				**yes**
	FCA 1937	75-352		
	FCA 1950	81-516		
Salt Creek Project				**yes**
	FCA 1937	75-352		
	FCA 1954			
Lake Oroville Project				**yes**
	FCA 1958	85-500		
Sacramento River Bank Protection Project				**yes**
	FCA 1960	86-645		
North Fork Feather River Project				**yes**
	FCA 1968	90-483	HD 90-314	

Table 2-1. Summary of Federal Authorized and Constructed State Plan of Flood Control Projects (Contd.)

Project	Federal Act	Public Law	Chief of Engineers Report	Included in the State Plan of Flood Control
Lower San Joaquin River and Tributaries Project				**yes**
	FCA 1944	78-534		
	FCA 1950	84-327		
Buchanan Dam and Eastman Lake Project				**channel work only**
	FCA 1962	87-874	SD 98	
Hidden Dam and Hensely Lake Project				**channel work only**
	FCA 1962	87-874	SD 37	
Merced County Stream Group Project				**Castle Dam and levees along diversion canals only**
	FCA 1944	78-534		
	FCA 1970	91-611		
Bear Creek Project				**yes**
	FCA 1944	78-534	HD 545	
Littlejohns Creek and Calaveras River Stream Group Project				**yes**
	FCA 1944	78-534	HD 545	
Farmington Reservoir Project				**channel work only**
	FCA 1944	78-534	HD 545	
Mormon Slough Project				**yes**
	FCA 1962	87-874	HD 576	

Note:
Other federal authorizations for flood management projects may be included in future updates to this State Plan of Flood Control Descriptive Document if the projects are added to the SPFC. Similarly, some of these projects may be removed from the SPFC if they are deauthorized.
Key:
FCA = Flood Control Act
HD = U.S. House Document
RHA = Rivers and Harbors Act
RHCD = Rivers and Harbors Committee Document
SCCD = Senate Commerce Committee Document
SD = U.S. Senate Document

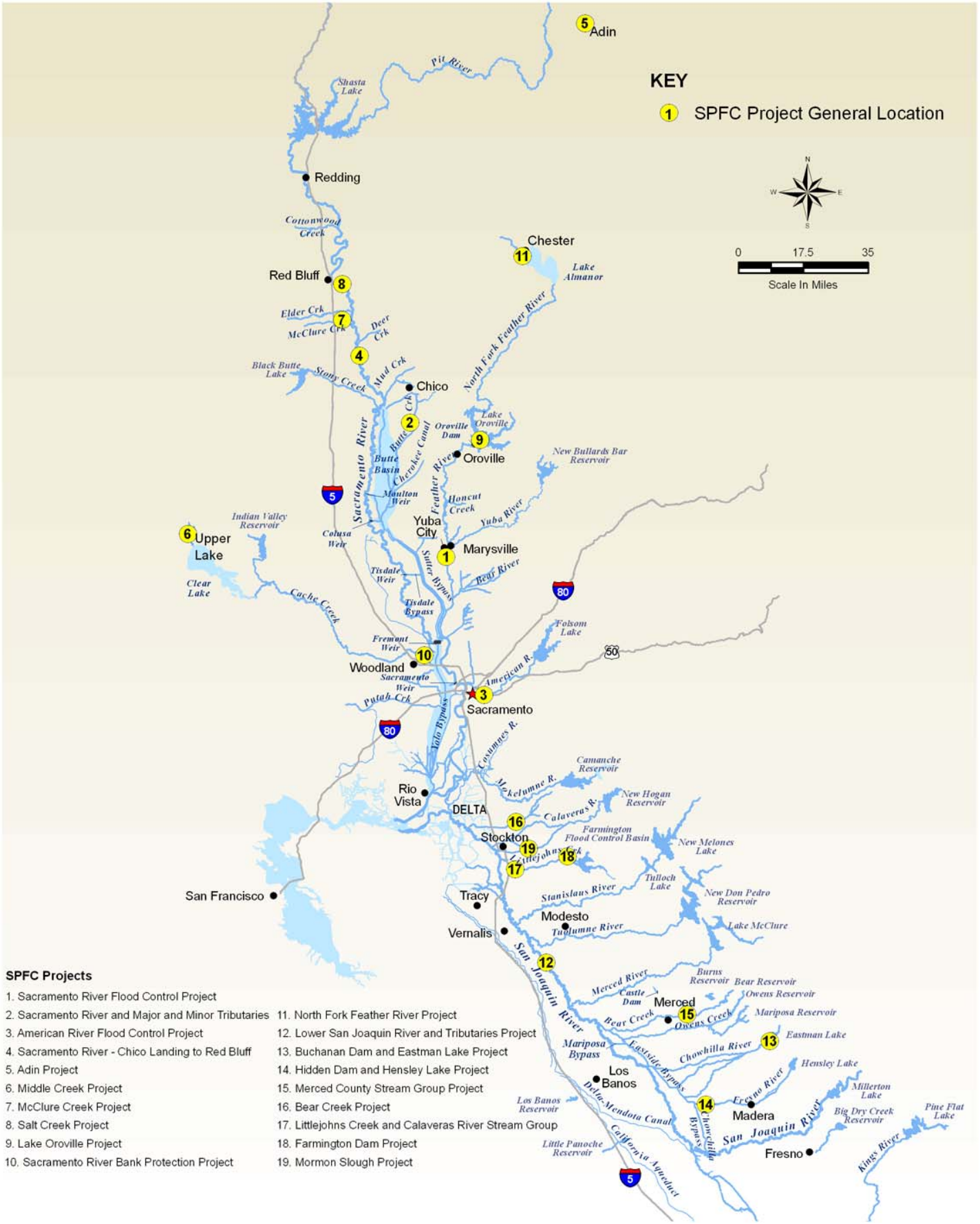

Figure 2-1. Approximate Locations of Federal/State Flood Damage Reduction Projects Within the Sacramento and San Joaquin River Basins that Comprise the State Plan of Flood Control

2.2 Federal Authorizations for Existing State-Federal Flood Protection Projects

This section shows the federal authorizations for each of the existing State-federal flood protection projects included in the SPFC. The projects are organized as Sacramento River Basin projects, San Joaquin River Basin projects, and other facilities with State assurances. While each authorization covers one major project, such as the SRFCP, implementation of the projects generally occurred over time with the construction of various units of the projects. Some levees are physically disconnected from the larger system and were constructed to provide local benefits while others were constructed to provide system benefits.

While the purpose of this section is to show federal authorizations, some statements on each project's features are included. This information was extracted from the Congressional authorizations and their supporting U.S. Army Corps of Engineers (USACE) Chief of Engineers Reports (included on the reference DVD).

Major SPFC project works associated with the following federal authorized projects are detailed in Section 3.0.

2.2.1 Sacramento River Basin Projects

The majority of the State-federal flood protection projects that constitute the SPFC are located in the Sacramento River Basin. Federal authorizations for projects described below began in 1917 and extended into the 1980s. Some projects authorized by later federal authorizations may eventually become part of the SPFC.

Sacramento River Flood Control Project

The SRFCP is the core of the flood system along the Sacramento River and tributaries. It includes most of the levees, weirs, control structures, bypass channels, and river channels that make up the SPFC. About 980 miles of levees were involved in the project. Portions of these levees were originally constructed by local interests and either included directly in the project without modification or modified to meet USACE project standards. The project was originally authorized by the Flood Control Act of 1917 and subsequently modified and extended by the Acts of 1928, 1937, and 1941. Cost changes over time are reflected in these acts along with rectification, additions, and deletions.

- **Flood Control Act of 1917** – Public Law 64-367 (64th Congress) is the Flood Control Act of 1917. The authorized project was in accordance with plans contained in the California Debris Commission report submitted on August 10, 1910, and printed as HD 81 (62nd Congress), as modified by the California Debris Commission report submitted on February 8, 1913, and printed in Rivers and Harbors Committee Document No. 5 (63rd Congress). The 1913 document provides for the rectification and enlargement of river channels and the construction of weirs.

- **Flood Control Act of 1928** – Public Law 70-391 (70th Congress) is the Flood Control Act of 1928. The 1928 act modified the Flood Control Act of 1917 in accordance with the California Debris Commission report submitted on May 1, 1924, and printed in SD 23 (69th Congress). Some significant changes made by the act include the following:

  - Elimination of reclamation works in Butte Basin
  - Construction of a weir above Colusa
  - Elimination of two of the four proposed cutoffs in the stretch of river between Colusa and the mouth of the Feather River
  - Use of the existing Tisdale Weir instead of construction of a new weir
  - Relocation of certain levee lines on the Feather River and Yolo Bypass
  - Settling basin at the mouth of Cache Creek
  - Three sloughs in the Sacramento-San Joaquin Delta (Delta) to be left open instead of closed
  - Increase in levee cross-section dimensions
  - Conclusion that San Joaquin Valley flood problems are different from those of the Sacramento Valley, and that flood control in the San Joaquin Valley should be considered in a separate report, if deemed advisable
  - Federal government to carry some maintenance responsibility (enlarged channels, of weirs, and of certain gages)
  - Increase in the project cost

- Change of the cost share between the federal government and nonfederal interests

- Set design capacities

- **Rivers and Harbors Act of 1937** – Public Law 75-332 (75th Congress) is the Rivers and Harbors Act of 1937. The prior 1917 and 1928 flood control acts were modified in accordance with a Senate Commerce Committee Document (75th Congress). The document concluded that maintenance by the federal government was not consistent with policies of the Flood Control Act of 1936 (Public Law 74-738, 74th Congress). Additional work was required on revetment for eroding levees, and the project cost was adjusted. Requirements were added for local interests to provide rights-of-way and hold the federal government harmless from damage claims.

- **Flood Control Act of 1941** – Public Law 77-228 (77th Congress) is the Flood Control Act of 1941. The 1941 act modified previous acts in accordance with HD 205 (77th Congress). The act authorized federal expenditures for completion of the project, and required the following local cooperation:

  - Furnish all rights-of-way, including railway, highway, and all other utility modifications

  - Hold and save the United States free from damage claims

  - Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army

Construction of the SRFCP began in 1918 and continued for decades. By 1944, the project was regarded as being about 90 percent complete. The plan for completing the project was presented in the November 30, 1953, "MOU Respecting the Sacramento River Flood Control Project" between USACE and The Reclamation Board (see reference DVD) (USACE and The Reclamation Board, 1953). This Memorandum of Understanding (MOU) included levee construction standards for river project levees and bypass levees, and outlined maintenance responsibilities. The plan included no difference in levee standards for urban versus agricultural levees. By 1961, the project was essentially completed (Kelley, 1989).

Some documents refer to the project from these authorizations as the "Old" Sacramento River Flood Control Project.

Sacramento River and Major and Minor Tributaries Project

The Sacramento River and Major and Minor Tributaries Project was initially authorized by the federal government in the Flood Control Act of 1944 (Public Law 78-534, 78th Congress), and was further amended by the Flood Control Act of 1950 (Public Law 81-516, 81st Congress). The project was a modification and extension of the SRFCP, and was to supplement reservoir storage by reducing flooding potential to certain areas along the Sacramento River.

The project provided for levee construction and/or channel enlargement of the following minor tributaries of the Sacramento River: Chico and Mud creeks and Sandy Gulch, Butte and Little Chico creeks, Cherokee Canal, Elder Creek, and Deer Creek (Tehama County). In addition, the project also included revetment of levees for the Sutter, Tisdale, Sacramento, and Yolo bypasses. Minor tributary improvements were to reduce flood risk to about 80,000 acres of agricultural land important to the economy of the region and to the City of Chico and other smaller communities. Bypass levee revetment features of the project were to reduce flood risk to floodplain lands adjacent to the bypasses, and ideally would decrease requirements for levee repairs under emergency conditions (USACE, 1999).

American River Flood Control Project

The American River Flood Control Project was authorized by the federal government in the Flood Control Act of 1954 to reduce flood risk along the lower American River. The project was constructed in 1958 by USACE, and includes approximately 8 miles of levee along the north bank of the American River between Carmichael Bluffs and the terminus of the SRFCP levee near the State Fairgrounds.

Sacramento River – Chico Landing to Red Bluff

The Sacramento River project for bank protection and channel improvements from Chico Landing to Red Bluff was authorized by the federal government in the Flood Control Act of 1950, as amended by the Flood Control Act of 1958 (Public Law 85-500, 85th Congress). The project was authorized in accordance with recommendations by the USACE Chief of Engineers in HD 272 (84th Congress). The project was a modification and extension of the SRFCP, and was to increase bank protection along the Sacramento River from Chico Landing to Red Bluff and lower portions of its principal tributaries to reduce flood risk with discharges modified by Shasta Dam and Black Butte Reservoir. This reservoir was planned to be constructed soon after the project. The area encompassed by the project included the Sacramento River from Chico Landing to Red Bluff, and lower portions of Antelope, Mill, Deer, Pine, Elder, Thomes, and Stony creeks (USACE, 1999).

Middle Creek Project

The Middle Creek Project, upstream from Clear Lake, was authorized by the Flood Control Act of 1954, Section 203. The authorized project was in accordance with recommendations by the USACE Chief of Engineers in HD 367 (81st Congress). Authorizing legislation by the State of California is contained in Section 12656.5 of the CWC and was enacted under the California Statutes of 1955. This project reduces local flood risk.

Lake Oroville Project

Federal participation in the construction of Oroville Dam was authorized by the Flood Control Act of 1958 (Public Law 500, 85th Congress). The federal interest was flood control provided by the flood control storage reservation of 750,000 acre-feet. This authorization also included the non-SPFC New Bullards Bar and the Marysville Dam (not constructed at the time of this writing).

Sacramento River Bank Protection Project

The Sacramento River Bank Protection Project (SRBPP) was authorized by the Flood Control Act of 1960 (Public Law 86-645, 86th Congress) to repair eroding levees along levee reaches of the Sacramento River. The project modifies the existing SRFCP through a program for bank erosion control works and setback levees within the limits of the existing levee system. Phases I and II have modified the SRFCP through construction of more than 835,000 linear feet of bank protection and setback levees. USACE and the Board will begin investigation of a Phase III in 2010.

North Fork Feather River Project

The North Fork Feather River Project at Chester was authorized by Section 203 of the Flood Control Act of 1968 (Public Law 90-483, 90th Congress). The authorized local project was in accordance with recommendations by the USACE Chief of Engineers in HD 314 (90th Congress). This project, consisting of a diversion dam, channel, and levees, reduces local flood risk.

Snagging and Clearing Projects

The Continuing Authorities Program allows USACE to respond to a variety of flood problems without the need to obtain specific Congressional authorization for each project. Section 208 of the 1954 Flood Control Act, as amended, allows work to remove accumulated snags and other debris, and to clear and straighten stream channels. Three projects in the Sacramento River Basin are snagging and clearing projects:

- **Adin Project** – A flood control project was authorized by the federal government for Ash and Dry creeks at Adin in Modoc County in the Flood Control Act of 1937, and modified by the Flood Control Act of

1954. Ash and Dry creeks are tributary streams to the Pit River above Shasta Dam. This project reduces local flood risk.

- **Salt Creek Project** – The Salt Creek Project was authorized by Section 2 of the Flood Control Act of 1937, as amended by Section 208 of the Flood Control Act of 1954. This project reduces local flood risk.

- **McClure Creek Project** – The McClure Creek Project was authorized by Section 2 of the Flood Control Act of 1937, as amended by Section 208 of the Flood Control Act of 1950. This project reduces local flood risk.

2.2.2 San Joaquin River Basin Projects

Components of the SPFC located in the San Joaquin River Basin include the Lower San Joaquin River and Tributaries Project, Littlejohns Creek and Calaveras River Stream Group Project, including the New Hogan and Farmington projects, and the Merced County Stream Group Project.

Lower San Joaquin River and Tributaries Project

Improvement of lower reaches of the San Joaquin River and tributaries was authorized by the federal government in the Flood Control Act of 1944 (Public Law 78-534). The project provided for improvement by the federal government of the existing channel and levee system on the San Joaquin River from the Delta upstream to the mouth of the Merced River, and the lower reaches of the Stanislaus and Tuolumne rivers, by raising and strengthening existing levees, constructing new levees, constructing revetments on riverbanks where required, and removing accumulated snags in the main river channel. The project also reduces flood risk for areas above the mouth of the Merced River through State construction of levee and channel improvements, authorized by the federal government in the Emergency Flood Control Funds Act of 1955. The project includes a State-designed and -constructed bypass system in the upper reaches of the project area. Project construction was completed by November 1968, except for the left bank San Joaquin River levee between the confluence with the Merced River and the confluence with the Tuolumne River (completed in 1972).

Buchanan Dam and Eastman Lake Project

The Buchanan Dam, Eastman Lake Project, was authorized by the Flood Control Act of 1962 (Public Law 87-874, 87th Congress) in accordance with recommendations by the USACE Chief of Engineers in SD 98. The dam and reservoir are not part of the SPFC, but the channel improvements downstream from Buchanan Dam on the Chowchilla River and tributaries are included in the SPFC.

Hidden Dam and Hensley Lake Project

The Hidden Dam, and Hensley Lake Project, was authorized by the Flood Control Act of 1962 (Public Law 87-874, 87th Congress) substantially in accordance with recommendations by the USACE Chief of Engineers in SD 37 (87th Congress). The dam and reservoir are not part of the SPFC, but the channel improvements downstream from Hidden Dam on the Fresno River are included in the SPFC.

Merced County Stream Group Project

Improvement of the Merced County Stream Group was authorized by the Flood Control Act of 1944 (Public Law 78-534, 78th Congress). The authorization was based on HD 473 (78th Congress). The project includes a diversion from Black Rascal Creek to Bear Creek, a diversion between Owens Creek and Mariposa Creek, channel improvements and levees, and one retarding-type reservoir east of the City of Merced. The project reduces flood risk to agricultural areas, the City of Merced, and the towns of Planada and Le Grand and other smaller communities. Of the five authorized reservoirs, the State provided assurances to the federal government for only one reservoir, Castle Dam, authorized by the Flood Control Act of 1970 (Public Law 91-611, Section 201, Statute 1824).

Bear Creek Project

The Bear Creek Project was authorized by the Flood Control Act of 1944 (Public Law 78-534, 78th Congress). Bear Creek is a tributary to the San Joaquin River in the Delta near Stockton. The Bear Creek channel and levee improvements are included in USACE Chief of Engineers recommendations to the Secretary of the Army in HD 545.

Littlejohns Creek and Calaveras River Stream Group Project

The Littlejohns Creek and Calaveras River Stream Group Project was authorized by the Flood Control Act of 1944 (Public Law 78-534, 78th Congress). This act authorized improvement of Littlejohns Creek and Calaveras River and tributaries in accordance with recommendations by the USACE Chief of Engineers in HD 545. The project included a diversion from Duck Creek to Littlejohns Creek and other channel improvements and levees.

Farmington Dam Project

The Farmington Dam Project was authorized by the Flood Control Act of 1944 (Public Law 78-534, 78th Congress). This act authorized improvement of Littlejohns Creek and tributaries in accordance with recommendations by the USACE Chief of Engineers in HD 545. Farmington Dam is not part of the SPFC, but channel improvements along South Littlejohns Creek and its north and south branches are included in the SPFC.

Mormon Slough Project

The Mormon Slough Project was authorized by the Flood Control Act of 1962 (Public Law 87-874, 87th Congress). The authorization was in accordance with recommendations in HD 574. The USACE Chief of Engineers concurred with these recommendations in his 1962 report. The project includes channel improvements, levees, and pumping plants.

2.3 Existing Federal Participation in Other Non-SPFC Flood Protection Projects

In addition to SPFC facilities, USACE has an interest and role in other flood management projects in the Central Valley. While these are not part of the SPFC, operation of these projects influences operation of the SPFC, especially in reducing flood peak flows through the SPFC levee system. The following information is provided in an overview level of detail to show other projects that function along with the SPFC as a flood protection system.

2.3.1 Multipurpose Reservoir Projects

Many of the storage facilities that contribute to flood management in the Sacramento and San Joaquin river basins are also operated for other purposes, such as water supply and power generation, but are not part of the SPFC because they include no State assurances to the federal government. Debris dams in the upper Yuba River Basin contribute in a minor way to flood management in the Sacramento River Basin, and hydroelectric reservoirs in the upper Sacramento River Basin provide credit space for larger downstream multipurpose reservoirs. Major multipurpose storage projects that contribute significantly to flood management are shown in Figure 2-2 and listed in Table 2-2 in chronological order of construction. USACE has participated in each of these reservoirs by establishing (funding in most cases) seasonal flood reservation storage and developing rules for operation of flood storage. Note that Oroville Dam is the only major multipurpose project listed that is part of the SPFC.

During high-water periods, reservoir operators coordinate with California Department of Water Resources (DWR) and USACE during daily operations conferences at the State-federal Flood Operations Center in Sacramento. These conferences lead to voluntary modifications of individual reservoir operating rules to improve overall system operation. In total, these reservoir operations significantly reduce flood flows to the downstream levee system.

Figure 2-2. Locations of Multipurpose (Including Flood Control) Dams and Reservoirs in the Sacramento and San Joaquin River Basins

Table 2-2. Major Multipurpose Reservoir Project Summary

Reservoir	Dam	Date Constructed	Total Reservoir Capacity (acre-feet)	Flood Storage Capacity (acre-feet)	Owner/Operator
Sacramento River Basin					
Shasta Lake	Shasta Dam	1949	4,550,000	1,300,000	Reclamation
Black Butte Lake	Black Butte Dam	1963	160,000	137,000	USACE
Folsom Lake	Folsom Dam	1956	1,000,000	400,000[2]	Reclamation
Lake Oroville	Oroville Dam[1]	1967	3,540,000	750,000	DWR
New Bullards Bar Reservoir	New Bullards Bar Dam	1967	960,000	170,000	Yuba County Water Agency
Indian Valley Reservoir	Indian Valley Dam	1976	301,000	40,000	Yolo County Flood Control and Water Conservation District
San Joaquin River Basin					
Millerton Lake	Friant Dam	1949	521,000	390,000	Reclamation
Lake McClure	New Exchequer Dam	1967	1,025,000	400,000	Merced Irrigation District
New Don Pedro Reservoir	New Don Pedro Dam	1970	2,030,000	340,000	Turlock and Modesto Irrigation Districts
Hensley Lake	Hidden Dam	1975	90,000	65,000	USACE
Eastman Lake	Buchanan Dam	1975	150,000	45,000	USACE
New Melones Lake	New Melones Dam	1978	2,420,000	450,000	Reclamation
Los Banos Reservoir	Los Banos Detention Dam	1965	34,600	14,000	Reclamation/DWR
Pardee Reservoir	Pardee Dam	1963	198,000	200,000[3]	East Bay Municipal Utilities District
Camanche Reservoir	Camanche Dam	1963	431,000		
New Hogan Reservoir	New Hogan Dam	1964	325,000	165,000	USACE

Source: USACE, 1997

Notes:
[1] Oroville Dam is part of the State Plan of Flood Control as is the smaller single purpose Castle Dam in the San Joaquin River Basin. All other dams in this table are non-SPFC.
[2] Folsom Dam is operated with variable flood storage between 400,000 acre-feet and 670,000 acre-feet to take credit for seasonally available storage in upstream reservoirs.
Key:
DWR = California Department of Water Resources
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
USACE = U.S. Army Corps of Engineers

2.3.2 Local and Regional Projects

The federal government has interest in local projects for which local or regional entities, rather than the State, provided assurances.

Yuba River Goldfields

The Yuba River gravel training walls constructed by the California Debris Commission provide substantial flood benefits to the Yuba Basin inhabitants. These facilities are maintained by the federal government.

Chico Landing to Keswick Dam

As discussed above, the bank protection projects from Chico Landing to Red Bluff are part of the SPFC. However, the authorizing legislation provided in the Flood Control Act of 1958 recognized the encroachment of development into the floodplain of the Sacramento River below Keswick Dam – development would ultimately prevent Shasta Dam from being operated to provide the benefits for which it was authorized. Accordingly, HD 272 (84th Congress) required local interests to enact and enforce adequate zoning regulations to prevent construction of permanent improvements within the floodplain.

Glenn, Butte, Tehama, and Shasta counties are involved in the zoning requirement from Chico Landing to Keswick Dam. Glenn, Butte, and Tehama counties adopted ordinances in 1972, 1971, and 1974, respectively, to control development within the 100-year floodplain. O&M Manual SAC512 mentions that these ordinances together with the State's Designated Floodway Program (see Section 2.4.3) satisfy the floodplain zoning requirement. Shasta County has a Designated Floodway (FI) District that includes the Sacramento River from Keswick Dam to the Shasta-Tehama county line, but the O&M manual makes no mention of when this was first instituted.

Big Dry Creek Dam and Diversion Project

Big Dry Creek Dam was authorized by the federal government in the Flood Control Act of 1941 (Public Law 77-288, 77th Congress). The project includes an earthfill dam across the channel of Big Dry Creek, creating a reservoir with a maximum capacity of 16,250 acre-feet and all storage space reserved for flood management. The project also includes accompanying diversion facilities both upstream and downstream from the dam. Flows from the dam in excess of downstream capacities are diverted to the San Joaquin River downstream from Friant Dam.

This project, located about 10 miles northwest of Fresno, reduces flood risk for the cities of Fresno and Clovis and the surrounding areas. Modification of the Big Dry Creek Dam and Diversion Project was included as one of the component features of the Redbank and Fancher Creeks Flood Control

Project authorized by the Water Resources Development Act (WRDA) of 1986. Although the State originally provided assurances to the federal government for the project in 1947, the 1987 Local Cooperation Agreement signed between USACE and the Fresno Metropolitan Flood Control District superseded the 1947 agreement – assurances are now provided by the district. The capacity of the Big Dry Creek Dam and Diversion Project was increased from 16,250 acre-feet to 30,200 acre-feet as part of the 1986 project (USACE, 1997).

Duck Creek Project

The Duck Creek Project was authorized by the Flood Control Act of 1944 (Public Law 78-534, 78th Congress). This act authorized improvement of Littlejohns Creek and tributaries in accordance with recommendations by the USACE Chief of Engineers in HD 545. The San Joaquin County Board of Supervisors, on behalf of the San Joaquin County Flood Control and Water Conservation District, provided assurances to the federal government for lands, holding the federal government free from damages, and for O&M.

Stanislaus River Local Interest Project Levees

Improvements for the Stanislaus River channel (New Melones Project) and local interest project levees (LIPL) below Goodwin Dam were authorized by the federal government in the Flood Control Act of 1962 (Public Law 87-874). USACE was given responsibility for maintenance if local interests agreed to prevent encroachment of the existing channel and floodway and maintain private levees. In 1963, The Reclamation Board accepted responsibility as the nonfederal sponsor.

On June 19, 1981, The Reclamation Board adopted the Stanislaus River Designated Floodway, including the existing channel and LIPL along the Stanislaus River between Goodwin Dam and the San Joaquin River confluence. In Resolution 81-33, the Board accepted USACE's offer for the Board to exercise USACE property rights in the designated floodway and project floodway. The Board also delegated control of encroachments in those areas to the USACE Sacramento District.

The Board provided assurances to USACE that if the LIPLs are not satisfactorily maintained, the Board will extend the encroachment lines of the designated floodway to include the area that would be flooded during a design flood if those levees did not exist.

Kings River and Tulare Basin Project

The Kings River and Tulare Lake Basin Project was adopted and authorized by the Flood Control Act of 1944 (Public Law 78-534, 78th Congress). The authorization was substantially in accordance with the

recommendations by the USACE Chief of Engineers in HD Number 630 (76th Congress, Third Session) and as modified by data in Design Memorandum No. 3, Kings River and Tulare Lake, California, Kings River Channel Improvement, General Design, dated April 20, 1959, and by Letter Supplement No. 1 to Design Memorandum No. 3, by the District Engineer, USACE Sacramento District. The Kings River Conservation District gave assurances for cooperation with the federal government instead of the State providing assurances. During flood times, the project discharges water (up to 4,750 cubic feet per second (cfs)) through the James Bypass to the Fresno Slough, a tributary of the San Joaquin River. This discharge directly affects operation of the Chowchilla Canal Bypass and San Joaquin River Control Structures (see O&M Manual SJR601B, Sections 3.2.6 and 3.2.7).

Merced County Stream Group Project

The State provided assurances to the federal government for portions of the Merced County Stream Group Project (see Section 2.2.2). In addition, USACE built and operates four retention-type reservoirs:

- Mariposa Dam (completed in 1948) is located on Mariposa Creek, about 18 miles east of Merced. Mariposa Reservoir has 15,000 acre-feet of flood management space, which is equal to the gross storage. The dam is owned, operated, and maintained by USACE.

- Owens Dam (completed in 1949) is located on Owens Creek about 16 miles east of Merced. Owens Reservoir has 3,600 acre-feet of flood management space, which is equal to the gross storage. The dam is owned, operated, and maintained by USACE.

- Burns Dam (completed in 1950) is located on Burns Creek, about 13 miles northeast of Merced. Burns Reservoir has 6,800 acre-feet of flood management space, which is equal to the gross storage. The dam is owned, operated, and maintained by USACE.

- Bear Dam (completed in 1954) is located on Bear Creek about 16 miles northeast of Merced. Bear Reservoir has 7,700 acre-feet of flood management space, which is equal to the gross storage. The dam is owned, operated, and maintained by USACE.

In Progress Projects

Several projects are in planning, design, or construction phases, and other projects have been completed. The Bear River setback levee, and improvements to Dry Creek and Stockton levees are examples of completed projects. Examples of projects that are in progress are the Hamilton City Flood Damage Reduction and Ecosystem Restoration Project, Folsom Dam Modifications Project, and early implementation

projects including those that have been underway with State bond funding since 2006. Some of these in progress and completed projects are expected to eventually become part of the SPFC, but some may not. These projects can only become part of the SPFC after construction is completed and they are accepted by USACE, USACE prepares the O&M manuals, the projects are transferred to the State, and the State accepts the projects. All or portions of some projects like the Middle Creek Project may be deauthorized and removed from the SPFC.

2.4 Other Non-SPFC Flood Protection Facilities

In addition to the projects described in Section 2.3, the flood protection system in the Central Valley includes other facilities that are not part of the SPFC. They are briefly discussed here.

2.4.1 Nonproject Levees

Nonproject, or local, levees and related facilities have been constructed by local agencies along many of the rivers, creeks, and streams in the Central Valley. Many of these facilities are operated and maintained similar to project facilities and connect to project facilities. By definition, they are not part of the SPFC, and are not addressed in this report. However, it is important to recognize that these nonproject levees affect the performance of the SPFC as part of the flood protection system. In addition, the levee system in the Delta downstream from Collinsville on the Sacramento River and downstream from the Stockton area on the San Joaquin River is composed entirely of nonproject levees maintained by USACE (e.g., levees of the Sacramento and Stockton ship channels) or local interests. Some of these levees have O&M manuals, but not SPFC manuals.

2.4.2 Other Nonproject Facilities

Numerous other flood protection facilities are owned and operated by local entities that are not part of the SPFC. These include the following:

- Local levees and floodwalls within SPFC-levee-protected areas.

- Local pumping plants that discharge drainage water into SPFC-leveed channels. Examples include a number of pumping plants owned and operated by local reclamation and levee districts and communities to pump interior storm runoff into the larger waterways.

2.4.3 Designated Floodways

Designated floodways are not part of the SPFC facilities, as defined in PRC Section 5096.805e because they are State-designated without assurances to,

or participation of, the federal government. However, these floodways provide an important management tool to help the State meet its requirement for passing project design flows (see Section 6.8 for designated floodways as a condition of project operation).

Designated floodways are the primary nonstructural flood management program employed by the State of California. The program was started in 1968 to control encroachments and preserve the flow regimes of floodways to protect public improvements, lives, and land-use values (CWC Section 8609). Designated floodways are defined as follows: (1) the channel of the stream and that portion of the adjoining floodplain reasonably required to provide for the passage of a design flood, as indicated by floodway encroachment lines on an adopted map, or (2) the floodway between existing levees, as adopted by the Board or the Legislature.

Designated floodways serve a critical function in protecting life and property from flood risks. The designated floodway system includes more than 60 designated floodways covering more than 1,300 miles of stream length. Figure 2-3 shows designated floodways along the Sacramento and San Joaquin rivers as well as major tributaries. There are additional designated floodways in the Tulare Lake Basin.

To designate a floodway, the Board usually completes a detailed hydraulic study to determine the design discharge associated with the design flood (usually 100-year recurrence interval) and the area of flooding that would result from the design flood. The findings of the study are then used to delineate floodway maps, and in some cases, determine areas of shallow flooding. In other cases, floodway boundaries are developed using analytical methods based on engineering judgment and review of historical floods. In proposing or revising designated floodways, the Board must also consider (1) flood control improvements and regulations affecting the floodplain, (2) the degree of danger from flooding to life, property, and public health and welfare, and (3) rate and type of development taking place on the floodplain (23 California Code of Regulations (CCR) Section 102).

Land uses within an adopted designated floodway are restricted to not impede the free flow of water in the floodway or jeopardize public safety (23 CCR Section 107). In general, activities such as agriculture, grazing, and recreation are allowed, as are structures and activities that can be quickly and easily removed or pose little impedance to river flow. The Board has the authority to determine additional permitted uses within the floodplain on a case-by-case basis.

Figure 2-3. Location of Designated Floodways Within the Sacramento and San Joaquin River Basins

3.0 SPFC Facilities

This section describes SPFC facilities according to the function they perform, which is to manage stormwater runoff. Therefore, the facility descriptions are presented geographically by river reach, generally bounded by points where significant inflows or outflows occur.

The facility descriptions are scaled to the major facilities-levees, pumping plants, weirs or other water control structures, drop structures, dams/reservoirs, other major channel improvements, and mitigation areas. Smaller components of these facilities and associated features, such as transportation relocations, stream gages, pipes passing through levees, or bridges, are not included in this section, but can be found in unit-specific O&M manuals or the O&M summary data table included on the reference DVD that accompanies this report.

The facilities are generally described in an upstream-to-downstream direction. However, since the flood management system is not linear, but a network of tributary and distributary channels, some deviation from the upstream-to-downstream convention is necessary. Levees referred to as being on the left bank or right bank of a river reach are based on their position when looking downstream.

Levee data for the SPFC are mostly consistent with the California Levee Database (CLD). Since CLD information is continually being revised to reflect the best available information, future updates to this SPFC Descriptive Document will reflect changes since the prior draft or update.

3.1 Summary

This subsection presents a high-level summary of the SPFC facilities that are described in more detail in Sections 3.2 and 3.3. Except for the backwater effect of flows mingling in the Delta, SPFC facilities on the Sacramento River and tributaries operate independently from SPFC facilities on the San Joaquin River and tributaries. The Sacramento River system carries flood flows that are about 10 times greater in volume than those in the San Joaquin River system.

Both the Sacramento and San Joaquin rivers use bypass systems to carry a large portion of floodwater. Together, the rivers and their tributaries have nearly 1,600 miles of SPFC (or “project”) levees. Non-SPFC reservoirs in

each system have flood reservation storage that significantly helps attenuate flows and aids in operation of downstream SPFC facilities.

3.1.1 Sacramento River Basin

The flood management system along the Sacramento River and tributaries manages flood flows originating from an area of approximately 27,000 square miles. Major tributaries to the Sacramento River include the Feather, Yuba, Bear, and American rivers, which discharge to the Sacramento River from the east. Three smaller upstream SPFC projects on streams tributary to the Sacramento River are shown in Figure 3-1 (North Fork Feather River near Chester, Middle Creek, and Adin projects). Figure 3-2 shows an overview of SPFC facilities in the Sacramento River Basin. The design flow capacities of the various stream reaches are also shown on Figure 3-2 and listed in Table 3-1.

Table 3-1 shows design capacities from the unit-specific O&M manuals and from the 1957 Revised Profile Drawings (see Section 6.6.1), and in some cases these capacities are inconsistent within a given river reach. The State operates SPFC facilities in the Sacramento River Basin based on the 1957 profile rather than on design flows from the O&M manuals.

These capacities are based on hydraulic analyses conducted before 1960, generally to establish the minimum top of levees during the design phase. These capacities do not account for geotechnical conditions that may result in actual capacities being less than design capacities. In some cases, State, federal, or local agencies may have conducted more recent hydraulic studies that result in higher or lower flows than those shown in the table – see the Flood Control System Status Report (DWR, 2010) for updated estimates of actual capacities and the CVFPP for resolution of these inconsistencies.

Where the design flow capacities from O&M manuals are different for the left-bank levee and right-bank levee along a particular reach, the lowest capacity is shown in Figure 3-2. Detailed maps of the area covered in Figure 3-2 are included in Attachment A.

Upstream from Ord Ferry at about River Mile 183 on the Sacramento River, most SPFC facilities were constructed primarily to help reduce local flooding and have no association with the continuous flood management system that stretches from Ord Ferry to Collinsville in the Delta.

Flow in the Sacramento River is reduced by spilling floodwater into bypass areas through historic overflow areas and SPFC weirs. The first spill from the Sacramento River occurs just upstream from the start of the levee system at Ord Ferry. Floodwater leaves the river through three non-SPFC

paths and flows into the Butte Basin, which drains into the Sutter Bypass. Additionally, floodwater spills into bypasses over five SPFC weirs. Because of these spills to the bypass areas, the design flow capacity of the Sacramento River generally decreases in a downstream direction except where tributary inflow increases river flow. For example, the design capacity of the Sacramento River upstream from the leveed system is about 260,000 cfs. Downstream from the Tisdale Weir, the design capacity of the river is only 30,000 cfs.

The comprehensive system of SPFC levees, river channels, overflow weirs, drainage pumping plants, and flood bypass channels is the largest flood management system in California. This system includes the following major SPFC facilities:

- About 440 miles of river, canal, and stream channels (including an enlarged channel of the Sacramento River from Cache Slough to Collinsville)
- About 1,000 miles of levees (along the Sacramento River channel, Sutter and Yolo basins, and Feather, Yuba, Bear, and American rivers)
- Four relief bypasses (Sutter, Tisdale, Sacramento, and Yolo bypasses)
- Knights Landing Ridge Cut to connect the Colusa Basin to the Yolo Bypass
- Five major weirs (Sacramento Weir, built in 1916; Fremont Weir, built in 1924; and Moulton, Tisdale, and Colusa weirs, built in 1932 and 1933)
- Two sets of outfall gates
- Five major drainage pumping plants
- Numerous appurtenant structures such as minor weirs and control structures, bridges, and gaging stations

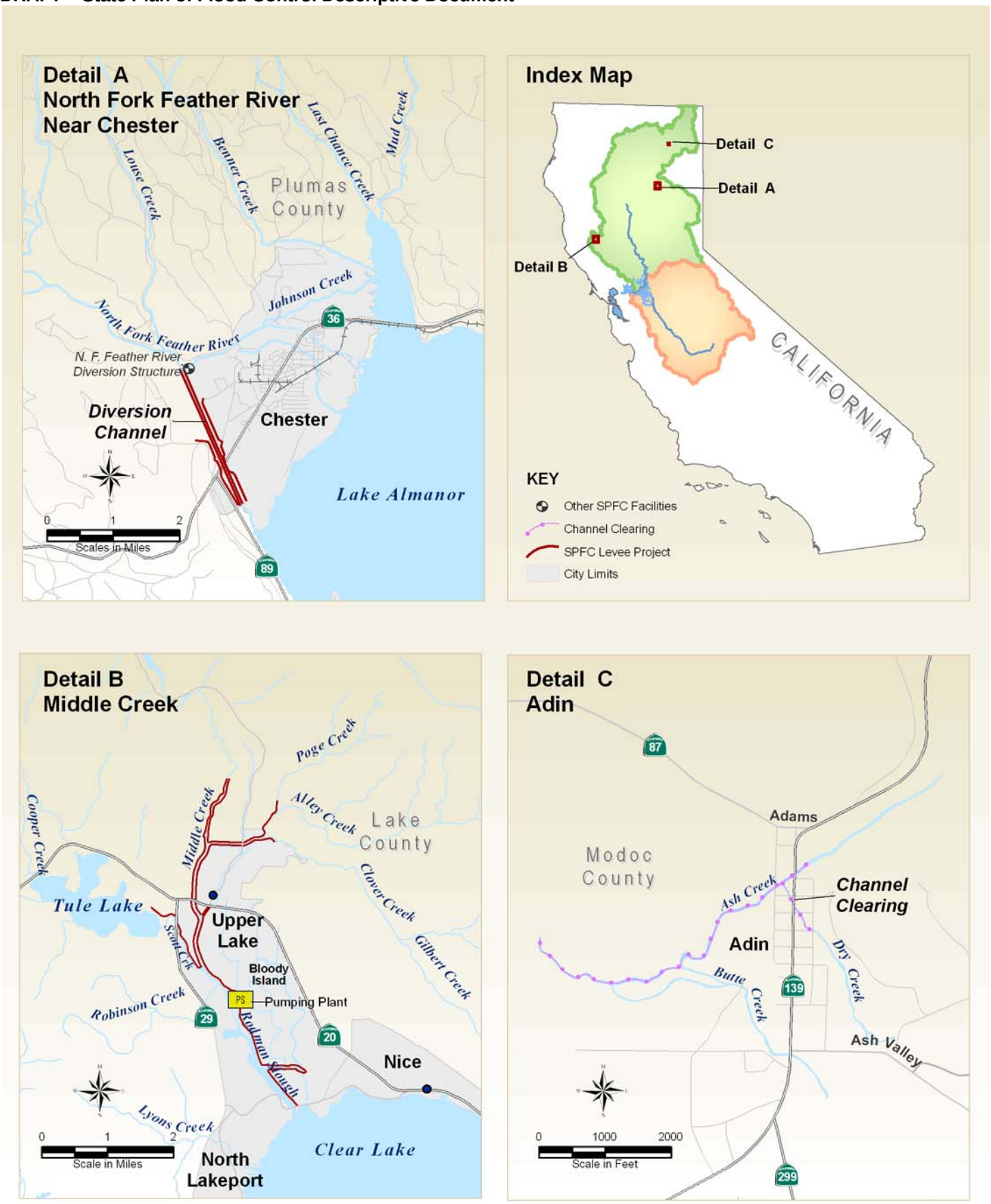

Figure 3-1. State Plan of Flood Control Facilities within the Sacramento River Basin at Chester, Middle Creek, and Adin

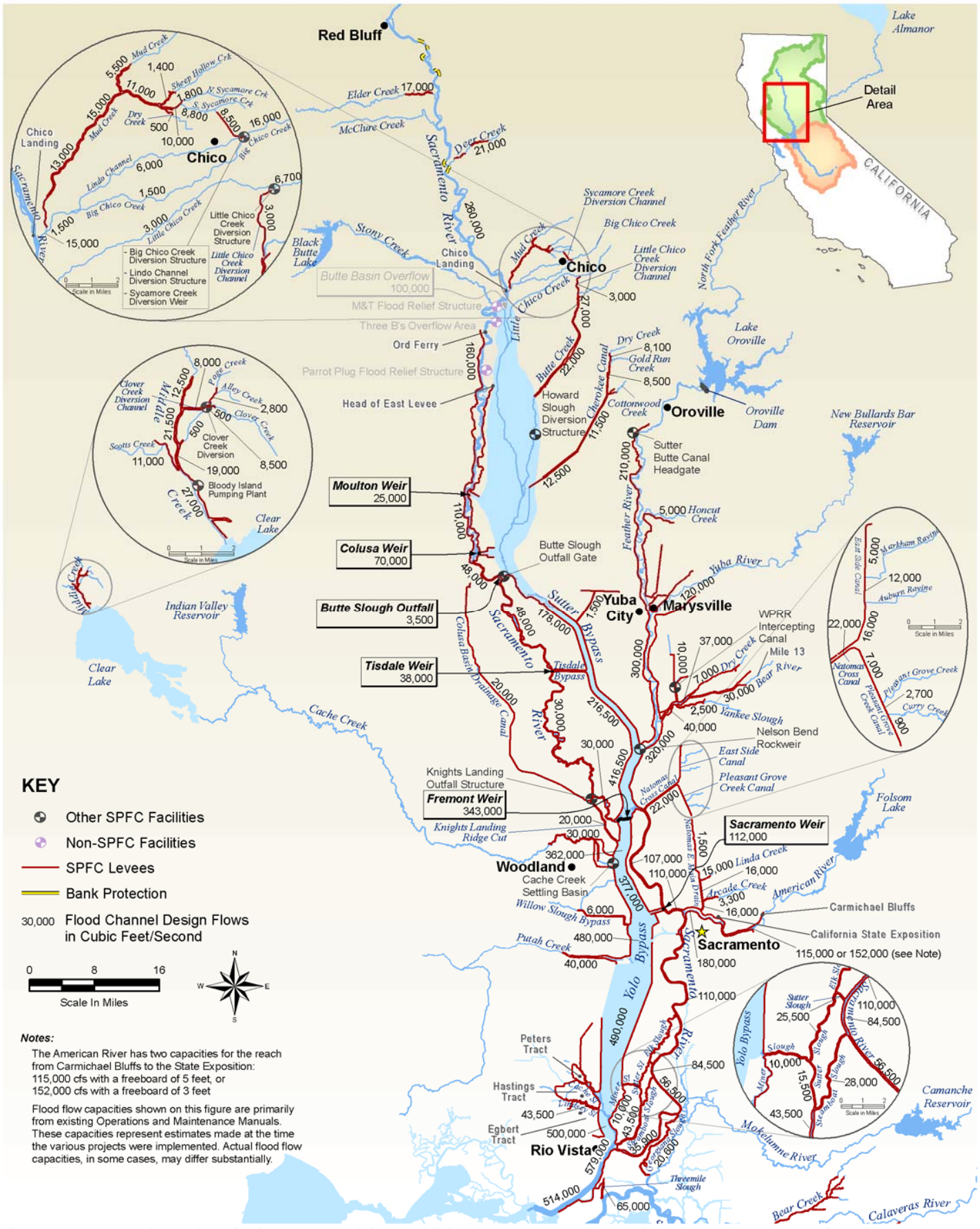

Figure 3-2. Design Flood Flow Capacities Within the Sacramento River, Bypasses, and Major Tributaries and Distributaries in the Sacramento River Basin

Table 3-1. Design Capacities by Reach in the Sacramento River Basin

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual		Design Capacity (cfs) from 1957 Revised Profile Drawings (Basis of State Operations)
	From	To	Left Bank	Right Bank	
Red Bluff to Chico Landing					
Sacramento River					
Deer Creek to Chico Landing			260,000 cfs from Senate Document No. 23		
Tributaries to Sacramento River					
Elder Creek	6.00	0.00	17,000	17,000	17,000
Deer Creek	7.40	0.00	21,000	21,000	21,000
Chico Landing to Colusa Weir					
Sacramento River					
Chico Landing to head of east levee	175.00	166.00	160,000	160,000	160,000
East levee head to Moulton Weir	166.00	148.25	160,000	160,000	160,000
Moulton Weir to Colusa Weir	148.25	138.00	110,000	135,000	135,000
Tributaries to Sacramento River					
Mud Creek and Big Chico Creek					
Mud Creek – End of Levees to Sycamore Creek	8.2[2]	6.8[2]	5,500	5,500	No Data
Mud Creek – Sycamore Creek to SPRR	6.8[2]	4.3[2]	15,000	15,000	15,000
Mud Creek – SPRR to Big Chico Creek	4.3[2]	0	13,000	13,000	13,000 to 15,000
Big Chico Creek – Mud Creek to Sacramento River	0.2[2]	0	15,000	15,000	15,000
Distributaries from Sacramento River					
Overflow to Butte Basin	175.00	166.00	100,000 cfs from Senate Document No. 23		
Moulton Weir	158.5	158.5	25,000	25,000	25,000
Colusa Weir	146[2]	146[2]	70,000	70,000	70,000

Table 3-1. Design Capacities by Reach in the Sacramento River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual		Design Capacity (cfs) from 1957 Revised Profile Drawings (Basis of State Operations)
	From	To	Left Bank	Right Bank	
Colusa Weir to Fremont Weir					
Sacramento River					
Colusa Weir to Butte Slough	138.00	130.00	48,000	48,000	65,000
Butte Slough to Tisdale Weir	130.00	119.50	66,000	48,000	66,000
Tisdale Weir to Knights Landing	119.50	90.00	30,000	30,000	30,000
Knights Landing to Fremont Weir	90.00	85.00	30,000	30,000	30,000
Tributaries to Sacramento River					
Butte Slough Outfall	138[2]	138[2]	3,500	3,500	1,000
Knights Landing Outfall	90[2]	90[2]	No Data	No Data	No Data
Distributaries from Sacramento River					
Tisdale Weir and Bypass	119[2]	119[2]	38,000	38,000	38,000
Fremont Weir	85[2]	82[2]	343,000	343,000	343,000
Sutter Bypass					
Butte Slough to Wadsworth Canal	93[2]	83.00	178,000	178,000	150,000
Wadsworth Canal to Tisdale Bypass	83.00	77.80	178,000	178,000	155,000
Tisdale Bypass to Feather River	77.80	67.00	216,500	216,500	180,000
Feather River to Verona	67.00	59.00	416,500	416,500	380,000
Tributaries to Sutter Bypass:					
Butte Creek					
Little Chico Creek Diversion Channel to Midway	15.3[2]	8[2]	27,000	27,000	27,000
Midway to 1.6 Miles Downstream of Aguas Frias Road	8[2]	0	22,000	22,000	22,000

Table 3-1. Design Capacities by Reach in the Sacramento River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual		Design Capacity (cfs) from 1957 Revised Profile Drawings (Basis of State Operations)
	From	To	Left Bank	Right Bank	
Cherokee Canal					
Dry Creek to Gold Run Creek at Nelson Road	21.7[2]	20.2[2]	N/A	8,100	No Data
Gold Run Creek at Nelson Road to Cottonwood Creek at Western Canal	20.2[2]	15.8[2]	8,500	8,500	No Data
Cottonwood Creek at Western Canal to RD 833 Canal Entrance at Afton Road	15.8[2]	7.9[2]	11,500	11,500	12,500
RD833 Canal Entrance at Afton Road to Lower Butte Basin about 1 Mile Downstream of Colusa-Gridley Road	7.9[2]	0	12,500	12,500	12,500
Wadsworth Canal	5.00	0.50	1,500	1,500	1,500
Feather River					
Oroville to mouth of Yuba River	50.85	27.40	210,000	210,000	210,000
Mouth of Yuba River to Bear River	27.40	12.00	300,000	300,000	300,000
Bear River to Yolo bypass	12.00	7.60	320,000	320,000	320,000
Tributaries to Feather River					
Honcut Creek	4.50[2]	0.00[2]	5,000	5,000	25,000
Yuba River	5.00	0.50	120,000	120,000	120,000
Bear River					
Mile 13 to Dry Creek	13.00[2]	6.00[2]	30,000	30,000	30,000
Dry Creek to WPRR	6.00[2]	4.70[2]	37,000	37,000	37,000
WPRR to Feather River	4.70[2]	0.00[2]	40,000	40,000	40,000
Tributaries to Bear River					
WP Interceptor Channel	6.30[2]	0.00[2]	10,000	10,000	10,000
South Dry Creek	1.50[2]	0.00[2]	7,000	7,000	9,000
Yankee Slough	4.00[2]	0.00[2]	2,500	2,500	2,500

Table 3-1. Design Capacities by Reach in the Sacramento River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual		Design Capacity (cfs) from 1957 Revised Profile Drawings (Basis of State Operations)
	From	To	Left Bank	Right Bank	
Fremont Weir to American River					
Sacramento River					
Fremont Weir to Sacramento Weir	85.00	63.90	107,000	107,000	107,000
Sacramento Weir to American River	63.40	51.70	110,000	110,000	18,000
Tributaries to Sacramento River					
Natomas Cross Canal	4.7	0.1	22,000	22,000	22,000
Tributaries to Natomas Cross Canal					
East Side Canal					
WPRR to Markham Ravine	No Data	No Data	N/A	5,000	5,000
Markham Ravine to Auburn Ravine	No Data	No Data	N/A	12,000	12,000
Auburn Ravine to Natomas Cross Canal	No Data	No Data	N/A	16,000	16,000
Pleasant Grove Creek Canal					
Sankey Road to Keys Road	No Data	No Data	900	900	800
Keys Road to Pleasant Grove Creek	No Data	No Data	2,700	2,700	2,300
Pleasant Grove Creek to Natomas Cross Canal	No Data	No Data	7,000	7,000	6,000
American River					
Carmichael to State Fair Grounds (left bank)	10.00[2]	3.00[2]	115,000 to 152,000[3]	N/A	115,000 to 152,000[3]
Mayhew to State Fair Grounds (right bank)	13.00[2]	3.00[2]	N/A	115,000 to 152,000[3]	115,000 to 152,000[3]
State Fair Grounds to Sacramento River	3.00[2]	0.00	180,000	180,000	180,000
Tributaries to American River					
Natomas East Main Drainage Canal					
Sankey Road to Dry (Linda) Creek	13.00[2]	4.00[2]	N/A	1,100	1,500
Dry (Linda) Creek to Arcade Creek	4.00[2]	2.00[2]	12,600 to 12,900	12,600 to 12,900	16,300
Arcade Creek to American River	2.00[2]	0.00	16,000 to 16,300	16,000 to 16,300	16,000 to 16,300

Table 3-1. Design Capacities by Reach in the Sacramento River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual		Design Capacity (cfs) from 1957 Revised Profile Drawings (Basis of State Operations)
	From	To	Left Bank	Right Bank	
Tributaries to Natomas East Main Drainage Canal:					
Dry Creek (previously, Linda Creek)	1.30[2]	0.00	15,000	N/A	15,000
Arcade Creek	2.00[2]	0.00	3,300	3,300	3,300
Distributaries from Sacramento River:					
Sacramento Weir and Bypass	45.30	45.30	112,000	112,000	112,000
Yolo Bypass					
Fremont Weir to Knight's Landing Ridge Cut	57[2]	54[2]	343,000	343,000	343,000
Knight's Landing Ridge Cut to Cache Creek	54[2]	51.8	362,000	362,000	362,000
Cache Creek to Sacramento Weir	51.8	45.3	377,000	377,000	377,000
Sacramento Weir to Putah Creek	45.30	39.5	480,000	480,000	480,000
Putah Creek to Miner Slough	39.5	19[2]	490,000	490,000	490,000
Miner Slough to Cache Slough	No Data	No Data	490,000	490,000	500,000
Cache Slough to Sacramento River	No Data	0.00	490,000	490,000	500,000
Tributaries to Yolo Bypass:					
Knight's Landing Ridge Cut	2.6	0	20,000	20,000	20,000
Cache Creek	12.7	0	30,000	30,000	30,000
Willow Slough	No Data	0	6,000	6,000	6,000
Putah Creek	9.7	0	40,000	40,000	62,000
Miner Slough	1.68	0	10,000	10,000	10,000
Cache Slough and Lindsey Slough	No Data	0	43,500	43,500	30,000

Table 3-1. Design Capacities by Reach in the Sacramento River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual		Design Capacity (cfs) from 1957 Revised Profile Drawings (Basis of State Operations)
	From	To	Left Bank	Right Bank	
American River to Collinsville					
Sacramento River					
American River to Elk Slough	51.6	42.3	110,000	110,000	110,000
Elk Slough to Sutter Slough	42.1	34.3	110,000	110,000	110,000
Sutter Slough to Steamboat Slough	34.1	32.7	84,500	84,500	85,000
Steamboat Slough to head of Georgiana Slough	32.5	26.75	56,500	56,500	56,500
Georgiana Slough to Yolo Bypass Junction	26.5	14.75	35,900	35,900	35,900
Yolo Bypass to 3-Mile Slough	14.62	9.75	579,000	579,000	579,000
3-Mile Slough to Collinsville	9.5	0	514,000	514,000	514,000
Distributaries from Sacramento River:					
Steamboat Slough – Sac River to Sutter Slough	10	7	28,000	28,000	28,000
Steamboat Slough – Sutter Slough to Sac River	7	0	43,500	43,500	43,500
Sutter Slough - Sacramento River to Miner	No Data	0	25,500	25,500	26,500
Sutter Slough - Miner to Steamboat	6.55[2]	No Data	15,500	15,500	15,500
Georgiana Slough	10	0	20,600	20,600	20,600
3-Mile Slough	No Data	0	65,000	65,000	65,000

Notes:
[1] Sequential river reaches were not necessarily designed as a system. Therefore, the capacities in the table do not add up. In some cases, left- and right-bank levees along the same reach may have different design capacities.
[2] The river mile was estimated at this location.
[3] The capacity is 115,000 cfs at 5 feet of freeboard and 152,000 cfs at 3 feet of freeboard.
Key:
cfs = cubic feet per second
N/A = not applicable
No Data = No Data currently presented
O&M = operations and maintenance
WPRR = Western Pacific Railroad

3.1.2 San Joaquin River Basin

The flood management system along the San Joaquin River manages flood flows originating from an area of approximately 16,700 square miles in the Sierra Nevada, Central Valley, and Coastal Range in Central California. Major tributaries to the San Joaquin River include the Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, and Fresno rivers, which discharge to the San Joaquin River from the east. In addition, during flood release events from Pine Flat Reservoir, the majority of Kings River flows are diverted north through the James Bypass into the San Joaquin River.

Unlike on the Sacramento River, where SPFC levees are continuous from Ord Ferry to the Delta, San Joaquin River SPFC levees are intermittent from near River Mile 225 to the Delta. The Chowchilla, Eastside, and Mariposa bypasses are the main SPFC facilities for the upstream portion of the San Joaquin River system. For portions of the system, these bypasses are the only SPFC facilities, and the San Joaquin River itself is not part of the SPFC. The bypass system ends upstream from the Merced River.

Figure 3-3 shows an overview of SPFC facilities in the San Joaquin River Basin. The design flow capacities of the various stream reaches are shown in Figure 3-3 and listed in Table 3-2. The State operates SPFC facilities in the San Joaquin River Basin based on the 1955 profile (see Section 6.6.2) rather than on design flows from the O&M manuals.

Where the design flow capacities from O&M manuals were different for the left-bank levee and right-bank levee along a particular reach, the lowest capacity is shown in Figure 3-3. Detailed maps of the area covered in Figure 3-3 are included in Attachment A. Similar to the discussion for Table 3-1 in Section 3.1.1, Table 3-2 shows design capacities used to set minimum levee height, without consideration of geotechnical conditions that may lower the actual capacities. See the Flood Control System Status Report (DWR, 2010) for updated estimates of actual capacities and the CVFPP for resolution of these inconsistencies.

Major SPFC facilities along the San Joaquin River and tributaries include the following:

- Chowchilla Canal Bypass (and levees), which begins at the San Joaquin River downstream from Gravelly Ford, diverts San Joaquin River flows, and discharges the flows into the Eastside Bypass

- Eastside Bypass (and levees), which begins at the Fresno River, collects drainage from the east, and discharges to the San Joaquin River between Fremont Ford and Bear Creek

- Mariposa Bypass, which begins at the Eastside Bypass and discharges to the San Joaquin River (and levees)
- Approximately 99 miles of levees along the San Joaquin River
- Approximately 135 miles of levees along San Joaquin River tributaries and distributaries
- Six instream control structures (Chowchilla Bypass Control Structure, San Joaquin River Control Structure, Mariposa Bypass Control Structure, Eastside Bypass Control Structure, Sand Slough Control Structure, and San Joaquin River Structure)
- Two major pumping plants

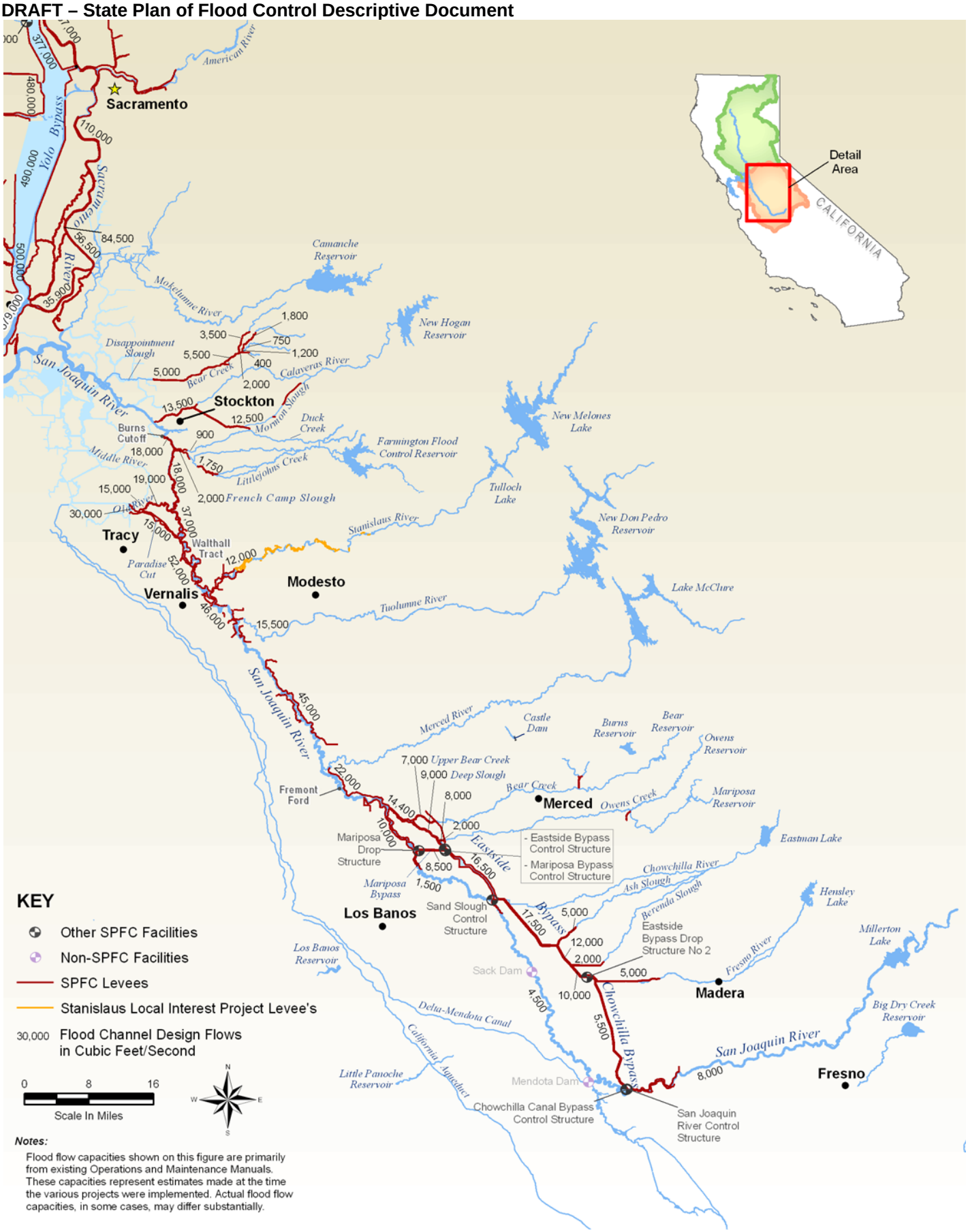

Figure 3-3. Design Flood Flow Capacities Within the San Joaquin River, Bypasses, and Major Tributaries and Distributaries in the San Joaquin River Basin

Table 3-2. Design Capacities by Reach in the San Joaquin River Basin

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual[2]	
	From	To	Left Bank	Right Bank
Friant Dam to Chowchilla Canal Bypass				
San Joaquin River	224.66	214.03	8,000	8,000
Chowchilla Canal Bypass to Sand Slough Control Structure				
San Joaquin River	170[3]	166.44	4,500	4,500
Distributaries from San Joaquin River:				
Chowchilla Bypass	32.04	15.85	5,500	5,500
Eastside Bypass				
Fresno River to Berenda Slough	15.85	13.59	10,000	10,000
Berenda Slough to Ash Slough	13.59	10.48	12,000	12,000
Ash Slough to Sand Slough	10.48	0.00	17,500	17,500
Tributaries to Eastside Bypass:				
Fresno River	8.36	0.00	5,000	5,000
Berenda Slough	4.28	0.00	2,000	2,000
Ash Slough	4.52	0.00	5,000	5,000
Sand Slough Control Structure to Merced River				
San Joaquin River				
Control Structure to Mariposa Bypass	149.89	145.15	1,500	1,500
Mariposa Bypass to Eastside Bypass	145.15	133.80	10,000	10,000
Eastside Bypass to Merced River	133.80	116.66	22,000	22,000
Tributaries to San Joaquin River:				
Mariposa Bypass	4.23	0.00	8,500	8,500
Eastside Bypass				
Control Structure to Mariposa Bypass	8.96	16[3]	16,500	16,500
Mariposa Bypass to Owens Creek	8.96	5[3]	8,000	8,000
Owens Creek to Bear Creek	5[3]	1[3]	9,000	9,000
Bear Creek to San Joaquin River	1[3]	0.00	14,400	14,400

Table 3-2. Design Capacities by Reach in the San Joaquin River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual	
	From	To	Left Bank	Right Bank
Tributaries to Eastside Bypass:				
Owens Creek	0.98	0.00	No Data	No Data
Deep Slough	6.66	0.00	9,000	9,000
Upper Bear Creek	7.98	4.25	7,000	7,000
Bear Creek	4.25	0.00	14,400	14,400
Merced River to Stanislaus River				
San Joaquin River				
Merced River to Tuolumne River	110.90	81.50	45,000	45,000
Tuolumne River to Stanislaus River	81.50	72.60	46,000	46,000
Tributaries to San Joaquin River:				
Tuolumne River	0.60	0.00	15,000	15,000
Stanislaus River	11.90	0.00	12,000	12,000
Stanislaus River to Burns Cutoff				
San Joaquin River				
Stanislaus River to Paradise Cut	72.60	58.30	52,000	52,000
Paradise Cut to Old River	58.30	53.30	37,000	37,000
Old River to Burns Cutoff	53.30	40.60	18,000	18,000
Tributaries to San Joaquin River:				
French Camp Slough	6.40	0.00	3,000	2,000
Tributaries to French Camp Slough:				
Littlejohns Creek	1.00	0.00	1,750	1,750
Duck Creek	0.90	0.00	900	900
Distributaries from San Joaquin River:				
Paradise Cut – San Joaquin River to Old River	0.00	7.4 or 5.9[3]	15,000	15,000
Old River – downstream from Paradise Cut	5.9	8.2	30,000	30,000

Table 3-2. Design Capacities by Reach in the San Joaquin River Basin (Contd.)

River Reach[1]	River Miles		Design Capacity (cfs) from O&M Manual	
	From	To	Left Bank	Right Bank
Old River – San Joaquin to Middle River	No Data	No Data	19,000	19,000
Old River – Middle River to Paradise Cut	No Data	No Data	19,000	15,000
Old River/Salmon Slough – Paradise Cut to Grant Line Canal	No Data	No Data	N/A	30,000
Burns Cutoff to Disappointment Slough				
Tributaries to San Joaquin River:				
Calaveras River	5.80	0.00	13,500	13,500
Tributaries to Calaveras River:				
Mormon Slough	8.40	6.20	12,500	12,500
Bear Creek – Disappointment Slough to Mosher Creek	No Data	No Data	5,500	5,500
Bear Creek – Mosher Creek to Paddy Creek	No Data	No Data	5,000	5,000
Bear Creek – upstream from Paddy Creek	No Data	No Data	3,500	3,500
Tributaries to Bear Creek:				
Paddy Creek – Bear Creek to North Paddy Creek	No Data	No Data	2,000	2,000
Paddy Creek – upstream from North Paddy Creek	No Data	No Data	400	400
Middle Paddy Creek	No Data	No Data	750	750
North Paddy Creek – Paddy Creek to Middle Paddy Creek	No Data	No Data	1,800	1,800
North Paddy Creek – upstream from Middle Paddy Creek	No Data	No Data	1,200	1,200

Notes:
[1] Sequential river reaches were not necessarily designed as a system. Therefore, the capacities in the table do not add up. In some cases, left- and right-bank levees along the same reach may have different design capacities.
[2] The State operates SPFC facilities in the San Joaquin River Basin based on the 1955 profile rather than on design flows from the O&M manuals.
[3] The river mile was estimated at this location.
Key:
cfs = cubic feet per second
N/A = not applicable
No Data = No Data currently presented
O&M = operations and maintenance

3.2 SPFC Facilities in the Sacramento River Basin

This section describes SPFC facilities in the Sacramento River Basin, reach by reach. Because of the numerous locations of tributary and distributary flow, the Feather River watershed, American River watershed, Sutter Bypass watershed, Yolo Bypass watershed, and Sacramento River watershed are described separately. The description for the Sacramento River watershed identifies where the Feather River, American River, Sutter Bypass, and Yolo Bypass are either tributary or distributary to the Sacramento River.

Figure 3-4 is an index map of the Sacramento River Basin showing the five major watersheds, including SPFC facilities.

3.2.1 Feather River Watershed

The Feather River, a tributary to the Sacramento River, drains a major watershed in the Sierra and Cascade mountain ranges. Figure 3-5 shows SPFC facilities in the Feather River watershed.

Figure 3-4. Index Map of the Sacramento River Basin Including the Five Major Watersheds With Facilities of the State Plan of Flood Control

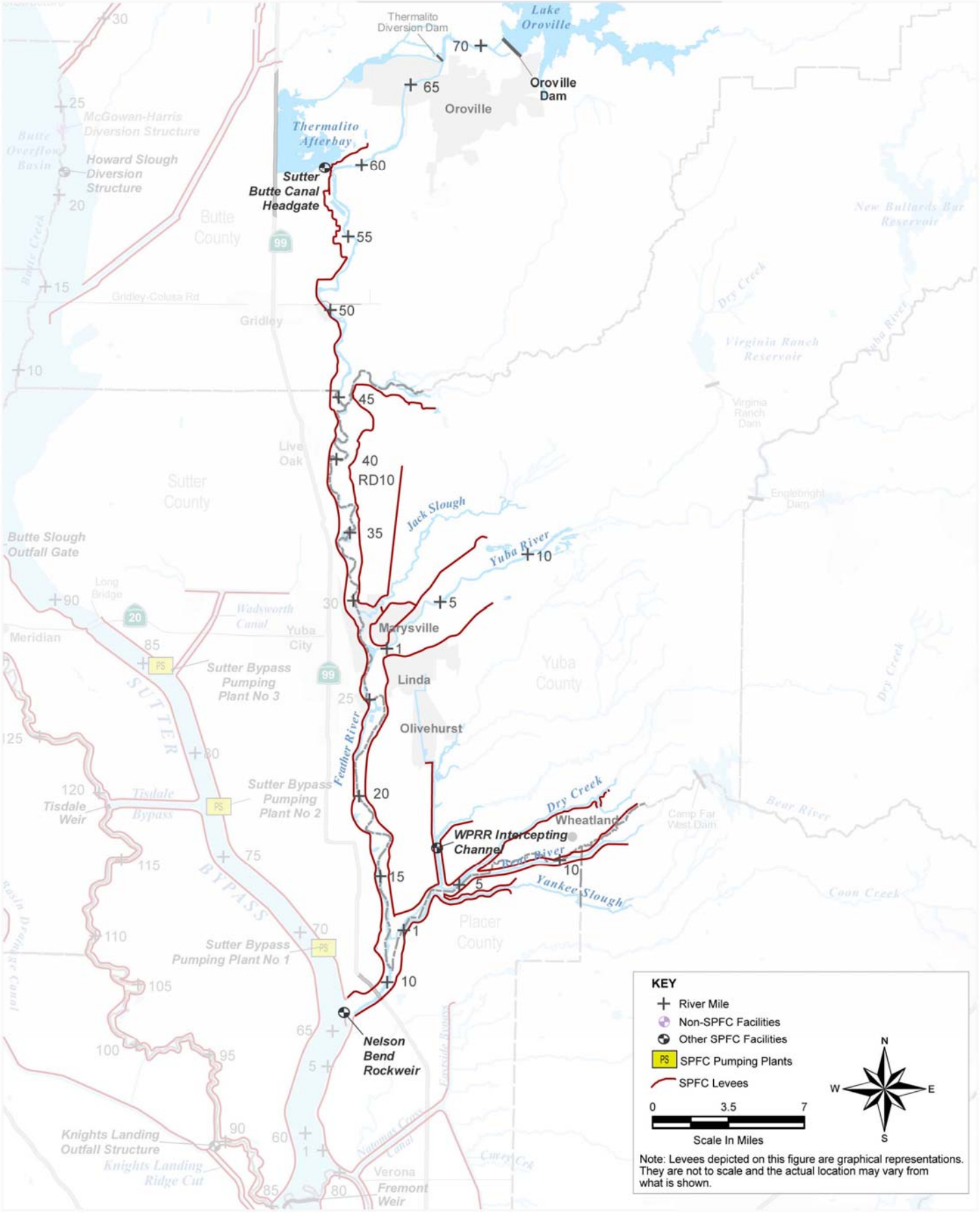

Figure 3-5. Feather River Watershed – State Plan of Flood Control Facilities Along the Feather, Yuba, and Bear Rivers and Tributaries

North Fork Feather River Near Chester

SPFC channel improvements and levees (see O&M Manual SAC508) reduce flood risk to the town of Chester, bridges for Highway 36, two county roads, and a railroad. The project (see Figure 3-1) consists of a diversion structure, an excavated rock-lined diversion channel, about 3 miles of levees along the channel (about 1.8 miles on the left bank and 1.2 miles on the right bank), and seven drop structures. At design flow (based on the O&M manual), an estimated 3,000 cfs would pass through the diversion structure to the North Fork Feather River and to Lake Almanor, and approximately 10,000 cfs would be conveyed by the diversion channel to Lake Almanor. The project is located upstream from Lake Oroville. Project O&M are performed by the Plumas County Department of Public Works.

Oroville Dam and Facilities

Lake Oroville and related facilities are operated by DWR to provide multiple benefits, including flood management. Of a total storage of 3.5 million acre-feet, the lake is operated with 750,000 acre-feet available for flood storage during the flood season. Since the State has provided assurances for flood management operation, Oroville Dam and facilities are included in the SPFC.

Feather River from Thermalito to Yuba River

This reach of river has a channel design capacity of 210,000 cfs at 3 feet of freeboard based on the O&M manuals. SPFC facilities include right- and left-bank levees along the Feather River, the Sutter-Butte Canal Headgate, a levee on the left bank of Honcut Creek, a back levee for Reclamation District (RD) 10, and a ring levee around Marysville. The levees were originally built by local interests and enlarged or improved by USACE as project levees.

Oroville Dam is part of the SPFC

- The Feather River right-bank levee (see O&M Manuals SAC144, SAC152, and SAC154), about 28 miles long, reduces flood risk to adjacent agricultural lands and the towns of Gridley, Live Oak, and Yuba City. Maintenance is provided by DWR through Maintenance Areas 7 and 16, and Levee Districts 1 and 9.

- The Feather River left-bank levee (see O&M Manual SAC151), extending about 11.2 miles from Honcut Creek to Jack Slough just north of Marysville, reduces flood risk for RD 10. Maintenance is provided by RD 10.

- The Sutter-Butte Canal Headgate (O&M Manual SAC160) controls release of river water to the irrigation canal. The Sutter-Butte Canal now receives water from the Thermalito Afterbay – no supplement to O&M Manual SAC160 has been found to document this change. The structure is operated and maintained by DWR.

- A left-bank levee (see O&M Manual SAC151) along Honcut Creek extends about 4.5 miles from high ground to the confluence with the Feather River. The Honcut Creek design channel capacity is 5,000 cfs, based on the O&M manual. This differs from the design capacity of 25,000 cfs from the 1957 revised profile. The levee is maintained by DWR and RD 10.

- The back levee (see O&M Manual SAC151) for RD 10 extends about 8 miles along Jack Slough and Simmerly Slough. The levee reduces flood risk from waters from the east. The levee is maintained by RD 10. Together, the Honcut Creek levee, the left-bank levee along the Feather River, and the back levee nearly surround RD 10.

Source: California Disaster Office, 1956.
The ring levee protects Marysville during the Flood of 1955

- The ring levee (see O&M Manual SAC147) around Marysville is about 7.2 miles long. The levee reduces flood risk to Marysville from the Feather River, the Yuba River, and Jack and Simmerly sloughs. The levee is maintained by the Marysville Levee Commission.

Yuba River

The channel capacity of the Yuba River upstream from its confluence with the Feather River is 120,000 cfs based on the O&M manuals. SPFC facilities include right- and left-bank levees. The right-bank levee (see O&M Manual SAC147) extends about 4 miles upstream from the Marysville ring levee (see description above). The levee is maintained by the Marysville Levee Commission. Note that the water control manual for the upstream New Bullards Bar Dam specifies 180,000 cfs for the Yuba River.

The left-bank levee (see O&M Manuals SAC145 and SAC149) extends about 6.1 miles from high ground to the confluence connection with Feather River levees. The levee is maintained by RD 784, and reduces flood risk to Linda and Olivehurst and adjoining agricultural land. The left-bank levee was originally built by local interests and enlarged or improved to project standards by USACE as a project levee.

Feather River from Yuba River to Bear River

The design channel capacity of the Feather River in this reach is 300,000 cfs with 3 feet of freeboard, based on the O&M manuals. SPFC facilities include right- and left-bank levees. The right-bank levee (see O&M Manual SAC144), about 14 miles long, reduces flood risk to Yuba City and adjoining agricultural land. The right-bank levee is maintained by Levee District 1. The left-bank levee (see O&M Manual SAC145) is about 13 miles long. The levee is maintained by RD 784 and reduces flood risk to Linda and Olivehurst and adjoining agricultural land.

The Three Rivers Levee Improvement Authority (TRLIA) has also completed levee setbacks that are now operable. The levee setbacks did not change the design capacity of this reach.

Bear River

SPFC facilities in the Bear River watershed include levees along Dry Creek, the Bear River, Yankee Slough, and the Western Pacific Railroad (WPRR) Intercepting Channel. Originally built by local interests, these levees were later repaired or enlarged to project standards by USACE.

- Dry Creek has a design channel capacity of 7,000 cfs based on the O&M manuals. This differs from the design capacity of 9,000 cfs estimated in the 1957 revised profile. The 1.5-mile-long right-bank levee (see O&M Manual SAC145) extends from high ground to the confluence with the Bear River. The levee is maintained by RD 784. The left-bank levee (see O&M Manual SAC146) extends about 8.5 miles from high ground to the confluence with the Bear River. The levee reduces flood risk to Wheatland and adjoining agricultural land. The left-bank levee is maintained by RD 817, RD 2103, and DWR.

- Upstream from its confluence with Dry Creek, the Bear River design channel capacity is 30,000 cfs, based on the O&M manual. The right-bank levee extends about 8.9 miles from high ground to the confluence. The levee is maintained by RD 817 and DWR and reduces flood risk to Wheatland and adjoining agricultural land. The left-bank levee (see O&M manual SAC141.1) extends about 7.5 miles from high ground to the confluence with Dry Creek.

- Yankee Slough has a design channel capacity of 2,500 cfs based on the O&M manual. Left- and right-bank levees (see O&M Manual SAC141.1) each extend about 4 miles from high ground to the confluence with the Bear River. Both levees along Yankee Slough are maintained by RD 1001.

- The design capacity of the WPRR Intercepting Channel is 10,000 cfs, based on the O&M manual. The right-bank levee, about 6.3 miles in length, extends from high ground and serves as a back levee for RD 784. Levee improvements by TRLIA have not yet been included in the O&M manual. The left-bank levee, about 4.2 miles in length, also reduces flood risk to RD 784. The levees are maintained by RD 784.

- Downstream from the Dry Creek confluence, the right-bank levee (see O&M Manual SAC145) of the Bear River extends about 4.7 miles to its connection with the Feather River levee. The levee is maintained by RD 784. Construction of a setback levee in 2005 and 2006 by TRLIA has not yet been included in the O&M manual. The WPRR Intercepting Channel enters Bear Creek from the north along this reach. Downstream from the WPRR Intercepting Channel, Bear Creek has a design capacity of 40,000 cfs with 3 feet of freeboard, based on the O&M manuals. Downstream from the Dry Creek confluence, the left-bank levee (see O&M Manuals SAC141.1 and SAC141.2) of Bear Creek extends about 5 miles to its connection with the Feather River levee. Yankee Slough enters along the left side of this reach. The left-bank levee is maintained by RD 1001.

Feather River from Bear River to Sutter Bypass

The design channel capacity of the Feather River in this reach is 320,000 cfs with 3 feet of freeboard based on the O&M manuals. SPFC facilities include left- and right-bank levees and a rock weir at Nelson Bend.

The right-bank levee (see O&M Manual SAC143) is 5.2 miles in length. Maintenance is provided by Levee District 1 and DWR through Maintenance Area 3. The left-bank levee (see O&M Manuals SAC141.1 and SAC141.2) is about 5 miles long and is maintained by RD 1001. Originally built by local interests, these levees were later enlarged or improved to project standards by USACE.

The rock weir (see O&M Manual SAC501) was constructed in 1970 and 1971 to control flow where the Feather River meets the Sutter Bypass. The improvements (Nelson Bend Modification Project) provide protection against the formation of Feather River overflow channels into the Sutter Bypass, and acts to retard deposition of sediments in the Sutter Bypass during flood flows.

Joint Feather River/Sutter Bypass Channel to the Sacramento River

From their junction, the Feather River and Sutter Bypass flow in a joint channel to the Sacramento River. The design channel capacity of this reach is 416,500 cfs with 6 feet of freeboard, based on the O&M manuals. SPFC facilities include left- and right-bank levees about 1.3 miles apart. The

right-bank levee (see O&M Manual SAC129), about 10 miles long, reduces flood risk to agricultural land in RD 1500. The levee is maintained by RD 1500. The left-bank levee (see O&M Manual SAC141.1), about 7 miles long, reduces flood risk to agricultural land in RD 1001. The levee is maintained by RD 1001. The left-bank levee was originally built by local interests and later enlarged or improved to project standards by USACE.

3.2.2 American River Watershed

The American River enters the Sacramento River at the City of Sacramento. Figure 3-6 includes SPFC facilities in the American River watershed.

American River from Carmichael Bluff to Natomas East Main Drainage Canal

The design capacity of this reach is 115,000 cfs with 5 feet of freeboard and 152,000 cfs with 3 feet of freeboard, based on the O&M manuals. SPFC facilities along this reach include right- and left-bank levees, two pumping plants, and vegetation on mitigation sites. The levees and pumping plants reduce flood risk to urban areas in Sacramento County. Portions of the levee were originally built by local interests and portions of these levees were enlarged to project standards by USACE.

The right-bank levee (see O&M Manuals SAC118.2 and SAC517) extends about 12 miles from high ground to the Natomas East Main Drainage Canal. The levee is maintained by American River Flood Control District and DWR through Maintenance Areas 10 and 11. The levee was constructed by USACE and was improved by USACE as part of the 1996 and 1999 Common Features authorization. Two SPFC pumping plants (see O&M Manual SAC518) are located along the American River and are operated by Sacramento County. Pumping Plant No. 1 is located about 1 mile downstream from the H Street Bridge; Pumping Plant No. 2 is located about 0.25 mile east of the Watt Avenue Bridge. The pumping plants dispose of local drainage water from about 15.5 square miles from the area located behind the levee. Five vegetation mitigation sites (see O&M Manual SAC517.3) are located between the Watt Avenue and Howe Avenue bridges.

Based on the O&M manual, the left-bank levee (see O&M Manual SAC118.1) begins at Mayhew Road, about 3.5 miles downstream from the right-bank levee and extends about 9 miles from high ground to the Natomas East Main Drainage Canal. The levee has been extended by USACE upstream from Mayhew. Four vegetation mitigation sites (see O&M Manual SAC118.1A) are located along this reach of levee. The levee is maintained by the American River Flood Control District, and DWR maintains the channel.

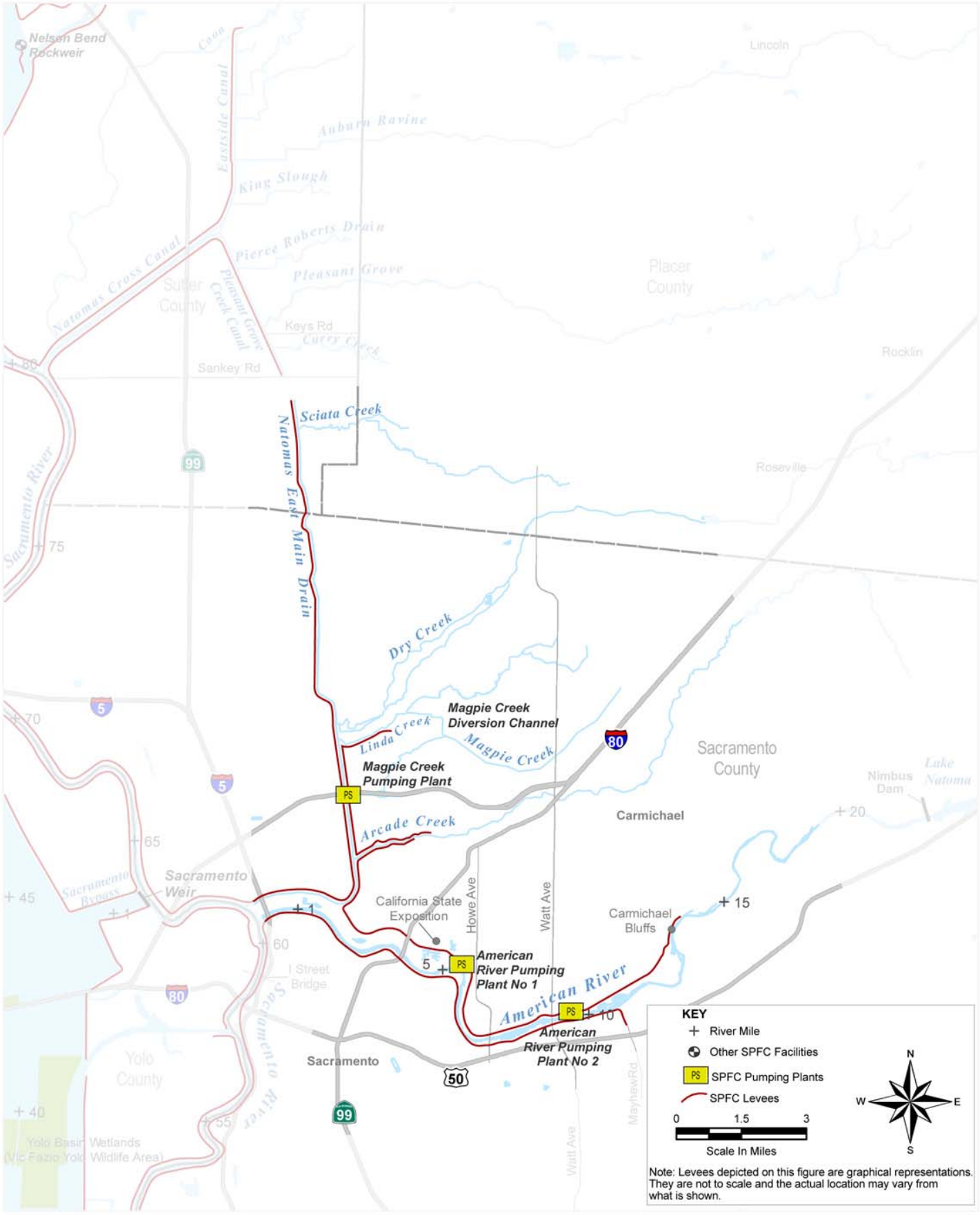

Figure 3-6. American River Watershed – State Plan of Flood Control Facilities Along the American River, Natomas East Main Drainage Canal, Natomas Cross Canal, and Tributaries

Natomas East Main Drainage Canal

The Natomas East Main Drainage Canal was designed to intercept streams approaching RD 1000 from the east and discharge them into the American River. SPFC facilities are levees and improved channels for the Natomas East Main Drainage Canal and tributaries. With the exception of the left-bank levee along Dry Creek and the right-bank levee along Arcade Creek, the levees were originally constructed by local interests and rebuilt by USACE to project standards. The levees are maintained by the American River Flood Control District.

- RD 1000 is entirely surrounded by levees. In the vicinity of Sankey Road on the east side of RD 1000, flow along the levee is southerly into the Natomas East Main Drainage Canal and northerly into the Pleasant Grove Creek Canal (see description under Section 3.2.5). For the reach of the Natomas East Main Drainage Canal from Sankey Road to the to the Dry Creek north levee, there is a right-bank levee (see O&M Manual SAC125) but no left-bank levee. The right-bank levee of Dry Creek has been extended as part of the Sacramento Area Flood Control Agency (SAFCA) and USACE authorized project, but is not yet in the O&M manual. The design capacity of this 9-mile reach of the Natomas East Main Drainage Canal is about 1,500 cfs, based on the O&M manual.

- Dry Creek enters the Natomas East Main Drainage Canal about 4 miles upstream from the American River. A left-bank levee (see O&M Manual SAC118.2) extends about 1.3 miles along Dry Creek. The design capacity of Dry Creek upstream from the Natomas East Main Drainage Canal is 15,000 cfs, based on the O&M manual. A 1.4 mile-long diversion channel from Magpie Creek to Dry Creek is intended to limit flood flows in the lower reaches of Magpie Creek. The Magpie Creek diversion channel has a design capacity of 250 cfs.

- From Arcade Creek to the American River, the Natomas East Main Drainage Canal has a capacity of 16,000 cfs, based on the O&M manuals. This reach of the Natomas East Main Drain has a right-bank levee (see O&M Manual SAC125) and a left-bank levee (see O&M Manual SAC118.2), each about 4 miles long. Along this reach, Arcade Creek enters from the east. The design capacity of Arcade Creek upstream from the Natomas East Main Drainage Canal is 3,300 cfs. Right- and left-bank levees (see O&M Manual SAC118.2) each extend along Arcade Creek about 2 miles from high ground to the Natomas East Main Drainage Canal.

American River from Natomas East Main Drainage Canal to Sacramento River

This reach of river has a design capacity of 180,000 cfs with 3 feet of freeboard, based on the O&M manuals. SPFC facilities include levees along both banks of the river. The right-bank levee (see O&M Manual SAC124) is about 2.2 miles long. The levee was originally built by local interests and accepted into the project without modification because it equaled or exceeded standards by USACE. The levee is maintained by RD 1000. A vegetation mitigation site (see O&M Manual SAC124.2) is located about 0.9 mile upstream from the Sacramento River. The left-bank levee (see O&M Manual SAC118.1) is about 2.5 miles in length. The levee was originally constructed by local interests and rebuilt by USACE to project standards. The levee reduces flood risk for areas in Sacramento County.

3.2.3 Sutter Bypass Watershed

The Sutter Bypass receives water from natural runoff areas south of Chico, overflow and weir flow from the Sacramento River, and drainage from the east side of the bypass through the Wadsworth Canal and pumping plants. The bypass joins the Feather River upstream from its confluence with the Sacramento River near the Fremont Weir. Figure 3-7 includes SPFC facilities in the Sutter Bypass watershed.

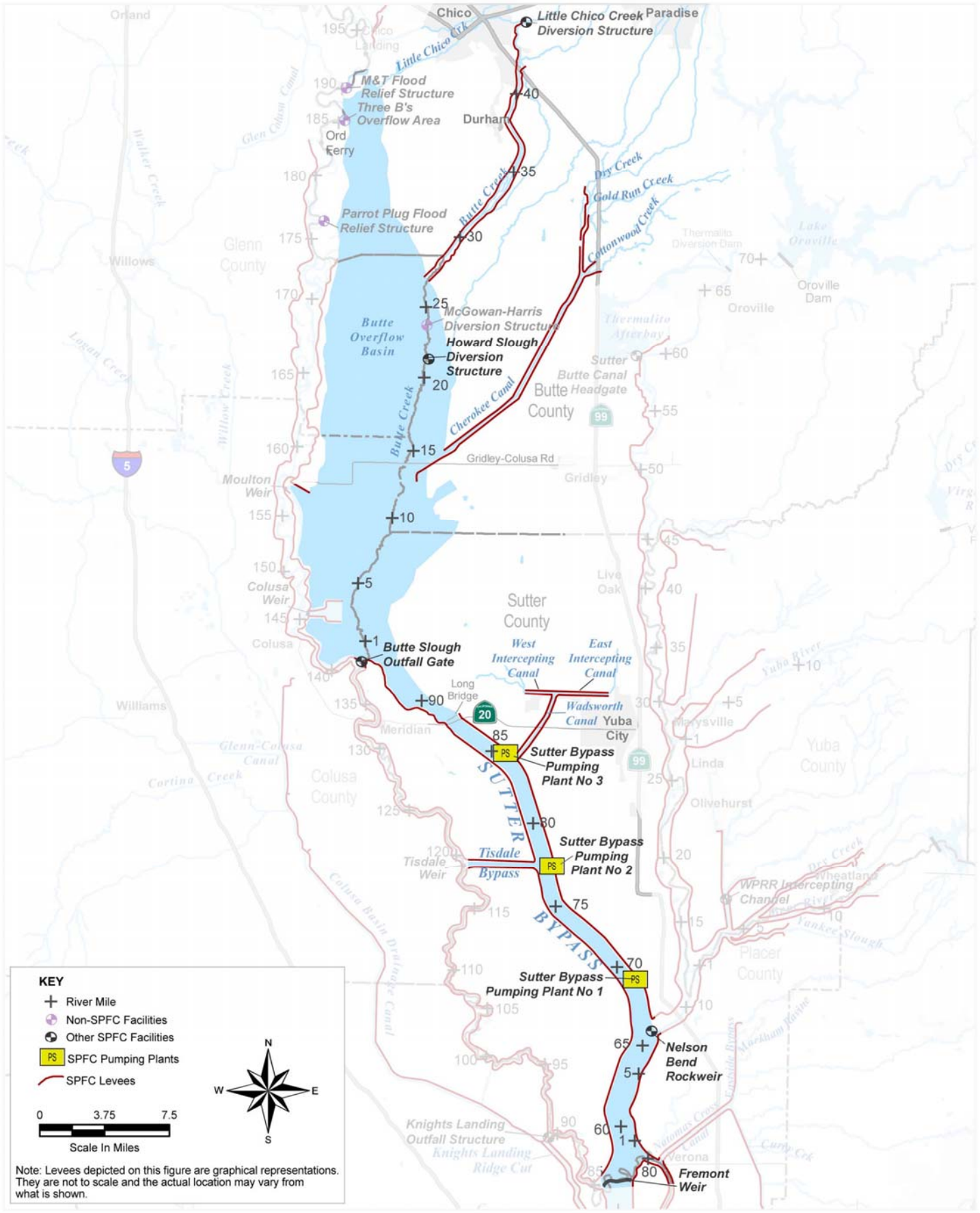

Figure 3-7. Sutter Bypass Watershed – State Plan of Flood Control Facilities Along Butte Creek, Cherokee Canal, Sutter Bypass, and Tributaries

Butte Creek Upstream from Butte Basin

SPFC facilities for Butte Creek include a diversion structure on Little Chico Creek, a diversion channel from Little Chico Creek to Butte Creek, and levees along the diversion channel and along Butte Creek. The facilities reduce flood risk to Chico, Durham, adjoining agricultural land, Highway 99, and several railroads and county roads. With the exception of levees along the downstream 8 miles of Butte Creek, levees were originally built by local interests and set back or enlarged to project standards by USACE. The facilities are maintained by DWR through Maintenance Area 5.

- The ungated Little Chico Diversion Structure (see O&M Manual SAC516) was designed to limit flood flows through Chico and route excess flood flows to Butte Creek. Upstream from the diversion, Little Chico Creek has a design capacity of 6,700 cfs, based on the O&M manual. The design capacity of Little Chico Creek downstream from the diversion is about 2,200 cfs. The design capacity of the 3-mile-long diversion channel to Butte Creek is about 3,000 cfs with 3 feet of freeboard. According to the O&M manual, the diversion channel can carry 4,500 cfs with no freeboard. The diversion channel has intermittent levees along the right bank (see O&M Manual SAC516).

- The design capacity of Butte Creek downstream from the confluence with the Little Chico Creek Diversion is 27,000 cfs with 3 feet of freeboard, based on the O&M manual. The channel can carry 40,000 cfs with no freeboard. Right- and left-bank levees (see O&M Manuals SAC515 and SAC516) extend about 15 miles downstream to the Butte Basin.

Cherokee Canal

SPFC facilities (see O&M Manual SAC519) consist of levees along Cherokee Canal, the lower reaches of Cottonwood Creek and Gold Run Creek, and irrigation and drainage structures from Butte Basin to high ground. The facilities provide reduced flood risk to adjacent agricultural lands, area transportation facilities, and irrigation canals. The facilities are maintained by DWR through Maintenance Area 13.

- The right-bank levee along Dry Creek and Gold Run Creek extends about 5.2 miles from high ground to the confluence with Cottonwood Creek. The left-bank levee extends about 3.5 miles from high ground to the confluence with Cottonwood Creek. The design capacity of this reach is about 8,500 cfs with 3 feet of freeboard, based on the O&M manual.

- The lower reach of Cottonwood Creek has a design capacity of about 3,500 cfs. Right- and left-bank levees, each about 1.3 miles long, extend from high ground to the connection with the Cherokee Canal levees.

- Downstream from Cottonwood Creek, the Cherokee Canal has a design capacity varying from 11,500 cfs to 12,500 cfs, based on the O&M manual. The right-bank levee extends about 14 miles. The left-bank levee is about 17 miles long. About midway along this reach, to allow flow to enter from the east, the left-bank levee is broken into two parallel segments for approximately 1.5 miles.

Butte Basin

SPFC facilities within the Butte Basin include channel improvements along lower Butte Creek and the Butte Slough Outfall Gates to the Sacramento River.

Water from Butte Creek (see O&M Manuals SAC153, SAC515, and SAC516), the Cherokee Canal (see O&M Manual SAC519), and other small tributaries from the north and east enter the Butte Basin. Flood flow from the Sacramento River enters the upper end of the Butte Basin (see discussion in Section 3.2.5) at three overflow areas below Chico Landing on the Sacramento River. While DWR performs some maintenance on these overflow areas (known as Three B's, M&T, and Parrot Plug), they are not the SPFC facilities, but their continued use is an important condition of operation of the SPFC (see Section 6.8).

Flood flow to the Butte Basin from the Sacramento River also occurs from the Moulton Weir (see O&M Manual SAC154) and from the Colusa Weir (see O&M Manuals SAC155 and SAC502). The weirs are described in Section 3.2.5, Sacramento River Watershed. The Butte Basin provides about 1 million acre-feet of storage at flood stage.

SPFC facilities in the Butte Basin are described below:

- Downstream from the Butte Creek levees, channel improvements (see O&M Manual SAC153) extend about 13 miles along lower Butte Creek to the Gridley-Colusa Road. The channel improvements and clearing allow a flow of about 2,500 cfs without extensive overbank flooding. The improvements along this reach also included replacing the old Howard Slough Diversion Structure with a new structure. The diversion structure is located across Butte Creek about 0.5 mile downstream from the bifurcation with Howard Slough. The O&M manual states that the nearby McGowan-Harris Diversion Structure, which was constructed by local interests, is not part of the project, but must be operated in

conjunction with the Howard Slough Diversion Structure. Both of these diversion structures are for irrigation and provide no flood management role. However, DWR does inspect these structures to be sure that flashboards are removed during the non-irrigation season to minimize their impact of flood stage.

- The Butte Slough Outfall Gates (see O&M Manual SAC161) to the Sacramento River control passage of floodwaters from the Butte Basin to the Sacramento River at a maximum flow of about 3,500 cfs, based on the O&M manual. The gates also allow passage of Butte Slough drainage water to the Sacramento River during the irrigation season.

Flood flows in the Butte Basin flow through Butte Slough and into the Sutter Bypass about 8 miles downstream from the Butte Slough Outfall Gates.

Butte Slough

SPFC facilities include the right-bank levee (see O&M Manual SAC134) from the Butte Slough Outfall Gates to the head of the Sutter Bypass. The levee, about 7.3 miles long, reduces flood risk to RD 70 and is maintained by RD 70. The levee was constructed by local interests and reconstructed to adopted grade and section by USACE. Based on the O&M manual, the design capacity of this reach is 185,000 cfs at the upstream end and 178,000 cfs with 6 feet of freeboard at the beginning of the Sutter Bypass.

Sutter Bypass

SPFC facilities along the Sutter Bypass and tributaries include levees and pumping plants. The levees along the Sutter Bypass are about 4,000 feet apart.

- From Long Bridge, just upstream from Highway 20 to the Wadsworth Canal, SPFC facilities include levees and a pumping plant. This reach has a design capacity of 178,000 cfs with 6 feet of freeboard, based on the O&M manuals. The right-bank levee (see O&M Manuals SAC133 and SAC134) is about 4.5 miles long and reduces flood risk to the town of Meridian and agricultural land in RD 70 and RD 1660. The left-bank levee (see O&M Manual SAC135) is about 4 miles long and reduces flood risk to adjacent agricultural land south of the town of Sutter and to Yuba City. Pumping Plant No. 3 (see O&M Manual SAC159) discharges water to the Sutter Bypass from the area located behind the levee. The plant has a capacity of about 180 cfs. In addition, reverse gravity flow water from the bypass provides irrigation water to adjacent agricultural areas.

- SPFC facilities along the Wadsworth Canal and intercepting canals are levees (see O&M Manual SAC135). Based on the O&M manual, the design capacity of the Wadsworth Canal is 1,500 cfs with 6 feet of freeboard at the confluence with the Sutter Bypass and reduces to 3 feet at River Mile 4. Both the right- and left-bank levees of the Wadsworth Canal are about 4.7 miles long. The Wadsworth Canal levees were built by local interests and reconstructed to adopted grade and section by USACE. At the upstream end of the Wadsworth Canal, the West Intercepting Canal and levees are about 1.4 miles long and the East Intercepting Canal and levees are about 3.8 miles long. The intercepting canals and levees were built by local interests, and a portion of the West Intercepting Canal was reconstructed by USACE. The levees reduce flood risk to adjacent agricultural land and to Yuba City. Maintenance is by DWR through Maintenance Area 3.

- From the Wadsworth Canal to the Tisdale Bypass, the Sutter Bypass has a design capacity of 178,000 cfs with 6 feet of freeboard, based on the O&M manuals. The right-bank levee (see O&M Manual SAC133) is about 5.8 miles long. The levee reduces flood risk to adjacent agricultural lands and the town of Meridian, and is maintained by RD 1660. The left-bank levee (see O&M Manual SAC135) is about 6.5 miles long. The levee reduces flood risk to adjacent agricultural land and Yuba City, and is maintained by DWR through Maintenance Area 3. Pumping Plant No. 2 (see O&M Manual SAC159) has a capacity of about 775 cfs. In addition, reverse gravity flow water from the bypass provides irrigation water to adjacent agricultural areas. Flow from the Tisdale Weir and Bypass (see O&M Manuals SAC129 and SAC135) enters the bypass from the west.

- SPFC facilities along the Sutter Bypass downstream from the Tisdale Bypass to the Feather River include levees and a pumping plant. The Sutter Bypass has a design capacity of 216,500 cfs with 6 feet of freeboard, based on the O&M manuals. The right-bank levee (see O&M Manual SAC129) is about 12.2 miles long. The levee reduces flood risk to adjacent agricultural lands and is maintained by RD 1500. The left-bank levee (see O&M Manual SAC135) is about 12.9 miles long. The levee reduces flood risk to adjacent agricultural land and is maintained by DWR through Maintenance Area 3. Pumping Plant No. 1 (see O&M Manual SAC159) has a capacity of about 280 cfs from the area located behind the levee into the bypass. In addition, reverse gravity flow water from the bypass provides irrigation water to adjacent agricultural areas.

Joint Feather River/Sutter Bypass Channel to the Sacramento River

As described under the Feather River watershed, from their junction, the Feather River and the Sutter Bypass flow in a joint channel to the Sacramento River. The design channel capacity of this reach is 416,500 cfs with 6 feet of freeboard, based on the O&M manuals. This differs from the design capacity of 380,000 estimated in the 1957 revised profile. SPFC facilities include left- and right-bank levees about 1.3 miles apart. The right-bank levee (see O&M Manual SAC129), about 10 miles long, reduces flood risk to agricultural land and is maintained by RD 1500. The left-bank levee (see O&M Manual SAC141.1), about 7 miles long, reduces flood risk to agricultural land and is maintained by RD 1001. The left-bank levee was originally built by local interests and later enlarged or improved to project standards by USACE.

3.2.4 Yolo Bypass Watershed

Fremont Weir is located at the junction of the Sacramento River and the joint Feather River/Sutter Bypass channel. The Yolo Bypass receives the majority of its flow by spill over the Fremont Weir from the Sacramento/Feather/Sutter Bypass. The Yolo Bypass receives additional flow from smaller tributaries along its length and from the Sacramento River through the Sacramento Bypass. For this description, the Yolo Bypass watershed begins in the Colusa Basin. Figure 3-8 shows SPFC facilities in the Yolo Bypass watershed.

Colusa Basin

SPFC facilities in the Colusa Basin include a left-bank levee, outfall gates to the Sacramento River, an excavated channel and levees to the Yolo Bypass, and stone biotechnical levee protection.

- The left-bank levee (see O&M Manual SAC132) to the Colusa Basin Drain (Colusa Trough Drainage Canal) is about 36.2 miles long and serves as a back levee for RD 108 and RD 787. The design capacity of the levee is 20,000 cfs with 3 feet of freeboard, based on the O&M manual. There is no SPFC right-bank levee. Maintenance is performed by RD 108 and DWR through Maintenance Area 12. About 36 acres of stone biotechnical levee protection (see O&M Manual SAC132.1) were added in three sites along this reach.

- The Knights Landing Outfall Gates (see O&M Manual SAC162), also known as the Sycamore Slough Outfall Gates, reduce flood risk to the lower Colusa Basin from Sacramento River backwater, but provide drainage to the Sacramento River during low flow. The structure was originally built by local interests. Flap gates were added by USACE and the State. Maintenance is conducted by DWR – Sacramento Yard.

- Knights Landing Ridge Cut (see O&M Manual SAC127) provides drainage of the Colusa Basin Drain to the Yolo Bypass. Based on the O&M manual, the capacity of the cut is 20,000 cfs with 3 feet of freeboard at the upstream end, and 6 feet of freeboard at the Yolo Bypass. The channel and its right- and left-bank levees are each about 6.4 miles in length. Maintenance is conducted by the Knights Landing Ridge Drainage District.

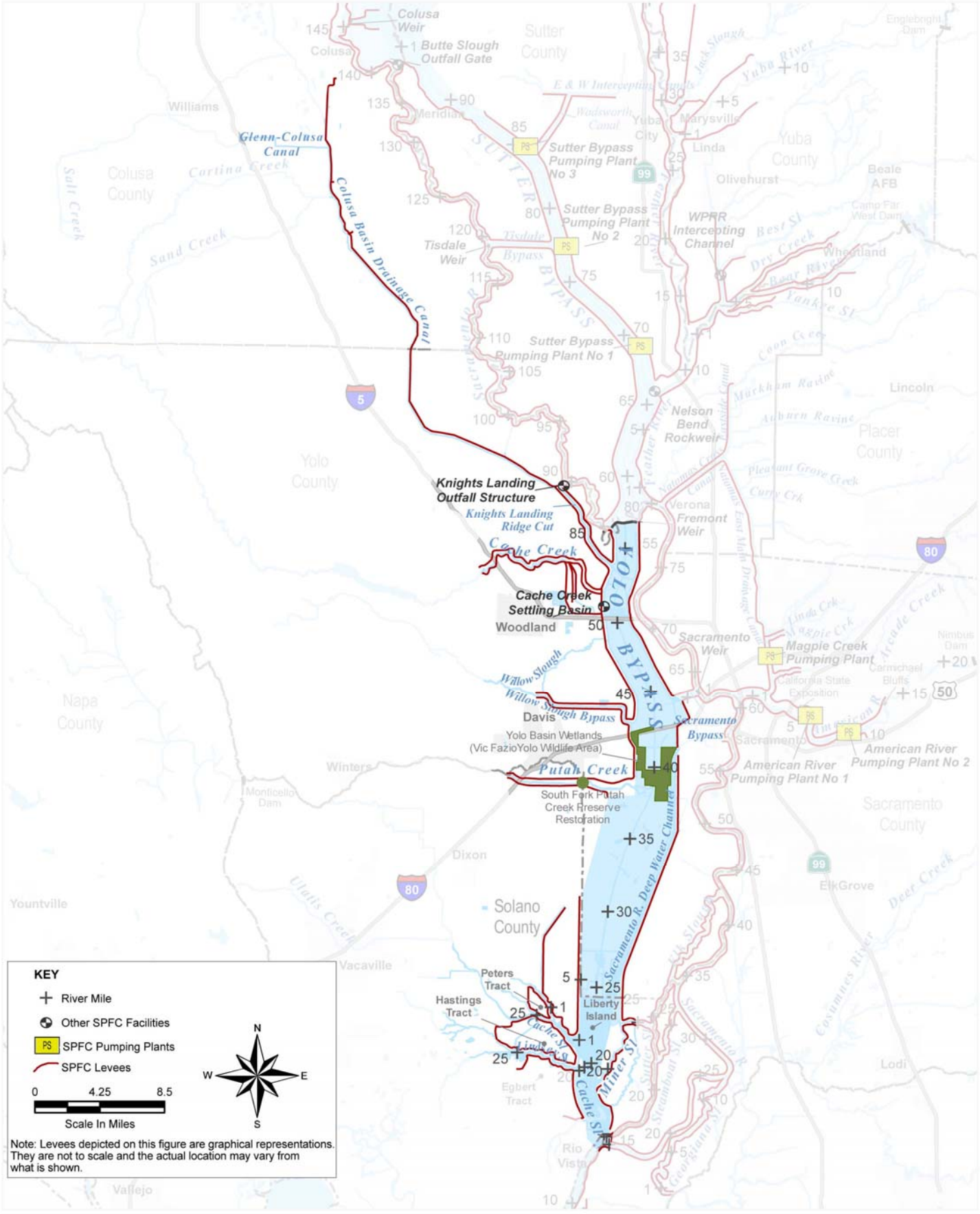

Figure 3-8. Yolo Bypass Watershed – State Plan of Flood Control Facilities Along the Yolo Bypass, Cache Creek, and Other Tributaries

Cache Creek

SPFC facilities on Cache Creek and tributaries are clustered in two separate areas, those of the Middle Creek Project upstream from Clear Lake, and those along Cache Creek near the Yolo Bypass. The Cache Creek Settling Basin and adjoining levees are important SPFC facilities to reduce sediment transport into the Yolo Bypass.

- The Middle Creek and Tributaries Project (see Figure 3-1) upstream from Clear Lake reduces flood risk for the town of Upper Lake, adjoining agricultural land, Highway 20, and several county roads. The project includes about 14.4 miles of levees (see O&M Manual SAC506.2), diversion structures, and a pumping station. A design freeboard of 3 feet has been provided for all levees. Levees are along Poge Creek/Alley Creek (2,800-cfs design capacity based on the O&M manual), and Clover Creek (500-cfs design capacity). A diversion structure on Clover Creek diverts flood flows to in a leveed diversion channel (8,000-cfs design capacity) to Middle Creek. Levees exist along Middle Creek (19,000- and 21,500-cfs design capacities) and Scott Creek (11,000-cfs design capacity). Downstream from Scott Creek, Middle Creek (27,000-cfs design capacity) has only a left-bank levee (see O&M Manuals SAC506. 2 and SAC506.3). A pumping plant (see O&M Manual SAC506.1) is located at Bloody Island to discharge (130-cfs capacity) drainage water from a 3.1-square-mile area from behind project levees into Middle Creek. During low flow, flow direction can be reversed to provide irrigation water from Middle Creek. The left-bank levee continues to Clear Lake. Through its history, the project has been maintained at times by the Lake County Flood Control and Water Conservation District, Lake County Watershed Protection District, and DWR at times. Since 2000, DWR has maintained project channels through Assessment District 17. A 2003 Environmental Impact Statement (EIS) for an ecosystem restoration project may lead to deauthorization of a portion of the project and breach existing levees along Rodman Slough (USACE, 2002).

- Lower Cache Creek has SPFC levees (see O&M Manual SAC126) beginning at high ground about 1.5 miles west of Interstate 5 near Woodland. The design capacity is 30,000 cfs, based on the O&M manual. The right-bank levee leading to the Cache Creek Settling Basin is about 6 miles long and the left-bank levee is about 8 miles long. The facilities reduce the flood risk to Woodland and adjoining agricultural lands. The facilities are maintained by DWR.

- East and west training levees (see O&M Manual SAC120), each about 2.5 miles long, direct flows toward the southern end of the Cache Creek Settling Basin. In addition, the embankments and spillway forming the

Cache Creek Settling Basin (see O&M Manual SAC120) are about 7.5 miles long. The purpose of the settling basin is to control debris and sediment that would otherwise flow into the Yolo Bypass and compromise its capacity. The O&M manual recognized that the deposition of sediment could not be predicted in advance. The east training levee is designed to be periodically breached to regulate deposition of sediment within the basin. Discharge from the basin directly enters the Yolo Bypass. The settling basin has been modified several times since its original construction in 1937. In 1991, the basin was enlarged to provide 50-year storage capacity. The basin was designed with the spillway to the Yolo Bypass to be raised in increments. The initial raise is complete and the additional raise will be completed by DWR when the sediment levels in the basin reach predetermined levels. The facilities are maintained by DWR.

Relocated Willow Slough

SPFC facilities include relocation of Willow Slough and levees along the excavated channel (see O&M Manual SAC120). A diversion weir is located at the point of bifurcation of the original and relocated channels. Based on the O&M manual, the design capacity of the relocated channel is 6,000 cfs with 3 feet of freeboard at the upstream end, gradually increasing to 6 feet at the Yolo Bypass. The right-bank levee extends about 7.4 miles from high ground to the Yolo Bypass. The left-bank levee extends about 7.6 miles from high ground to the Yolo Bypass. The mouth of Willow Slough is now about 5.5 miles south of the original channel. The project is maintained by DWR's Sacramento Yard.

Putah Creek

SPFC facilities (see O&M Manual SAC119) include channel improvements and levees. Based on the O&M manual, the design channel capacity is 40,000 cfs with 3 feet of freeboard from high ground to the Yolo Bypass. Freeboard gradually increases from 3 feet at the upstream end to 6 feet at the Yolo Bypass. The project includes clearing the Putah Creek channel from the highway bridge at Winters to a point about 1 mile upstream from the Interstate 80 crossing of Putah Creek. From that point 1 mile upstream from Interstate 80, the project includes channel excavation and clearing to the Yolo Bypass and right- and left-bank levees. The facilities reduce flood risk to southern portions of Davis and adjoining agricultural lands. Maintenance is conducted by DWR.

The South Fork Putah Creek Preserve Restoration (see O&M Manual SAC119A) includes 84 acres adjacent to the south bank of South Putah Creek and north of the levee. The project includes a lower vegetated riparian bench area and upper terrace area.

Cache Slough and Lindsey Slough

SPFC facilities include levees along sloughs and land tracts near the terminus of the Yolo Bypass. The design capacity of the Lindsey Slough discharge to the Yolo Bypass is 43,500 cfs with 3 feet of freeboard, based on the O&M manuals. Levees, maintained by RD 2060, RD 2068, RD 2093 and RD 536, include the following:

- Back levee (see O&M Manual SAC109) from RD 2068 and RD 2098
- Levees around Peters Tract (see O&M Manual SAC108)
- Levees around Hastings Tract (see O&M Manual SAC107)
- North and south levees of Egbert Tract (see O&M Manual SAC106)

Yolo Bypass

The Yolo Bypass begins at Fremont Weir (see O&M Manual SAC157 and description under Section 3.2.5). SPFC facilities include levees on the left and right sides of the bypass.

- From Fremont Weir to Knights Landing Ridge Cut, the design capacity of the Yolo Bypass is 343,000 cfs with 6 feet of freeboard, based on the O&M manuals. The right-bank levee (see O&M Manual SAC127) is about 2 miles long and reduces flood risk to adjacent agricultural land. Maintenance is performed by DWR. The Knights Landing Ridge Cut, with a design capacity of 20,000 cfs, enters the right side of the Yolo Bypass along this reach. The left-bank levee (see O&M Manual SAC123) is about 4 miles long and reduces flood risk to adjacent agricultural land in RD 1600. Maintenance is conducted by RD 1600 and DWR.

- Based on the O&M manuals, the design capacity increases to 362,000 cfs from the Knights Landing Ridge Cut to Cache Creek. There is a right-bank levee for the Yolo Bypass between the Knights Landing Ridge Cut and the Cache Creek Settling Basin, but it does not show in the O&M manuals as a SPFC facility. The left-bank levee (see O&M Manual SAC123) is about 2 miles long and reduces flood risk to adjacent agricultural land in RD 1600. Maintenance is conducted by RD 1600 and DWR.

- From Cache Creek to the Sacramento Bypass, the design capacity of the Yolo Bypass is 377,000 cfs with 6 feet of freeboard, based on the O&M manuals. SPFC facilities in this reach include levees along both sides of the bypass. The right-bank levee (see O&M Manual SAC121) is about 6.4 miles long and reduces flood risk to agricultural land in RD

2035 and Woodland. Maintenance of the levee is by DWR and RD 2035. The left-bank levee (see O&M Manual SAC122) is about 6.1 miles long and reduces flood risk to adjacent agricultural land. Maintenance of the left-bank levee is conducted by RD 1600, while DWR maintains the floodway and the right-bank levee. Design inflow to the Yolo Bypass from the Sacramento Bypass is 112,000 cfs, based on the O&M manual.

- From the Sacramento Bypass to Putah Creek, the design capacity of the Yolo Bypass is 480,000 cfs with 6 feet of freeboard, based on the O&M manuals. SPFC facilities in this reach include levees along the sides of the bypass. The right-bank levee (see O&M Manuals SAC119, SAC120, and SAC121) is about 5.2 miles long. Willow Slough, with a design flow of 6,000 cfs, enters the Yolo Bypass within this reach. The left-bank levee (see O&M Manual SAC116) is about 7 miles long and reduces flood risk to West Sacramento. The left-bank levee is maintained by DWR. The Yolo Basin Wetlands (see O&M Manual SAC521; Vic Fazio Yolo Wildlife Area) is located within this reach and provides about 3,400 acres of wildlife habitat, including permanent wetlands, seasonal wetlands, grassland/uplands, and riparian woodland. Although the wetlands are part of the SPFC, they are subordinate to the flood purposes of the Yolo Bypass because of a flowage easement over the area. The Sacramento Deep Water Ship Channel, completed in 1963, narrowed the channel of the Yolo Bypass and impacted the design profile. The west levee of the ship channel replaced a portion of the left levee of the Yolo Bypass.

- From Putah Creek to the Sacramento River, the Yolo Bypass has a design capacity of 490,000 cfs with 6 feet of freeboard, based on the O&M manuals. SPFC facilities include levees. The SPFC right-bank levee (see O&M Manuals SAC106, SAC107, and SAC109) begins about 7 miles downstream from Putah Creek and extends about 13 miles to the Sacramento River in the Delta, near Rio Vista. Along this reach, Cache Slough and Lindsey Slough enter the Yolo Bypass. The levee reduces flood risk to adjacent agricultural land. Maintenance is conducted by DWR, RD 536, RD 2060, and RD 2068. The left-bank levee (see O&M Manuals SAC105 and SAC113) extends about 23 miles to the Sacramento River. Along this reach, Miners Slough has a design inflow of 10,000 cfs from a series of Delta sloughs that are distributary from the Sacramento River. Maintenance is conducted by RD 501 and RD 999. The Sacramento Deep Water Ship Channel narrowed the channel of the Yolo Bypass and impacted the design profile. The west levee of the ship channel replaced a portion of the left levee of the Yolo Bypass.

- Liberty Island, Little Holland Tract, Prospect Island Little Egbert Tract, and other lands surrounded by private levees lay within the bypass near its southern end. The levees, generally limited in height, restrict low flows in the Yolo Bypass, but overtop during high discharges. Levees on Liberty Island and a portion of Little Holland Tract failed during Yolo Bypass flows in 1998 and the lands have remained flooded since that time.

3.2.5 Sacramento River Watershed

The previous sections describe the main tributaries that provide flow directly to the Sacramento River or divert flow away from the river. This section completes the description of SPFC facilities within the Sacramento River Basin in an upstream-to-downstream direction. Figures 3-9, 3-10, and 3-11 include SPFC facilities in the main stem of the Sacramento River watershed.

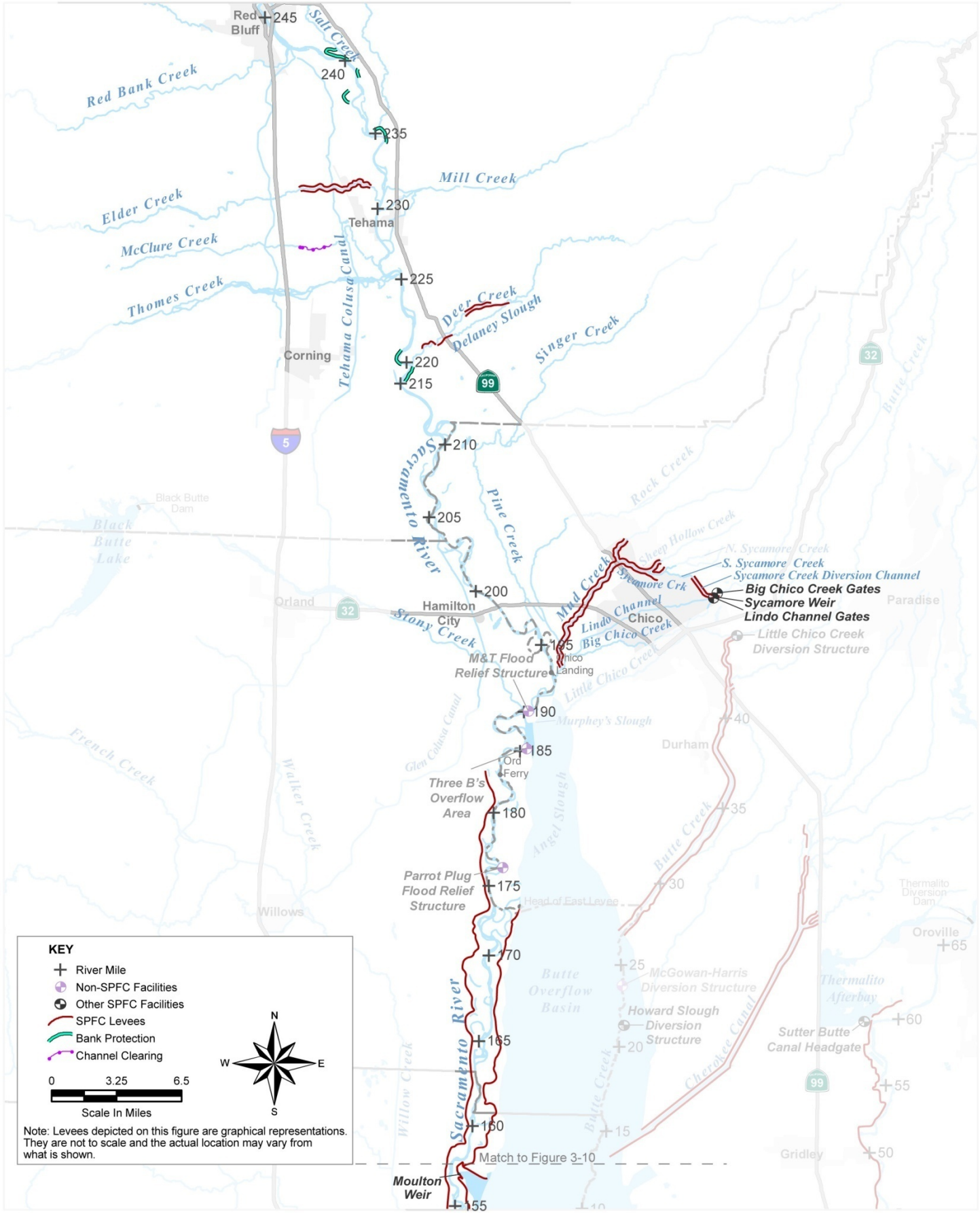

Figure 3-9. Main Stem Sacramento River Watershed – State Plan of Flood Control Facilities Along the Sacramento River and Certain Tributaries from Red Bluff to Moulton Weir

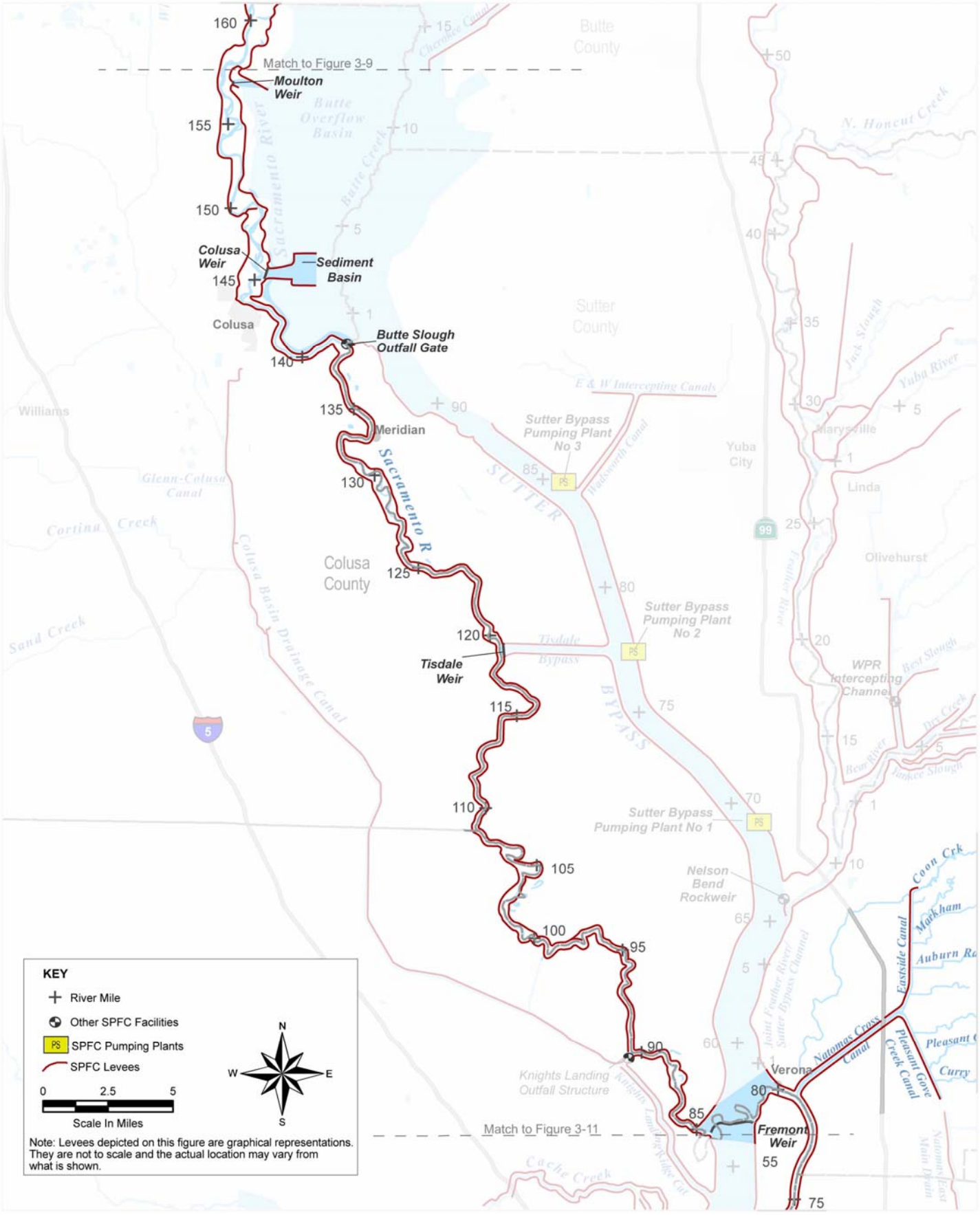

Figure 3-10. Main Stem Sacramento River Watershed – State Plan of Flood Control Facilities Along the Sacramento River from Moulton Weir to Fremont Weir

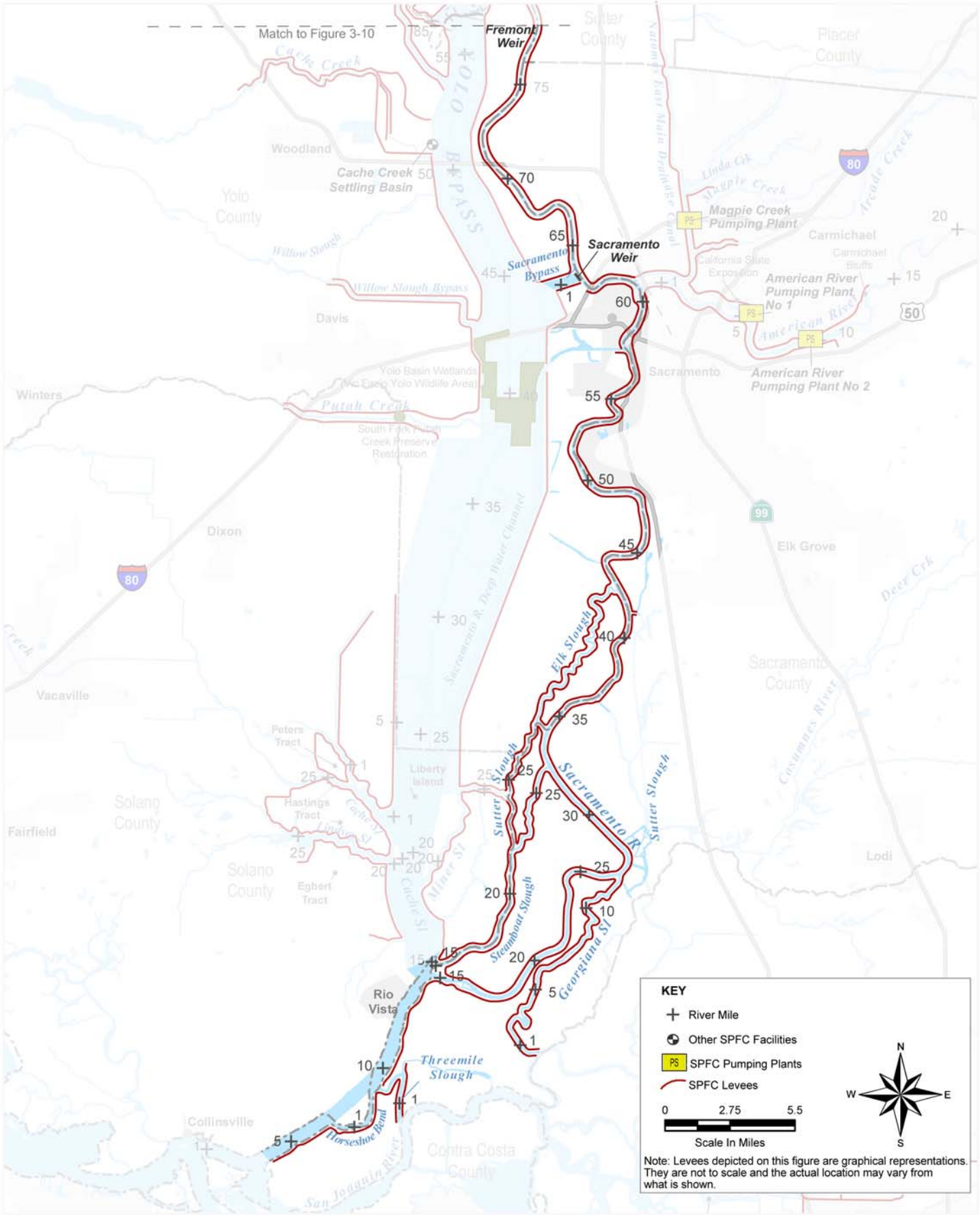

Figure 3-11. Main Stem Sacramento River Watershed – State Plan of Flood Control Facilities Along the Sacramento River and Certain Tributaries and Distributaries from Fremont Weir to Collinsville

Ash and Dry Creeks at Adin

SPFC channel clearing and snagging (see O&M Manual SAC503) was conducted over about 1 mile of Ash Creek downstream from Highway 299 and Dry Creek from its confluence with Ash Creek to a point about 900 feet upstream. The project (see Figure 3-1) reduces flood risk to the town of Adin located in Modoc County about 80 miles northeast of Redding. Ash Creek drains into the Pit River, which drains into Shasta Lake. The project is maintained by the Adin Community Services District.

Sacramento River Tributaries Between Red Bluff and Chico Landing

There are several SPFC improvements along tributaries to the Sacramento River between Red Bluff and Chico Landing, none of which is connected to the SPFC levee system that begins downstream at Ord Ferry.

- Salt Creek enters the Sacramento River about 4 miles downstream from Red Bluff. Channel clearing and shaping (see O&M Manual SAC513) of Salt Creek from its confluence with the Sacramento River to about 1.7 miles upstream reduces flood risk to residences on the east side of Salt Creek as well as agricultural land. The Tehama County Flood Control and Water Conservation District maintains the project.

- Elder Creek enters the Sacramento River about 12 miles downstream from Red Bluff. SPFC improvements (see O&M Manual SAC510) include channel clearing for about 1.25 miles upstream from the Sacramento River and an adjacent leveed channel reach. The left-bank levee is about 4.1 miles long and the right-bank levee is about 4 miles long. The design capacity of the leveed channel is 17,000 cfs with 3 feet of freeboard, based on the O&M manual. The improvements reduce flood risk to the town of Garber, adjacent agricultural land, several highways, and a railroad. The Tehama County Flood Control and Water Conservation District maintains the project.

- McClure Creek is located in Tehama County. The creek drains from west to east toward the town of Tehama, about 13 miles south of Red Bluff. SPFC improvements (see O&M Manual SAC511) include channel clearing along an 8,700-foot reach from about 1 mile upstream from U.S. Highway 99 to 0.7 mile downstream from the highway. The improvements reduce flood risk to the town of Tehama to the north, bridges for Highway 99, several county roads, and adjacent agricultural land to the south. The Tehama County Flood Control and Water Conservation District maintains the project.

- Deer Creek enters the Sacramento River about 21 miles downstream from Red Bluff. SPFC improvements (see O&M Manual SAC509) include channel clearing and levees along Deer Creek. The design

capacity of the channel is 21,000 cfs with 3 feet of freeboard, based on the O&M manual. Channel clearing extends from upstream from Delany Slough to the Sacramento River. The right-bank levee is about 1.5 miles long. The left-bank levee extends about 4.3 miles, in two segments, from high ground to the Sacramento River floodplain. The facilities were designed to reduce flood risk to the town of Vina and adjacent agricultural land. The Tehama County Flood Control and Water Conservation District maintains the project.

Aerial view of the Sacramento River where the river meanders near River Mile 239

Sacramento River from Red Bluff to Chico Landing

SPFC facilities, including bank protection sites (see O&M Manual SAC512), extend intermittently along a 50-mile reach of the Sacramento River between Red Bluff (River Mile 244) and Chico Landing (River Mile 194). Because of the meandering nature of the river in the reach, USACE identified locations that needed improvement to prevent movement of the river into adjoining lands.

Specific works completed between River Miles 169 and 242 are listed below:

- River banks were shaped and stone protection was placed on the left bank of the Sacramento River at Site No. 8, River Mile 183.4; and Site No. 9, River Mile 183.9; and on the right bank at Site No. 10, River Mile 189.7; Site No. 11, River Mile 188.6; and Site No. 12, River Mile 189.7. Completed December 3, 1963.

- River banks were shaped and stone protection was placed on the right bank of the Sacramento River at Site No. 6, River Mile 169.0; and Site No. 7, River Mile 169.8. Completed December 20, 1963.

- River banks were shaped and 500 feet of stone bank protection placed on the right bank of the Sacramento River at Site Mile 177.3. Completed October 23, 1968.

- River banks were shaped and 525 feet of stone bank protection placed on the left bank of the Sacramento River at Site Mile 218.3. Completed June 12, 1970.

- River banks were shaped and stone protection was placed on the left bank of the Sacramento River at Site Mile 185.3. Completed November 18, 1971.

- River banks were shaped and stone protection was placed on the left bank of the Sacramento River at Site Miles 194.0 (1,900 feet.) and 196.3 (875 feet). Completed January 4, 1974.

- River banks were shaped and stone protection was placed on the left bank of the Sacramento River at Site Miles 208.4 (4,470 feet) and 213.1 (2,080 feet). Completed November 6, 1974.

- River banks were shaped and stone protection was placed on the Sacramento River left bank at Site Miles 194.0 (440 feet) and 230.5 (3,425 feet); and right bank at Site Miles 202.0 (600 feet) and 229.0 (3,280 feet). Completed November 5, 1975.

- River banks were shaped and 6,500 feet of stone bank protection placed on the right bank of the Sacramento River at Site Mile 197.0. Complete on January 9, 1976.

- River banks were shaped and stone protection was placed on the left bank of the Sacramento River at Site Miles 202.4 (1,300 feet.), 207.0 (1,900 feet) and 211.1 (4,000 feet). Completed July 29, 1976.

- Repair of 650 feet of stone bank protection took place along the left bank of the Sacramento River at Site Mile 196.3. Completed November 15, 1976

- River banks were shaped and stone protection was placed on the Sacramento River right bank at Site Miles 215.3 (1,320 feet), 226.3 (7,130 feet) and 231.2 (1,550 feet) and on the left bank at Site Miles 233.9 (1,640 feet), 238.1 (710 feet), 239.8 (690 feet), and 242.0 (2,525 feet). Completed November 9, 1978.

- River banks were shaped and stone protection was placed on the Sacramento River right bank at Site Mile 204.9 (710 feet), and on the left bank at the Site Mile 242.0 (500 feet) extension. Completed June 14, 1979.

While some of these sites have failed because of river meander, all sites are still included in the SPFC because no specific action has been taken to remove them. Other bank protection sites have been built along the leveed section of the Sacramento River that begins at Ord Ferry (see SRBPP at the end of Section 3.2.5).

Big Chico Creek/Mud Creek

Big Chico Creek/Mud Creek enters the Sacramento River about 1 mile downstream from Chico Landing. SPFC facilities (see O&M Manual

SAC504) on this stream system include channel clearing, levees, diversion structures, and a diversion channel to reduce flood risk in Chico and local transportation facilities. The project includes improvement on Big Chico Creek, Sandy Gulch, Sheep Hollow, Sycamore Creek, Dry Creek, and Mud Creek. Butte County is the maintaining agency. Design capacities shown below are from the O&M manual.

- Diversion structures on the eastern side of Chico on Big Chico Creek and Sandy Gulch (Lindo Channel) divert excess flows through a diversion channel to Sycamore Creek. These structures include the Big Chico Creek Gates, Lindo Channel Gates, and the Sycamore Weir. The diversion channel, about 2 miles long, has a design capacity of 8,500 cfs and has a levee along the left bank. Sandy Gulch, Big Chico Creek Gates, Lindo Channel Gates, and the Sycamore Weir are shown in the O&M manual map book included on the reference DVD, on the map for O&M Manual SAC504.

- The project includes the unimproved channels of Big Chico Creek and Lindo Channel that lie between the diversion structures and the Sacramento River.

- Channel improvements and levees extend along both banks of Sycamore Creek, Sheep Hollow, and Mud Creek. About 20 miles of levee are located along these channels, downstream from the diversion channel. Levees line portions of the diversion channel. The design capacity of these levees at their upstream end on Sycamore Creek is 10,000 cfs with 3 feet of freeboard. Sheep Hollow (with a design capacity of 1,400 cfs) and Dry Creek (with a design capacity of 500 cfs) enter Sycamore Creek about 1.8 miles upstream from the Sycamore Creek and Mud Creek confluence. At the confluence, Sycamore Creek has a design capacity of 11,000 cfs and Mud Creek has a capacity of 5,500 cfs. While the design capacity of Mud Creek is 15,000 cfs for most of its length, portions of the channel have a capacity of 13,000 cfs.

Butte Basin Overflow Area

No SPFC facilities are located on the east side of the Sacramento River between Chico Landing and the start of SPFC left-bank levees near River Mile 175. The design flow of the Sacramento River at Chico Landing is about 260,000 cfs and the design flow of the river at Ord Ferry is about 160,000 cfs, based on the O&M manual. This reduction in river capacity requires flow to leave the river. Historically, overflow over the east bank of the river flowed into the Butte Basin. While the magnitude and duration of these flows have been reduced by upstream flow regulation, overflow into the Butte Basin still occurs and is essential to the success of the downstream flood management system along the Sacramento River.

Flows above 90,000 cfs at Ord Ferry overtop the east - bank of the Sacramento River at several locations upstream from the SPFC left-bank levees. The three prominent overflow areas are the M&T Flood Relief Structure (adjacent to the Murphy Slough Plug) located about 3 miles downstream from Chico Landing, the Three B's Overflow Area located about 7.5 miles downstream from Chico Landing, and the Parrot Plug Flood Relief Structure (also known as "Goose Lake Flood Relief Structure") located about 15.5 miles downstream from Chico Landing. While these are State-constructed facilities (thus not meeting the SPFC definition of State-federal facilities for which the State provided assurances to the federal government), both USACE and the State have performed work related to the overflow and the State continues to perform maintenance. The State has included regulation of the overflow areas and the Butte Basin in 23 CCR. See Section 6.8 for a description of how flow to and through the Butte Basin is a condition of meeting the SPFC design profiles.

Sacramento River from Ord Ferry to Moulton Weir

Ord Ferry marks the beginning of SPFC levees that extend more than 183 river miles to the Delta. SPFC facilities along the Sacramento River between Ord Ferry and Moulton Weir include levees. The design capacity of this reach is 160,000 cfs, based on the O&M manuals. The right-bank levee (see O&M Manuals SAC137, SAC139, and SAC140) begins at Ord Ferry and extends about 24 miles downstream to a point opposite Moulton Weir. The levee reduces flood risk to adjacent agricultural lands and small communities, and is maintained by Levee Districts 1 and 2, and by DWR through Maintenance Area 1.

The left-bank levee (see O&M Manuals SAC136 and SAC138) begins about 7.5 miles downstream from Ord Ferry and extends about 16.3 miles to Moulton Weir. The levee assures a consistent division of flows between the Butte Basin and the Sacramento River. Since water flows on both sides of the levee, the levee does not preclude flood flows to the area east of the levee. Maintenance is performed by Levee District 3 and DWR through Maintenance Area 1. The levees in the reach are generally set back from the river and are about 0.5 to 1.5 miles apart.

Moulton Weir spills water into the Butte Basin

Moulton Weir

Moulton Weir and its training levee are SPFC facilities. The weir (see O&M Manual SAC154) is a fixed crest concrete structure; about 500 feet

long, with a design capacity of 25,000 cfs to the Butte Basin (see Section 3.2.3). The outlet channel is flanked by training levees on the downstream side of the weir. Discharge over the weir occurs when Sacramento River flows exceed about 60,000 cfs at the site. Maintenance is conducted by DWR.

Sacramento River from Moulton Weir to Colusa Weir

SPFC facilities along this reach of river include levees. The design capacity of this reach is 135,000 cfs, based on the O&M manuals. The right-bank levee (see O&M Manual SAC137) is about 10 miles long. The levee reduces flood risk to adjacent agricultural lands and small communities, and is maintained by DWR through Maintenance Area 1. The levees in the reach are generally set back from the river and are about 0.5 to 1.5 miles apart.

The left-bank levee (see O&M Manual SAC136) is about 9 miles long. The levee reduces flood risk to adjacent agricultural land and small communities. Maintenance is conducted by Levee District 3 and DWR through Maintenance Area 1.

The Colusa Weir, its training levees, and sediment basin are SPFC facilities

Colusa Weir and Sediment Basin

Colusa Weir, its training levees, and sediment basin are SPFC facilities. The weir (see O&M Manual SAC155) is a fixed crest concrete structure, about 1,650 feet long, with a design capacity of 70,000 cfs to Butte Basin (see Section 3.2.3). Spill over the uncontrolled Colusa Weir begins when Sacramento River flows at the weir exceed about 30,000 cfs.

The bypass channel leading from the weir lies between two training levees that extend about 2 miles into Butte Basin. A sediment basin (see O&M Manual SAC502) was added to limit the discharge of sand into downstream agricultural areas. The basin is operated to assure that at least 1 million cubic yards of reserve sediment storage are available at the beginning of each flood season. The weir, training levees, and sediment basin are maintained by DWR.

Tisdale Weir spills into the Sutter Bypass (photo courtesy of Sutter County)

Sacramento River from Colusa Weir to Tisdale Weir

SPFC facilities between the Colusa Weir and Tisdale Weir include levees and the Butte Slough Outfall Gates. The design capacity upstream from the outfall gates is 65,000 cfs and downstream is 66,000 cfs, based on the O&M manuals. The right-bank levee (see O&M

Manuals SAC137 and SAC131) is about 26 miles long. The levee reduces flood risk to adjacent agricultural lands and Colusa, and is maintained by DWR through Maintenance Areas 1 and 12 and the Sacramento River West Side Levee District.

The left-bank levee (see O&M Manuals SAC133, SAC134, and SAC136) is about 25.6 miles long. The levee reduces flood risk to adjacent agricultural land. Maintenance is performed by RD 70, RD 1660, and by DWR through Maintenance Areas 1 and 12.

The Butte Slough Outfall Gates (see O&M Manual SAC161) to the Sacramento River control passage of floodwaters from Butte Basin to the Sacramento River at a maximum flow of 3,500 cfs. The gates also allow passage of Butte Slough drainage water to the Sacramento River during the irrigation season.

Tisdale Weir

Tisdale Weir and bypass levees to the Sutter Bypass are SPFC facilities. The weir (see O&M Manual SAC156) is a fixed crest concrete structure with a design capacity of 38,000 cfs. The bypass channel is 1,150 feet wide and extends 4 miles to the Sutter Bypass. Levees (see O&M Manuals SAC129 and SAC133) are continuous along both sides of the bypass. Both levees reduce flood risk to adjacent agricultural land in RD 1500 and RD 1660. The weir was originally built by local interests and improved by USACE to project standards. The facilities are maintained by DWR.

Sacramento River from Tisdale Weir to Fremont Weir

SPFC facilities between Tisdale Weir and Fremont Weir include levees and the Knights Landing Outfall Gates. The design capacity of the river downstream from Tisdale Weir is 30,000 cfs, based on the O&M manuals. The right-bank levee (see O&M Manuals SAC127 and SAC130) is about 32 miles long. The levee reduces flood risk to adjacent agricultural lands and is maintained by the Sacramento River West Side Levee District. The levees along this reach are generally at the riverbank, about 300 to 400 feet apart.

Sacramento River near Knight's Landing, courtesy of Julia Fredenberg (http://www.flickr.com/photos/julia_fredenburg/2212323091/)

The Knights Landing Outfall Gates are located along the right-bank levee about 26 miles downstream from Tisdale Weir. The Knights Landing Outfall Gates (see O&M Manual SAC162), also known as the Sycamore Slough Outfall Gates, reduce flood risk to the lower Colusa Basin from Sacramento River backwater, but provide drainage to the Sacramento River

during low flow. The structure was originally built by local interests. Flap gates were added by USACE and the State.

The left-bank levee (see O&M Manual SAC128) is about 33.6 miles long. The levee reduces flood risk to adjacent agricultural land. Maintenance is performed by RD 1500.

Fremont Weir

The Sacramento River and the joint channel for the Sutter Bypass and Feather River join at the Fremont Weir. The weir, an SPFC facility, is a fixed crest concrete structure. At this location, the Sacramento River has a design capacity of 30,000 cfs, and the joint channel for the Sutter Bypass and Feather River has a design capacity of 416,500 cfs, roughly half of which spilled from the Sacramento River to the Butte Basin at the overflow areas south of Chico Landing, and over the Moulton, Colusa, and Tisdale weirs.

The Sacramento River and the joint channel for the Sutter Bypass and Feather River join at the Fremont Weir

The Fremont Weir (see O&M Manual SAC157) is a concrete overflow section about 9,120 feet long with a design capacity of 343,000 cfs. The Fremont Weir begins to spill water to the Yolo Bypass (see Section 3.2.4) when the combined flow from the Sacramento River, Sutter Bypass, and Feather River reaches about 60,000 cfs. This value depends on the amount of flow that each river contributes and the flow in the American River. The Sacramento River continues on the east side of the weir. The weir is maintained by DWR.

Sacramento River from Fremont Weir to Sacramento Weir

SPFC facilities along this reach include levees. The design capacity of the Sacramento River in this reach is 107,000 cfs, based on the O&M manuals. The right-bank levee (see O&M Manuals SAC122 and SAC123) is about 18 miles long. The levee reduces flood risk to adjacent agricultural land and is maintained by RD 1600 and RD 827.

The left-bank levee (see O&M Manuals SAC124 and SAC141.1) is about 17 miles long. The levee reduces flood risk to the urbanizing area in Natomas and adjoining agricultural land. The levee is maintained by RD 1000. Near the upstream end of the levee, the Natomas Cross Canal enters the river from the east with a design capacity of 22,000 cfs, based on the O&M manual.

The 4.8-mile-long East Side Canal and right-bank levee (see O&M Manual SAC142) and the 4.3-mile-long Pleasant Grove Creek Canal and left-bank levee (see O&M Manual SAC125) collect water from streams approaching

RD 1000 (Natomas Basin) and RD 1001, and discharge it into the head of the Natomas Cross Canal. Levees along both sides of the canal (see O&M Manuals SAC125 and SAC142) are each about 5 miles long. The East Side Canal levee (design capacity of 16,000 cfs, based on the O&M manuals) and the right-bank levee of the Natomas Cross Canal are maintained by RD 1001. The Pleasant Grove Creek Canal levee (design capacity of 6,000 cfs, based on the O&M manual) and left-bank levee of the Natomas Cross Canal are maintained by RD 1000. The Pleasant Grove Creek Canal left levee was raised in the early 1950s by USACE and reduces flood risk to the Natomas area. RD 1000 assists with the maintenance of the right levee, which is not part of the SFPC.

The Sacramento Weir is the only weir that requires manual operation for flow release

Sacramento Weir and Bypass

The Sacramento Weir and its bypass levees are SPFC facilities. The weir (see O&M Manual SAC158) is a reinforced concrete structure with wooden needles that provide a movable crest. The Sacramento Weir is the only weir and overflow area that requires manual operation for flow release. The weir consists of 48 weir sections, each 38 feet wide, with a total design capacity of 112,000 cfs. Sections of the weir are opened when the Sacramento River reaches or exceeds a stage of 27.5 feet National Geodetic Vertical Datum (NGVD) at the I Street Bridge. The weir was constructed by the City of Sacramento and later adopted into the SRFCP by USACE.

The leveed bypass downstream from the Sacramento Weir extends to the Yolo Bypass. The right-bank levee (see O&M Manual SAC116) is about 1.8 miles long and the left-bank levee (see O&M Manual SAC122) is about 1.8 miles long. The Sacramento Weir and bypass are maintained by DWR.

Sacramento River from Sacramento Weir to American River

SPFC facilities along this reach of river include levees on both banks. This reach serves a unique function among all major SPFC channels in that it carries water in both directions, depending on flow conditions. Since the American River enters the downstream end of this reach with a design capacity of 180,000 cfs, and the Sacramento River downstream from the American River has a design capacity of only 110,000 cfs, a portion of the American River must flow upstream to the Sacramento Weir during large flood events.

The Sacramento River near Walnut Grove, courtesy of Aquafornia: http://www.flickr.com/photos/aquafornia/2398065

The right-bank levee (see O&M Manual SAC116) of the Sacramento River and the left-bank levee (see O&M Manual SAC124) are both about 2.5 miles long. The right-bank levee reduces flood risk to West Sacramento and is maintained by DWR. The left-bank levee reduces flood risk to the Natomas area and is maintained by RD 1000 and DWR through Maintenance Area 4.

Sacramento River from American River to Elk Slough

SPFC facilities along this reach of river include levees. Based on the O&M manuals, the design capacity is 110,000 cfs with 3 feet "or more" of freeboard (transitions to 6 feet near the downstream end of the reach). Based on the 1957 profile, the reach appears to have 6 feet of freeboard. Improvements have been made to both the left- and right-bank levees to improve stability since the development of the 1957 profile.

The right-bank levee (see O&M Manuals SAC113, SAC114, and SAC116) is about 22 miles long. The levee was originally built by local interests and repaired with bank protection, levee setbacks, and levee enlargements to project standards by USACE. The levee reduces flood risk to West Sacramento near its upstream end and to adjacent agricultural land. The levee is maintained by RD 307, RD 537, RD 900, RD 765, RD 999, and DWR through Maintenance Area 4.

The left-bank levee (see O&M Manuals SAC111, SAC115, SAC117, and SAC118.1) is about 18 miles long. The levee reduces flood risk to Sacramento and suburbs to the south. The upstream 4-mile-long (approximately) portion of the left-bank levee was built by local interests and brought into the project without modification since it equaled or exceeded USACE project standards. The remaining levee was built by local interests and rebuilt to project standards by USACE. The levee is maintained by the American River Flood Control District and DWR through Maintenance Area 9.

Sacramento River from Elk Slough to Collinsville

SPFC facilities along this reach include levees. For most of the reach length, the design capacity decreases because of distributary channels as the river enters the Delta. Based on O&M manuals, the design capacity of the river is as follows:

- Downstream from the Elk Slough distributary – 110,000 cfs with 6 feet of freeboard
- Downstream from the Sutter Slough distributary – 84,500 cfs with 6 feet of freeboard

- Downstream from the Steamboat Slough distributary – 56,500 cfs with 6 feet of freeboard

- Downstream from the Georgiana Slough distributary – 35,900 cfs with 6 feet of freeboard

- Downstream from the confluence with the Yolo Bypass – 579,000 cfs with 6 feet of freeboard

- Downstream from the Three Mile Slough distributary – 514,000 cfs with 6 feet of freeboard

The right-bank levee along the Sacramento River (see O&M Manuals SAC104, SAC110, and SAC112) is about 20 miles long. The levee was constructed by local interests and enlarged, setback, or repaired to project standards by USACE. There is no right-bank levee downstream from the confluence with the Yolo Bypass. The levee reduces flood risk to adjacent agricultural land in the Delta and is maintained by RD 3, RD 150, and RD 349.

The left-bank levee along the Sacramento River (see O&M Manuals SAC101, SAC102, SAC103, and SAC111) is about 38 miles long. The levee was constructed by local interests and enlarged, set back, or repaired to project standards by USACE. The levee reduces flood risk to adjacent agricultural areas in the Delta and is maintained by RD 369, RD 551, RD 554, RD 556, RD 755, the Brannan Andrus Levee Maintenance District, and DWR through Maintenance Area 9.

SPFC levees on distributary channels include the following:

- Levees on both banks of Elk Slough (see O&M Manuals SAC112 and SAC113); design capacity 0 cfs. RD 999 maintains 9.7 miles of right-bank levee and RD 150 maintains 9.6 miles of left-bank levee.

- Levees on both banks of Sutter Slough (see O&M Manuals SAC105, SAC110, SAC112, and SAC113); design capacity 25,500 (between Miner Slough and the Sacramento River) cfs and 15,500 cfs (between Steamboat Slough and Miner Slough). RD 999 maintains 3.8 miles of right-bank levee and RD 3439 maintains 6.6 miles of left-bank levee.

- Levees on both banks of Miner Slough (see O&M Manuals SAC105 and SAC113), a distributary from Sutter Slough; design capacity 10,000 cfs to Yolo Bypass. RD 999 maintains 2.3 miles of right-bank levee and RD 501 maintains 7.8 miles of left-bank levee.

- Levees on both banks of Steamboat Slough (see O&M Manuals SAC104, SAC105, SAC110); design capacity of 28,000 cfs upstream from Miner Slough and 43,500 cfs downstream from Miner Slough. RD 249 maintains 4.4 miles of right-bank levee; RD 501 maintains 6.8 miles of left-bank levee.

- Levees on both banks of Georgiana Slough (see O&M Manual SAC103); design capacity 20,600 cfs. RD 556 maintains 5.5 miles of right-bank levee, the Brannan Andrus Maintenance District maintains 6 miles of right-bank levee, and RD 563 maintains 12.4 miles of left-bank levee.

- Levees on both banks of Three Mile Slough (see O&M Manuals SAC101 and SAC102); design capacity 65,000 cfs. RD 341 maintains 3.3 miles of right-bank levee and RD 1601 maintains 2.5 miles of left-bank levee.

Sacramento River Bank Protection Project

The SRBPP is a continuing construction project to provide protection for the existing levees and flood control facilities of the SRFCP. The purpose of the bank protection work is to correct erosion problems on levees and immediately adjacent banks that may lead to levee breaks and resulting losses of life and property. Other SRBPP bank protection work has been aimed at maintaining sufficient overflows into the bypass system and Butte Basin so that excessive flood flows do not cause failures of downstream levees.

Phase I of the SRBPP was constructed from 1963 to 1975, and consisted of 430,000 feet of completed levee protection. In 1974, repair of 405,000 levee feet was authorized for SRBPP Phase II. Construction began in 1976 and is nearly complete. Bank protection at these waterways varied by location, but in general included the following measures:

- Setback levees – New levees constructed behind existing levees.

- Meanderbelt program – Allowed stream channels to meander within existing levees to maintain the dynamic natural system.

- Channel stabilization program – Construction of bank protection at the outside of each river bend not currently protected.

- Limited bank protection (urban areas) – Construction of rock revetment to the sustained high-water mark at critical erosion sites along the levee systems protecting urban areas.

- Bank protection – Including revetment, modified revetment, and nonrevetment.

- Mitigation – Including vegetation plantings, establishment and maintenance of wildlife habitat, and recreational facility development.

Construction included 11 rivers and waterways: (1) American River, (2) Bear River, (3) Colusa Basin, (4) Elder Creek, (5) Feather River, (6) Georgiana Slough, (7) Miner Slough, (8) Murphy's Slough, (9) Sacramento River, (10) Steamboat Slough, and (11) Sutter Slough.

USACE and the Board will begin investigation of Phase III of the SRBPP in 2010.

3.3 SPFC Facilities in the San Joaquin River Basin

This section provides a reach-by-reach description of SPFC facilities in the San Joaquin River Basin. Descriptions are provided for the Chowchilla and Eastside bypass system and for the San Joaquin River. Tributary and distributary flow points are identified along each flow path.

An index map of the San Joaquin River Basin showing the two major watersheds, which include SPFC facilities, is included as Figure 3-12.

Figure 3-12. Index Map of the San Joaquin River Basin Including the Two Major Watersheds With Facilities of the State Plan of Flood Control

3.3.1 Chowchilla and Eastside Bypasses Watershed

The bypass system for the San Joaquin River begins at the San Joaquin River about 5 miles east of the town of Mendota. The bypass is designed to carry all flood flows from the San Joaquin River at that location if Kings River floodwater (up to 4,750 cfs) is entering downstream through Fresno Slough. The bypass system discharges water back to the San Joaquin River at two locations, about 42 miles and 50 miles downstream from the upstream end of the bypass.

This section describes SPFC facilities along the bypass system and on tributary streams to the bypass system. The project used portions of levees already in place along canal banks, rehabilitated them, and built new reaches of levees. The bypass system includes about 193 miles of levees. Levees along tributary streams were designed with 3 feet of freeboard. The Lower San Joaquin Levee District is the maintaining agency.

Figure 3-13 shows SPFC facilities in the Chowchilla and Eastside Bypass watershed.

Chowchilla Canal Bypass Control Structure

The Chowchilla Canal Bypass Control Structure is an SPFC facility. Water enters the bypass system from the San Joaquin River through the Chowchilla Canal Bypass Structure (see O&M Manual SJR601B). The structure has four gated bays, each 20 feet wide, with a total design capacity of 5,500 cfs. At times, higher discharges can be diverted into the bypass, depending on sediment movement. While not described in the O&M manual, flows up to 12,000 cfs have been diverted to the bypass. While the gates were designed for automatic operation, the gates are currently operated manually. Approach embankments connect the structure with the levee system. The Chowchilla Canal Bypass Control Structure operates in conjunction with a nearby identical structure across the San Joaquin River.

The Chowchilla Canal Bypass Control Structure is an SPFC facility

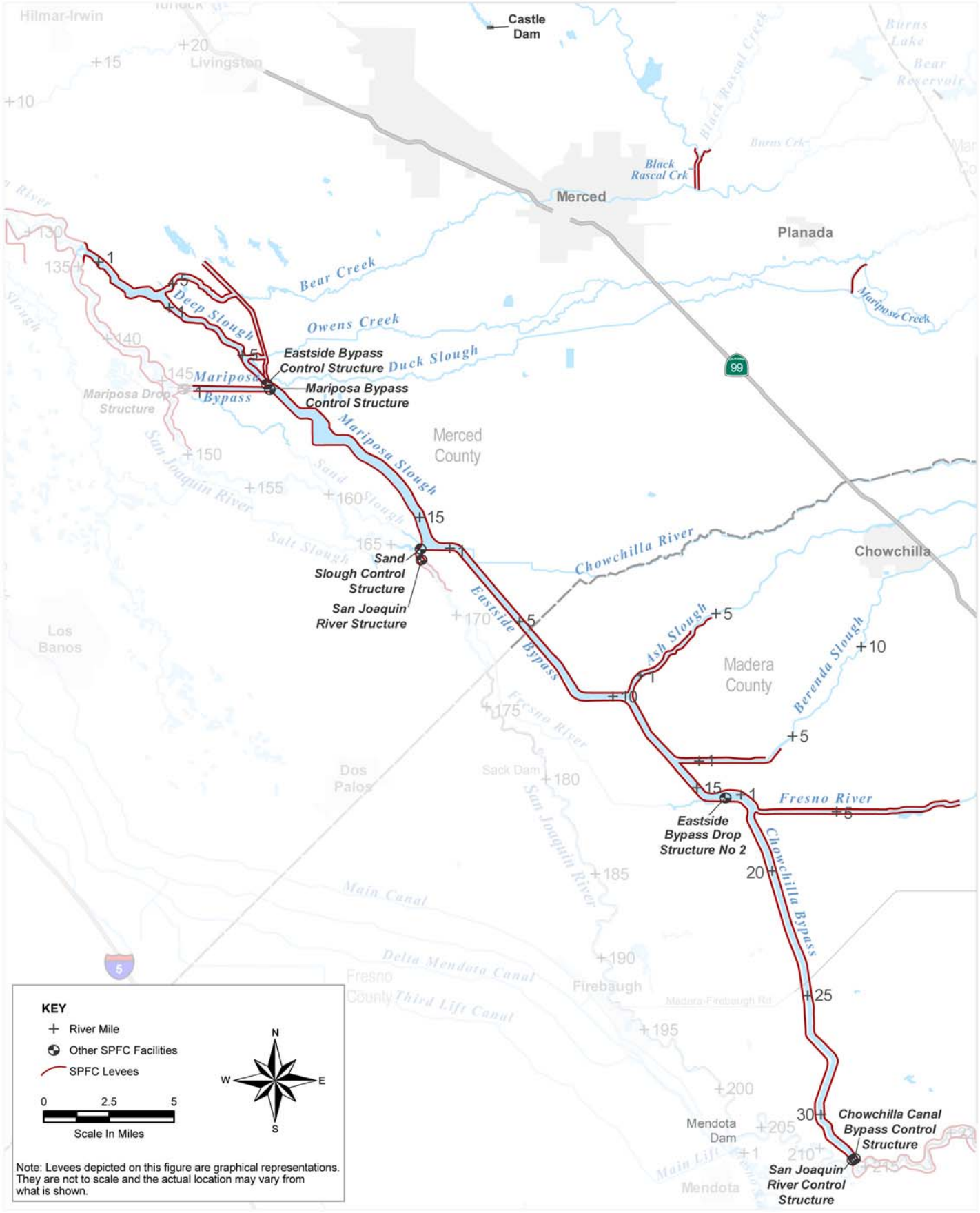

Figure 3-13. Chowchilla and Eastside Bypasses – State Plan of Flood Control Facilities Along the Chowchilla and Eastside Bypasses and Tributaries

Chowchilla Canal Bypass from Control Structure to Fresno River

SPFC facilities along this reach of the bypass include levees on both banks and a debris settling basin. The design capacity of the reach is 5,500 cfs. The levees (see O&M Manual SJR601) in this reach are each about 14.6 miles long. The debris and settling basin, with 200,000 cubic yards of storage capacity, is located just downstream from the control structure. This reach of the bypass includes a pilot reach of habitat planting between Avenue 14 and the Madera-Firebaugh Road.

Fresno River

The Fresno River enters the bypass system at the downstream end of the Chowchilla Bypass. SPFC facilities (see O&M Manual SJR606) include an excavated trapezoidal channel with levees on both banks for a realigned Fresno River and a diversion weir. Based on the O&M manual, the channel and levees, with a design capacity of 5,000 cfs, are each about 18.3 miles long. The average levee height is about 7 feet and the maximum height is about 9 feet. The diversion weir provides for release of flows for riparian water users along the right and left banks. The facilities reduce flood risk to adjacent agricultural land and the City of Madera. The facilities are maintained by the Madera County Flood Control & Water Conservation District.

Levees line the channel downstream from the Chowchilla Bypass Control Structure

Eastside Bypass from Fresno River to Berenda Slough

The Eastside Bypass begins at the confluence of the Chowchilla Bypass and Fresno River. SPFC facilities (see O&M Manual SJR601) include levees on both banks of the channel and drop structures. Based on the O&M manual, the design capacity of the channel and levees is 10,000 cfs, and the length is about 4 miles. Two drop structures help control the channel grade. The facilities are maintained by the Lower San Joaquin River Levee District.

Berenda Slough

Berenda Slough is a distributary channel of the Chowchilla River that enters the bypass system. The design capacity of Berenda Slough at its confluence with the Eastside Bypass is 2,000 cfs, based on the O&M manual. SPFC facilities (see O&M Manuals SJR601 and SJR605) include channel enlargements, levees on both channel banks, and diversion structures. The right-bank levee is about 1.9 miles long and the left-bank levee is about 2.7 miles long. A diversion dam on Berenda Slough sends excess flows through a diversion channel to Ash Slough. Several other flow diversions move water between streams. The facilities reduce flood risk to

the City of Chowchilla and adjacent agricultural land, and are maintained by Madera County.

Eastside Bypass from Berenda Slough to Ash Slough

SPFC facilities (see O&M Manual SJR601) along this reach of bypass include levees on both banks of the channel. The channel and levees, with a design capacity of 12,000 cfs, based on the O&M manual, are about 3.1 miles long. Two drop structures help control the channel grade. Ash Slough enters the bypass at the downstream end of the reach. The levees are maintained by the Lower San Joaquin Levee District.

Ash Slough

Ash Slough is a distributary channel of the Chowchilla River that enters the bypass system. The design capacity of Ash Slough at its confluence with the Eastside Bypass is 5,000 cfs, based on the O&M manuals. SPFC facilities (see O&M Manuals SJR601 and SJR605) include channel enlargements, levees on both banks of the channel, diversion structures, and drop structures. The right-bank levee is about 2.7 miles long and the left-bank levee is about 2.3 miles long. Four drop structures help control the channel grade. The facilities reduce flood risk to the City of Chowchilla and adjacent agricultural land, and are maintained by the Lower San Joaquin Levee District.

Eastside Bypass from Ash Slough to Sand Slough

SPFC facilities (see O&M Manual SJR601) along this reach of bypass include levees on both banks of the channel. The channel and levees, with a design capacity of 17,000 cfs based on the O&M manual, are about 10.5 miles long. Water from the San Joaquin River enters the bypass through the Sand Slough Control Structure (see description under Section 3.3.2, San Joaquin River Watershed) at the downstream end of the reach. Design inflow from the San Joaquin River is about 4,500 cfs. The levees are maintained by the Lower San Joaquin Levee District.

Eastside Bypass from Sand Slough to Mariposa Bypass

SPFC facilities (see O&M Manual SJR601) along this reach of bypass include l**e**vees on both banks of the channel. The channel and levees, with a design capacity of 16,500 cfs based on the O&M manual, are about 8.7 miles long. At the downstream end of this reach, the flow branches – up to 13,500 cfs continue down the Eastside Bypass and up to 8,500 cfs flow into the Mariposa Bypass. Flow in both bypasses is regulated by control structures just downstream from the flow branch. The levees are maintained by the Lower San Joaquin Levee District.

Mariposa Bypass

SPFC facilities for the Mariposa Bypass (see O&M Manual SJR601) include levees along both banks, a control structure at its upstream end, and drop structure near its downstream end. The channel and levees, with a design capacity of 8,500 cfs based on the O&M manual, are about 3.4 miles long. The Mariposa Bypass Control Structure (see O&M Manual SJR601A) consists of 14 equal 20-foot-wide bays – eight gated and six ungated. While the gates were designed for automatic operation, the gates are currently operated manually. The facilities are maintained by the Lower San Joaquin Levee District.

Eastside Bypass from Mariposa Bypass to Bear Creek

SPFC facilities (see O&M Manual SJR601) along this reach of bypass include levees on both banks of the channel and the East Side Bypass Control Structure. The channel and levees, with a design capacity of 13,500 cfs based on the O&M manual, are about 6 miles long. The Eastside Bypass Control Structure (see O&M Manual SJR601A), located about 1,100 feet downstream from the junction with the Mariposa Bypass, consists of six equal 20-foot-wide bays. While the gates were designed for automatic operation, the gates are currently operated manually. Owens Creek, with a design capacity of 2,000 cfs, enters the bypass on the left bank. Levees on Owens Creek extend about 0.8 mile upstream from the bypass. Bear Creek, with a design capacity of 7,000 cfs, enters the bypass at the downstream end of the reach. Levees on Bear Creek (see O&M Manual SJR601) extend about 3.5 miles upstream from the bypass. The East Side Canal and left-bank levee extends from the Eastside Bypass to a point approximately 1.7 miles north of Bear Creek. The facilities are maintained by the Lower San Joaquin Levee District.

The Merced County Stream Group project (see O&M Manual SJR607) includes two diversion channels with levees and channel clearing, a dam, and channel enlargements to reduce the flood risk for the City of Merced and adjacent agricultural land. SPFC facilities include a diversion channel from Black Rascal Creek to Bear Creek. The design capacity of the channel is 3,000 cfs based on the O&M manual. The right-bank levee along the channel is about 1.6 miles long and the left-bank levee is about 1.9 miles long. SPFC facilities also include a diversion channel from Owens Creek to Mariposa Creek. The design capacity of the channel is 400 cfs. The right- and left-bank levees along the diversion channel are each about 1.5 miles long. Channel improvements are included along Black Rascal Creek, Bear Creek, Burns Creek, Miles Creek, Owens Creek, and Mariposa Creek. The facilities are maintained by Merced County.

Castle Dam (see O&M Manual SJR607A) is located on Canal Creek, a tributary of Black Rascal Creek. Castle Dam (completed in 1992) is located

on Canal Creek about 6 miles northeast of Merced. Castle Reservoir has 6,400 acre-feet of flood storage. Castle Dam is owned by the State and Merced County, and is operated and maintained by the Merced Irrigation District (USACE, 1999).

Eastside Bypass from Bear Creek to San Joaquin River

SPFC facilities (see O&M Manual SJR601) along this reach of bypass include levees on both banks of the channel. The channel and levees, with a design capacity of 18,500 cfs based on the O&M manual, are about 3.6 miles long. The Eastside Bypass ends at its confluence with the San Joaquin River. The facilities are maintained by the Lower San Joaquin Levee District.

3.3.2 San Joaquin River Watershed

Unlike the Sacramento River, where SPFC levees are continuous over about 180 miles from beginning to end, SPFC levees on the San Joaquin River are intermittent. About 45 miles of San Joaquin River from the beginning of the bypass system downstream to near the Sand Slough Control Structure have no SPFC levees or other facilities.

Flow in the San Joaquin River upstream from the control structures for diverting water to the bypass system normally varies from 0 to 8,000 cfs, with infrequent up to 12,000-cfs flows when the capacity of the upstream Millerton Lake behind Friant Dam is exceeded. With a total flow of 8,000 cfs in the river, normal operations would divert 5,500 cfs into the bypass and a maximum of 2,500 cfs down the San Joaquin River. If flows exceed 8,000 cfs at the control structures, or 10,000 cfs at the latitude of Mendota, the Lower San Joaquin Levee District operates the facilities at its own discretion with the objective of minimizing damage to the flood system and to the adjacent area. At times, flows exceeding 5,500 cfs are diverted to the bypass.

Figures 3-14, 3-15, and 3-16 show SPFC facilities along the San Joaquin River.

San Joaquin River from High Ground to San Joaquin River Control Structure

Levees are the only SPFC facilities along this reach (see O&M Manual SJR601). The design capacity of the levees is 8,000 cfs based on the O&M manual. The right-bank levee begins at high ground on Road 21, about 9 miles upstream from the control structure. The left-bank levee begins at high ground about 7.5 miles upstream from the control structure. At the downstream end of the reach, flows are divided between the Chowchilla Bypass (see Section 3.3.1) and the San Joaquin River. The San Joaquin

River Control Structure releases water into the San Joaquin River. Levees are maintained by the Lower San Joaquin Levee District.

San Joaquin River Control Structure

The San Joaquin River Control Structure (see O&M Manual SJR601B) is an SPFC facility, identical to the Chowchilla Bypass Control Structure. The structure has four gated bays, each 20 feet wide. While the gates were designed for automatic operation, the gates are currently operated manually. Approach embankments connect the structure with the levee system. The San Joaquin River Control Structure operates in conjunction with the Chowchilla Canal Bypass Control Structure at the head of the Chowchilla Bypass. The San Joaquin River downstream from the control structure for about 33 miles to near the Sand Slough Control Structure has no SPFC facilities.

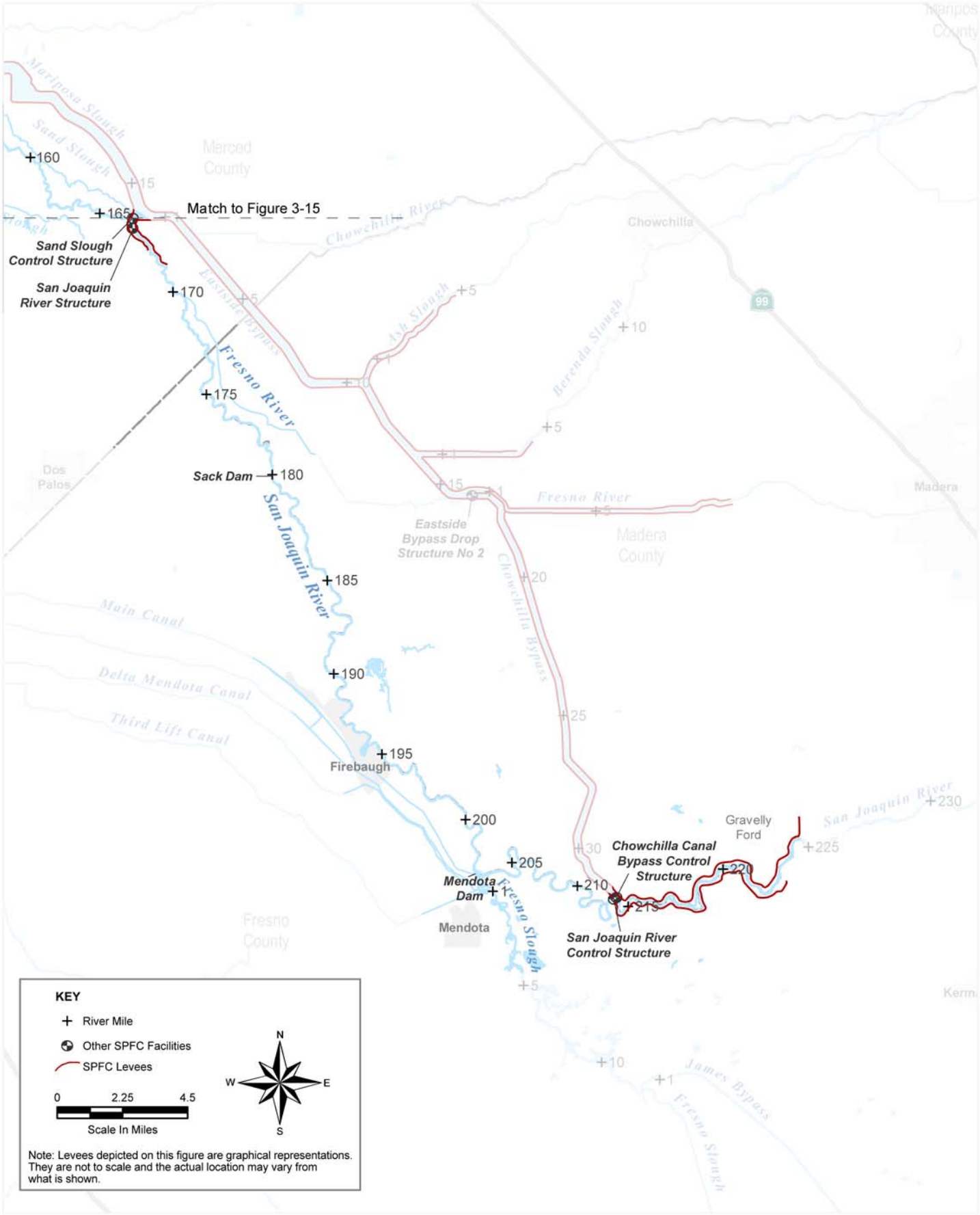

Figure 3-14. San Joaquin River Watershed – State Plan of Flood Control Facilities Along the San Joaquin River from Gravelly Ford to the Sand Slough Control Structure

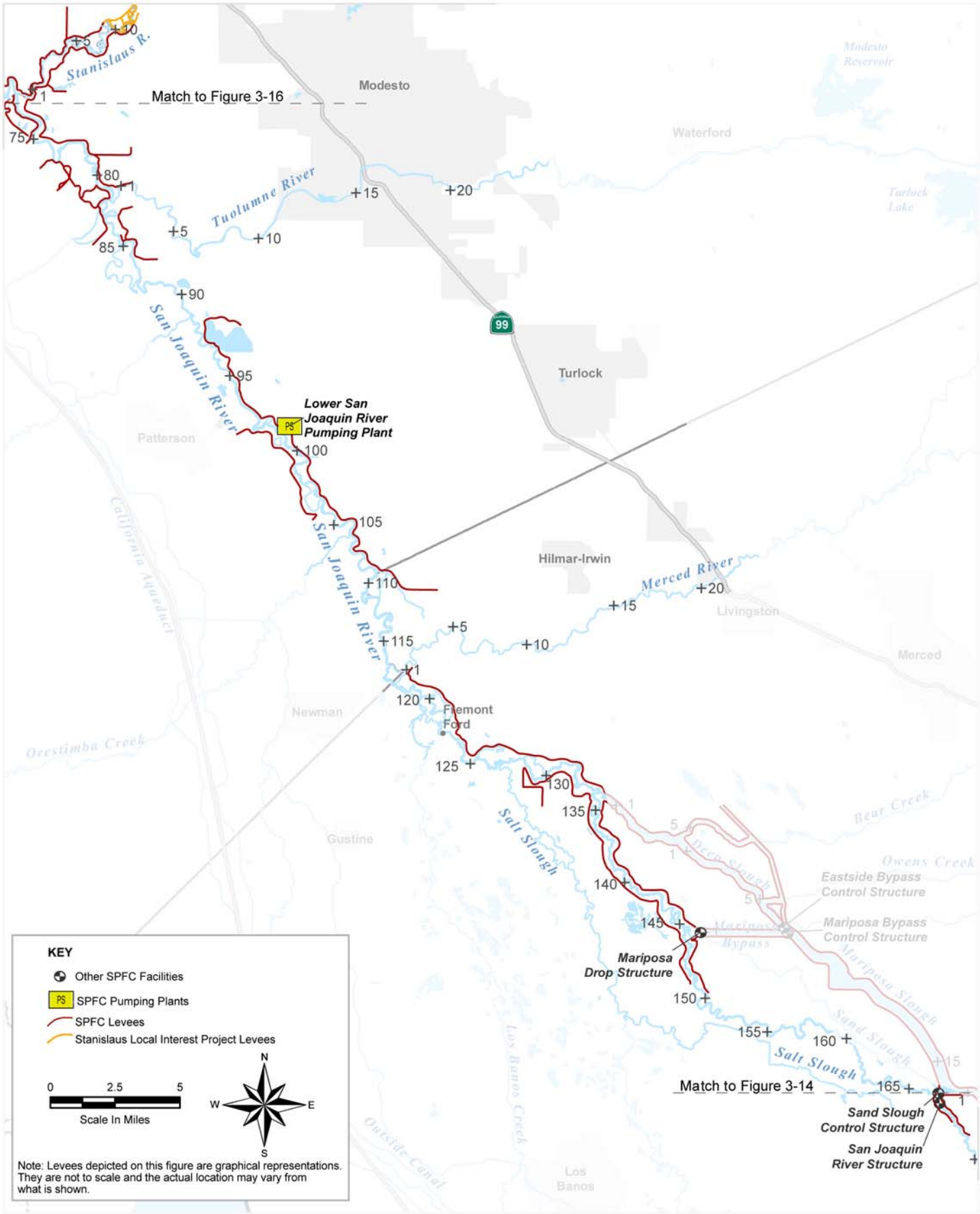

Figure 3-15. San Joaquin River Watershed – State Plan of Flood Control Facilities Along the San Joaquin River from the Sand Slough Control Structure to Stanislaus River

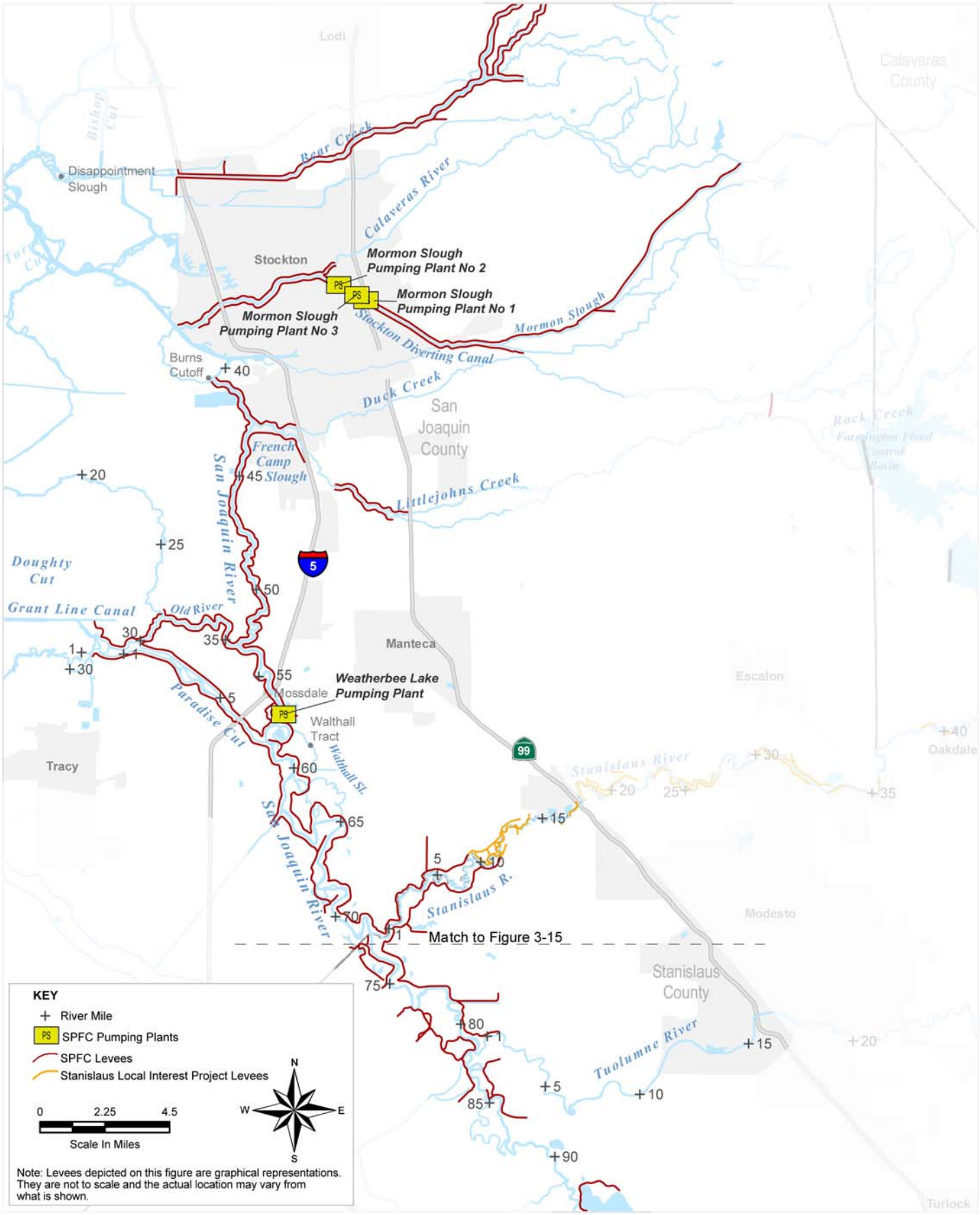

Figure 3-16. San Joaquin River Watershed – State Plan of Flood Control Facilities Along the San Joaquin River and Major Tributaries and Distributaries from Stanislaus River to Disappointment Slough

San Joaquin River from Control Structure to Fresno Slough

There are no SPFC facilities along the San Joaquin River between the San Joaquin River Control Structure and Fresno Slough. The channel capacity downstream from the control structure is about 2,500 cfs. The Kings River Channel Improvement Project (see O&M Manuals SJR604 and SJR604A) is a non-SPFC project in the Tulare Lake Basin, but federally regulated flows enter the San Joaquin River. During flood release events from Pine Flat Reservoir, the majority of Kings River flows, up to 4,750 cfs, are diverted north into the San Joaquin River through James Bypass and Fresno Slough.

San Joaquin River from Fresno Slough to San Joaquin River Structure at Sand Slough

While local levees extend on both banks of the San Joaquin River downstream from Mendota Dam to near Sand Slough, the only SPFC facilities are near the downstream end of the reach (see O&M Manual SJR601). A 2.2-mile-long right-bank levee and a 1.6-mile-long left-bank levee connect with the Eastside Bypass. The Sand Slough Control Structure spills San Joaquin River water into the bypass. Just upstream from the Sand Slough Control Structure, the San Joaquin River Structure controls flow into the San Joaquin River through operable gates. While the O&M manual describes the flow split between the bypass and the river, the San Joaquin River Structure has remained closed for many years because of limited channel capacity in the San Joaquin River – the design capacity is 1,500 cfs based on the O&M manual, but vegetation and other channel constrictions have reduced the actual capacity to less than 100 cfs. SPFC facilities are maintained by the Lower San Joaquin Levee District.

San Joaquin River from San Joaquin River Structure to Mariposa Bypass

SPFC facilities (see O&M Manual SJR601) along this reach are levees just upstream from the junction with the Mariposa Bypass. The levee design capacity is 1,500 cfs based on the O&M manual. The right-bank levee extends 3 miles upstream from the junction and the left-bank levee extends 2 miles upstream from the junction.

San Joaquin River from Mariposa Bypass to Eastside Bypass

SPFC facilities (see O&M Manual SJR601) are levees along both sides of the river. The levee design capacity is 10,000 cfs based on the O&M manual. The levees are each about 7 miles long.

San Joaquin River from Eastside Bypass to Merced River

The San Joaquin River and the Eastside Bypass join about 11.5 miles upstream from the Merced River. SPFC facilities (see O&M Manual SJR601) along this reach include levees. The design capacity of this reach

is 26,000 cfs based on the O&M manual. The right-bank levee is continuous from the junction with the Eastside Bypass to the overflow area of the Merced River. The left-bank levee extends from the Eastside Bypass to Salt Slough, about 6 miles downstream. This levee extends upstream on the right bank of Salt Slough for about 2.5 miles.

San Joaquin River from Merced River to Stanislaus River

The river has discontinuous SPFC levees along both banks of this 44 mile-long reach and one pumping plant. Based on the O&M manuals, the design channel capacity is 45,000 cfs between the Merced River and Tuolumne River and 46,000 cfs between the Tuolumne River and Stanislaus River. The design flow of the Tuolumne River at the confluence with the San Joaquin River is 15,000 cfs.

The right-bank levee (see O&M Manuals SJR4, SJR5, and SJR6) consists of three discontinuous segments totaling 20.4 miles. The levees protect agricultural land in RD 2031, RD 2063, RD 2091, and Dos Rios Ranch. About midway between the Merced and Tuolumne rivers, an SPFC pumping plant (see O&M Manual SJR6A) allows discharge of drainage water from the levee-protected area to the San Joaquin River. The pumping plant (capacity of 30,000 gallons per minute) also has provision for gravity flow of drainage water when the flow in the San Joaquin River is low. The left-bank levee (see O&M Manuals SJR12 and SJR13) consists of four discontinuous segments totaling 16.4 miles. The levees protect agricultural land in RD 1602, RD 2099, RD 2100, RD 2101, and RD 2102, and are maintained by those agencies.

Stanislaus River

SPFC facilities on the Stanislaus River include levees on both banks upstream from the San Joaquin River. Under flood control conditions, upstream reservoir release operations are designed not to exceed a flow of 8,000 cfs (channel capacity) in the lower Stanislaus River from Goodwin Dam downstream to the San Joaquin River. The LIPLs (see Chapter 2) have been identified by USACE as adequate to contain this design capacity. The right-bank levee (see O&M Manual SJR3) is 6.1 miles long from high ground to its connection with the San Joaquin River levee. The left-bank levee (see O&M Manual SJR4) is 7.2 miles long from high ground to its connection with the San Joaquin River levee. Channel maintenance (see O&M Manual SJR614) is included downstream from Goodwin Dam.

San Joaquin River from Stanislaus River to Paradise Cut

SPFC facilities on this reach of San Joaquin River include levees on both banks of the river. The design capacity is 52,000 cfs based on the O&M manuals. The right-bank levee (see O&M Manual SJR3) is 11.3 miles long.

This levee protects agricultural land in RD 2064, RD 2075, and RD 2094, and is maintained by those agencies. The left-bank levee (see O&M Manual SJR11) begins about 2 miles downstream from the Stanislaus River. This levee protects a State prison, the Deuel Vocational Institution, and agricultural land in RD 2085 and RD 2095. It is maintained by RD 2085 and RD 2095. Paradise Cut is a distributary to the San Joaquin River.

Paradise Cut

SPFC facilities along Paradise Cut include levees on both sides of the channel from the San Joaquin River to the confluence with the Old River. The design channel capacity is 15,000 cfs based on the O&M manuals. The right-bank levee (see O&M Manual SJR9) is 5.9 miles long. This levee protects Stewart Tract and the developing area of Lathrop. The left-bank levee (see O&M Manual SJR10) is 6.2 miles long. The levees are maintained by RD 2058 and RD 2062.

San Joaquin River from Paradise Cut to Old River

SPFC facilities include levees on both banks of the river and a pumping plant. The design capacity is 37,000 cfs based on the O&M manuals. The right-bank levee (see O&M Manuals SJR2 and SJR3) is about 5.5 miles long and is maintained by RD 17, and RD 2096. The Wetherbee Lake Pumping Plant and Navigation Gate (see O&M Manual SJR3A) is located where the right-bank levee crosses Walthall Slough, about 0.8 mile upstream from Mossdale. The pumping plant has a rated capacity of 22,500 gallons per minute. The left-bank levee (see O&M Manual SJR9) is 5 miles long and protects Lathrop. It is maintained by RD 2062.

Old River

SPFC facilities along Old River include levees on both sides of the channel. The right-bank levee (see O&M Manuals SJR7 and SJR8) extends about 7.1 miles from the San Joaquin River to the Grant Line Canal. Based on the O&M manuals, the project design capacity for the right-bank levee is 19,000 cfs from the San Joaquin River to the Middle River, 15,000 cfs from the Middle River to Paradise Cut, and 30,000 cfs from Paradise Cut to the Grant Line Canal. The left-bank levee (see O&M Manual SJR9) extends about 5.6 miles from the San Joaquin River to the confluence with Paradise Cut. The project design capacity for the left-bank levee is 19,000 cfs. The levee protects Stewart Tract and the urbanizing area of Lathrop. Levees along Old River are maintained by RD 2062, RD 2089, RD 544, and RD 1.

San Joaquin River from Old River to Burns Cutoff

SPFC facilities along this reach of river include levees on both banks. The design capacity is 18,000 cfs based on the O&M manuals. The right-bank levee (see O&M Manuals SJR1 and SJR2) is 12.6 miles long and is

maintained by RD 17 and RD 404. French Camp Slough enters the river about 2.3 miles upstream from Burns Cutoff. The left-bank levee (see O&M Manual SJR7) is about 12.4 miles long and is maintained by RD 544.

French Camp Slough

SPFC facilities within the French Camp Slough drainage include a diversion, channel clearing and excavation, and levees. A dike across Duck Creek and a 5,000-foot-long diversion channel (see O&M Manual SJR613B) divert Duck Creek flow to Littlejohns Creek. The channel has a design capacity of 500 cfs based on the O&M manual. The project included cleared and excavated channels along South Littlejohns Creek and both the north and south branches. South Littlejohns Creek has a 2.3-mile-long right-bank levee in two segments and a 2.6-mile-long left-bank levee. The project reduces flood risk to Stockton and its surrounding urban area.

Both the right (see O&M Manual SJR1) and left (see O&M Manual SJR2) levees on French Camp Slough extend about 1.8 miles upstream from the San Joaquin River. The project design capacity for the left-bank levee is 3,000 cfs and the project design capacity for the right-bank levee is 2,000 cfs based on the O&M manuals. Levees along French Camp Slough are maintained by RD 17 and RD 404.

Calaveras River and Mormon Slough

The Calaveras River is a tributary to the San Joaquin River. SPFC facilities within the Calaveras River drainage include a diversion from Mormon Slough, pumping plants, and levees and improved channels along Mormon Slough, Porter Creek, and the Calaveras River (see O&M Manual SJR611.1 for channels and levees and O&M Manual SJR611.2 for the pumping plants). There is also a diversion from the Calaveras River to Mormon Slough at Bellota that does not show in the O&M manual as an SPFC facility.

Intermittent spoil dikes and levees are located along about 11 miles of Mormon Slough. Both banks of Mormon Slough have levees for a distance of about 2.3 miles upstream from the Mormon Slough Diversion. Porter Creek has a 0.9-mile-long left-bank levee upstream from its confluence with Mormon Slough. The Stockton Diverting Canal, about 5 miles long, diverts Mormon Slough water to the Calaveras River. Both banks of the diverting canal have levees. Design capacity is 12,500 cfs based on the O&M manuals. Three pumping plants along the right bank of the diverting canal discharge local drainage water into the canal.

The Calaveras River has levees along both banks for a distance of about 6.5 miles upstream from the San Joaquin River. The design capacity of the

river is 13,500 cfs. Facilities are maintained by the San Joaquin County Flood Control and Water Conservation District.

Bear Creek

Bear Creek is a tributary to the San Joaquin River – the creek is not the same as the Bear Creek that is tributary to the Eastside Bypass. SPFC facilities include cleared and excavated the channel and levees on Bear Creek, Paddy Creek, Middle Paddy Creek, and North Paddy Creek. The project includes 14.4 miles of cleared and enlarged channel, 1.3 miles of new channel, and 30.1 miles of levee. O&M Manual SJR612.2 covers the project from high ground to Highway 99. O&M Manual SJR612.1 covers the project from Highway 99 to Disappointment Slough. Facilities are maintained by the San Joaquin County Flood Control District.

3.4 Other Flood Projects with State Assurances

The State has provided the federal government assurances on other flood management projects in California, but these projects do not meet the definition (see Section 1.1) for the SPFC because of their location. The SPFC is limited to projects within the watersheds of the Sacramento and San Joaquin rivers. Examples of other flood projects with State assurances include the following:

- The Truckee River and Tributaries Project was authorized by the Flood Control Act of 1954 (Public Law 780, 83rd Congress). The Truckee River drains into Pyramid Lake in the Great Basin. Since it is not within the watershed of the Sacramento or San Joaquin rivers, the project is not part of the SPFC.

- The Fairfield Vicinity Streams Project was authorized by House and Senate Public Works Committees' resolutions adopted December 15, 1970, and December 17, 1970, respectively, under provisions of Section 201 of the Flood Control Act of 1965. The authorization was substantially in accordance with a report of the Secretary of the Army and the USACE Chief of Engineers in HD 159 (91st Congress). Section 117 of Public Law 99-190 modified the project authorization. Project authorization was also modified under the Supplemental Appropriations Act of 1987 (Public Law 100-71). The project (see O&M Manual SAC514) reduces flood risk to the City of Fairfield and Suisun City. The Fairfield Vicinity Streams Project includes improvements along Union Avenue Creek, a small unnamed tributary near Highway 80, 1 mile of Legewood Creek from Highway 12 to Peytonia Slough, Laurel Creek from just south of Gulf Drive to McCoy Creek, and McCoy Creek south to the Buffer Channel. The peak flow for McCoy Creek

upstream to its confluence with Laurel Creek is 3,700 cfs. At this confluence, the peak inflow from McCoy is 2,000 cfs, and 3,700 cfs from the Laurel Diversion. At the Laurel Diversion confluence with the Diversion Stub, the peak inflow is 700 cfs from the Diversion Stub and 2,600 cfs from the channel. While the State provided assurances to the federal government, the project is not part of the SPFC because it does not meet the SPFC definition – the project drains downstream from River Mile 0.0 for the Sacramento River and is therefore not part of the Sacramento River watershed.

4.0 SPFC Lands

In most cases, federal project authorizations require the local sponsor to provide all lands, easements, and rights-of-way for project construction, maintenance, and operation. Property rights for SPFC lands are held by the Sacramento-San Joaquin Drainage District (SSJDD), which is under the jurisdiction of the Board. The SSJDD was created by State legislation in 1913 and has associated property rights going back to 1900.

SPFC property rights extend to about 18,000 parcels of land. All comprehensive property records, indexes, and mapping associated with SPFC lands are maintained by DWR's Division of Engineering-Geodetic Branch, Cadastral Survey Section. Each parcel of land has a file folder containing hard copies of the parcel description and other pertinent information. About 400 plat maps show the locations of the land parcels. Since the recording system has been in place for more than 100 years, it is set up to identify rights on individual properties at specific locations and is not readily suitable to general queries or other summaries.

4.1 Summary

In general, SSJDD acquired and holds property rights necessary for the original construction of facilities and ongoing O&M, and to allow flooding, ponding, seeping or overflow of water. Property rights are for approximately 210,500 acres of land throughout 19 Central Valley counties. Table 4-1 summarizes, by county, the approximate acreage of land on which SSJDD holds property rights.

Table 4-1. Acres of Land for Which Sacramento-San Joaquin Drainage District Holds Property Rights, by County

County	Acres
Butte	7,010
Colusa	5,272
Fresno	5,018
Glenn	38,000
Lake	174
Madera	5,460
Mariposa	3,246
Merced	10,900
Modoc	2
Placer	95
Plumas	177
Sacramento	8,650
San Joaquin	4,350
Solano	16,100
Stanislaus	500
Sutter	29,200
Tehama	580
Yolo	74,800
Yuba	950

Note: This table represents approximate acres of land in each county. For more information on property rights, contact DWR Division of Engineering-Geodetic Branch, Cadastral Survey Section.

4.2 Data Gaps

The record of SPFC property rights holdings is not clear in all areas. Because of the incremental construction of SPFC facilities over almost a century, records are not of uniform quality and records for rights in some areas are missing.

SPFC property rights have been acquired and disposed of for various reasons throughout the history of the SPFC in the Sacramento and San Joaquin river valleys. For example, property rights may have been acquired for spoiling or borrowing of soil material necessary for construction and, in some cases, these rights were disposed of through sale or transfer after construction.

Standards for easements beyond the landside toe of levees for O&M have varied with time. Since the 1980s, a 10-foot easement has been standard.

However, a majority of SPFC levee easements were acquired before that time according to standards existing at the time of acquisition. Therefore, 10-foot easements do not exist throughout the system. Similarly, easements to gain access to and from various points along the levee system are not consistent. In some areas, unauthorized encroachments extend well into easement areas and sit on easements or on levees.

4.3 Fee Title Lands

Fee title lands, or fee simple lands, are those with full ownership. Some of the property rights for the SPFC are held in fee title, but the current method of record-keeping does not allow easy summarization of these holdings. Some levees are on lands owned by the State. The State owns the land within the Chowchilla Bypass, and the Eastside Bypass upstream from Sand Slough.

In some areas, land was purchased by the State in fee and then disposed of while the State retained some easement rights.

4.4 Easements

Easements are limited-use rights to property owned by others. SSJDD often acquired property rights in areas where it was determined that purchasing easements was more appropriate than purchasing the land in fee title. The majority of SSJDD's property rights are easements. In these locations, most notably the Sutter, Sacramento, Yolo, Butte, Tisdale, and Mariposa bypasses, and the Eastside Bypass downstream from Sand Slough, flowage easements were acquired that compensate landowners for giving the SSJDD the right to flow or flood water over land.

Common easement types used by SSJDD are listed below:

- **Levee** – Standard levee easement language has been revised numerous times in the past 100 years. With each revision, the standard version has become more specific and defined. Also, standard language has been modified or sections deleted in some easement deeds, as requested by the grantor. Because of the revisions and customization, language in each deed must be evaluated to determine SSJDD's exact rights for the parcel. For example, two levee easements (acquired at different times, one 60 years ago to build the levee, the other 5 years ago to enlarge and improve the levee) are adjacent but have different levee rights. The latter would have the right to preserve and retain all vegetative growth desirable for project purposes; the older document would only state that

SSJDD had the right to build, construct, reconstruct, repair, and maintain, with no mention of replanting or preserving vegetation. Current levee language, Rights 1 through 8 (revised in 1994) are as follows:

> *1. Construct, reconstruct, enlarge, fence, plant with trees, shrubs and other vegetation, preserve and retain all vegetative growth desirable for project purposes, repair and use flood control works, which shall include, but not be limited to, access, haul and patrol roads, levees, ditches, embankments, channels, berms, fences and appurtenant structures, and operate and maintain said flood control works in conformity with the Code of Federal Regulations, Corps of Engineers' Standard O&M Manual, and State of California Standards.*
>
> *2. Clear and remove from said flood control works any or all natural or artificial obstructions, improvements, trees and vegetation necessary for construction, operation, maintenance, repair, reconstruction and emergence flood fight.*
>
> *3. Flow waters and materials and by said flow erode.*
>
> *4. Place or deposit earth, debris, sediment or other material.*
>
> *5. Excavate and remove earth, debris, sediment, or other material, including that placed or deposited as above.*
>
> *6. Locate or relocate roads and public utility facilities by grantee or others.*
>
> *7. Restrict the rights of the grantor, his successors and assigns, without limitations, to explore, extract, remove, drill, mine or operate through the surface or upper 100 feet of the subsurface in exercise of the grantor's interest in any minerals, including oil and gas.*
>
> *8. Restrict any use by others which may interfere with any of the uses listed herein or any use necessary or incidental thereto.*

- **Access** – A perpetual easement and right-of-way to construct, reconstruct, operate, maintain, and use an access and service road over a property.

- **Canal/Channel** – A perpetual easement and right-of-way to construct, reconstruct, enlarge, operate, and maintain, a canal or ditch, and all works necessary and appurtenant to a flood control facility.

- **Drainage and Flowage** – A perpetual easement and right-of-way to construct, reconstruct, enlarge, operate, and maintain drainage facilities, and to flood, seep, pond, and overflow water over a property.

- **Flowage** – A perpetual easement and right-of-way to flood, seep, pond, and overflow water over, through, and across a property.

- **Slope** – A perpetual easement, with the right to construct, reconstruct, extend, and maintain cut and fill slopes and drainage facilities over a property.

- **Temporary** – Other temporary easements and rights of way for access, borrow, spoil, and construction may have been acquired. Since these rights terminated after construction, they are no longer part of the SPFC property rights.

4.5 Agreements

SSJDD has agreements with public entities (city, county, utilities, other State departments, and federal) for specified use of easements and properties. Each agreement is unique and allows specific uses and restrictions.

4.6 Designated Floodways

See Sections 2.4.3 and 6.8.1 for descriptions of designated floodways. Designated floodways are not considered lands of the SPFC, but they are a condition for successful operation of the SPFC. They do not carry specific property rights, but are a regulatory designation.

4.7 Historic Overflow to Butte Basin

See Section 3.2.5 for a description of historic overflow into the Butte Basin and inundation of lands within the basin. Also see Section 6.8.2 for a description of Board regulation of overflow to the Butte Basin under CCR Title 3. By precedent of historical use, the SPFC relies on continued overflow during floods for successful operation of levees along the Sacramento River.

4.8 Encroachment Permits

The Board issues permits for encroachments that are compatible with the flood system and do not hamper O&M. These are not SPFC property rights, but are permitted use of SPFC facilities. However, there are many unpermitted encroachments on SPFC facilities. Some of these encroachments are clearly incompatible with O&M of SPFC facilities and should be removed. Others need permitting to document their presence.

As part of the American River Common Features General Reevaluation Report (GRR), USACE estimated that encroachments exist on (USACE, 2008):

- Fifty-seven percent of the left bank of the Sacramento River, from Natomas Cross Canal to American River
- Thirteen percent of the left bank of the Sacramento River, from the American River to Morrison Creek
- Nine percent of the right bank of the American River
- Twenty-six percent of the left bank of the American River

Similar estimates are not available for other river reaches within the SPFC.

Limiting and controlling encroachments are important to public safety. Encroachments can limit visibility for inspections and can impede access necessary for floodfights and O&M. Encroachments can significantly delay planned construction activities.

Encroachment permits granted by the Board must also be approved by USACE.

4.9 Ongoing Evaluation

Each individual property upon which the SSJDD holds property rights represents an agreement between the previous owner of the rights and SSJDD or a Final Order of Condemnation forcibly transferring property rights to the government. While standard ownership and easement rights agreements have been used by SSJDD, these agreements have changed throughout the years. In addition, individual property owners may have negotiated modified agreement terms. While the types of property rights may be aggregated into groups of similar rights, each individual deed must be reviewed to understand the specific rights held for the parcel.

Documentation and analysis of SPFC lands is extremely complex. More than 100 years of records exist that document thousands of land acquisitions and disposals. Over this period, recordkeeping protocols, technology, surveying accuracy and methods, and legal language have all changed and developed significantly. Many early records use descriptive language that leaves significant interpretation to the boundary delineation of a parcel or the rights conferred by the deed. Compiling, rectifying, and standardizing these records into a state-of-the-art electronic database is an ongoing activity underway by DWR. This effort has been initiated, but substantial work remains to be completed so that records can be analyzed in detail. In the absence of this completed geographic information system (GIS) database, only approximate conclusions can be drawn from the existing data. Specific inquires into the rights of individual parcels or groups of parcels are handled by DWR's Division of Engineering, Geodetic Branch.

Based on rights that can be quantified, additional property rights may need to be obtained, especially for gaining access to SPFC facilities and for adequate easements along the landside toes of levees. Therefore, the State and local maintaining agencies (LMA) may not have the land rights necessary for SPFC facility O&M as intended.

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5.0 SPFC Operations and Maintenance

The modes of O&M are part of the SPFC. Modes of O&M for the SPFC include O&M manuals, inspections of SPFC facilities, maintenance by the State and LMAs, and flood operations.

5.1 Summary

The State depends on a large number of LMAs to keep the SPFC levees in good condition. The State performs maintenance of structures, channels, and specific levee reaches. USACE does not perform O&M on SPFC facilities.

O&M manuals specify needed inspections and O&M for each unit of the SPFC. A unit may be a reach of levee on one bank of a river, a pumping plant, a weir, control structure, dam and reservoir, or other facility.

Two standard O&M manuals, one each for the Sacramento and San Joaquin river portions of the system, and 145 unit-specific O&M manuals provide information on O&M of facilities.

5.2 Operation and Maintenance Manuals

The O&M manuals contained on the reference DVD included with this report are part of the SPFC. O&M manuals describe actions that maintaining agencies should follow during high-water events and for keeping project facilities in good working condition. USACE has prepared standard O&M manuals for Sacramento and San Joaquin river facilities. These standard O&M manuals are supported by more detailed O&M manuals for each unit of the State-federal flood management system in the Sacramento and San Joaquin valleys.

5.2.1 Standard O&M Manuals

The standard O&M manuals present requirements that apply to all maintaining agencies that operate and maintain the various geographical SPFC units. The two standard O&M manuals are listed below:

- *Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project* (USACE, revised May 1955)

- *Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California* (USACE, April 1959)

The standard O&M manual for the Sacramento River portion of the system (see O&M Manual SAC000) and the standard O&M manual for the San Joaquin River portion of the system (see O&M Manual SJR000) can be found on the reference DVD in the back pocket of this report. This general information applies to all units of each project and conforms with Section 208.10, Title 22 of the Code of Federal Regulations (CFR), as approved by the Acting Secretary of the Army on August 9, 1944, and published in the Federal Register on August 17, 1944. Each manual includes a copy of the regulation.

Examples of general rules contained in each manual for O&M of local flood control works (facilities) are as follows:

- O&M for maximum benefits

- O&M in accordance with USACE-prescribed regulations

- Reserve supply of materials for flood emergencies

- No encroachments that adversely affect O&M

- No improvements without USACE approval

- Semiannual report

- USACE access at all times

- Maintenance and repairs performed by maintaining agencies as deemed necessary by USACE

- Coordination during flood periods

Examples of more detailed O&M information contained in the standard manuals include the following:

- Conditions requiring facility maintenance such as erosion, care of vegetation, burrowing animals, degradation of levee crown

- Need for patrols during floods

- Need for inspections
- Procedures to combat flood conditions

5.2.2 Unit-Specific O&M Manuals

USACE prepared detailed O&M manuals for each separate unit of the State-federal flood management system when each unit was completed. Unit-specific O&M manuals (see reference DVD) were incrementally prepared for specific O&M requirements that apply to the unit. These O&M manuals supplement information included in the standard O&M manuals. Each manual includes information on authorization, location, project description, protection provided, assurances provided by locals, maintenance methods, operation methods, and inspection and reporting. The O&M manuals generally include the as-constructed drawings as an appendix, but file them separately due to their large size. Some manuals include information on repairs or upgrades completed following construction of the original facilities. While a total of 118 unit-specific O&M manuals (see reference DVD) has been found, other manuals may be found.

Most of the unit-specific O&M manuals were prepared for individual segments of levees, often aligned to the LMA responsible for their maintenance. Other unit-specific O&M manuals were prepared for pumping plants along a given reach of stream channel, weirs, diversions, storage reservoirs, or other features of the SPFC.

Each unit-specific O&M manual also includes information on ancillary features that are part of each unit such as bridges, culverts, and other minor drainage facilities, and hydrographic features such as gages necessary for operation. The O&M manuals and the reference DVD contained at the end of this report contain specific information on these features. However, since undocumented changes to these have likely occurred over time, the information should be viewed as a general inventory of these facilities, not a definitive list of existing features.

O&M Manuals SAC1 through SAC17 are early manuals that have been superseded by more recent information in O&M manuals numbered SAC100 and higher. SAC1 through SAC17 are included on the reference DVD for historical completeness, but do not reflect current information.

Repairs and other modifications have been made subsequent to original construction to many levees throughout the system. The common practice is for USACE to prepare a supplemental O&M manual to cover a repair or modification. DWR and USACE are in the process of assembling a set of these supplemental O&M manuals.

5.3 Inspections

Each individual unit-specific O&M manual includes requirements for inspection of SPFC facilities. The State is responsible for inspections of SPFC levees and structures. The State inspects levees that are maintained by DWR and many separate local agencies, and then reports the findings to USACE, which performs quality assurance work. DWR has implemented a self-inspection program that requires LMAs to inspect their levees in the summer and winter, while DWR conducts inspections in the spring and fall. From the inspection information submitted, USACE may choose to conduct follow-up inspections in certain areas. USACE uses its own follow-up inspections and the State's inspection findings to make Public Law 84-99[1] eligibility determinations for each local agency.

While each O&M manual contains specific inspection criteria, the following are examples of items included in inspections:

- Debris
- Channel vegetation
- Levee vegetation
- Encroachments
- Sedimentation
- Settlement
- Erosion
- Rodent damage
- Condition of structures
- Other conditions specified in each O&M manual

Annual inspection reports and a variety of other inspection reports prepared by DWR's Flood Project Integrity and Inspection Branch can be found on the California Data Exchange Center (CDEC) Web site:

http://cdec.water.ca.gov/fsir.html

The maintenance status of project channels and structures is reported in an annual Inspection Report. Each annual report includes criteria for inspections of levee maintenance, channels, and structures.

5.3.1 Interim Vegetation Inspection Criteria

In April 2007, USACE released a draft white paper, *Treatment of Vegetation Within Local Flood Damage Reduction Systems*, which called for the removal of wild growth, trees, and other encroachments that might impair levee integrity or floodfighting access to reduce the risk of flood

[1] Public Law 84-99 defines federal rehabilitation assistance for flood control works.

damage. Guidance on vegetation standards for flood control structures can be found in USACE Engineering Technical Letter (ETL) 1110-2-571 and Engineering Manual (EM) 1110-2-301. These standards limit uncontrolled vegetation growth (brush, weeds, or trees) to smaller than 2 inches in diameter. USACE notified sponsors that levees that fail to meet these existing standards be rated as unacceptable, with the consequence that they could lose eligibility for federal assistance (Public Law 84-99) in post-flood levee rehabilitation.

In response to USACE vegetation criteria, DWR revised its levee inspection criteria for vegetation in fall 2007. The interim vegetation inspection criteria will be considered in the short term until they can be revised using best available science, and USACE completes its review and revision of its levee vegetation standards. The inspection criteria are aimed at improving public safety by providing visibility for inspections, eliminating vegetation conflicts and encroachments that could hamper floodfight activities, and improving access for overall maintenance.

These criteria apply on the entire landside slope plus a 10-foot-wide easement beyond the landside toe. On the waterside, these criteria apply to vegetation on only the top 20 feet (slope length) of the levee slope. Trees within these areas must be trimmed up to 5 feet above the ground (12 feet above the crown road) and thinned enough for visibility and access. Brush, weeds, or other vegetation more than 12 inches high blocking visibility and access within these levee areas should be trimmed, thinned, mowed, burned, dragged, or otherwise removed in an allowed manner.

5.3.2 Enforcement

During the spring and fall inspection cycles, DWR identifies and documents inspection items as acceptable (A), minimally acceptable (M), or unacceptable (U) considering USACE inspection rating criteria.

The Board, in conjunction with DWR and LMAs, addresses deficient items, including the following:

- Critical items impacting the structural integrity of the levee
- Vegetation not in compliance with interim vegetation inspection criteria, or determined to critically weaken a levee and lower public safety
- Critical erosion issues
- Aggressive rodent control and repair of levee damage by rodents

- Encroachments affecting floodfighting activities or levee integrity

To ensure these inspection deficiencies are addressed, the Board, in conjunction with DWR, does the following:

- Notifies USACE of inspection findings
- Requires submittal of an LMA Corrective Action Plan consistent with the agency's O&M responsibility
- Identifies a time period required to correct deficiencies
- Sends notification letters to appropriate land use agencies indicating inspection status, maintenance history, and impacts on Public Law 84-99 eligibility through DWR's Flood Risk Notification Program

To enforce compliance regarding deficiencies, the State will rate items that are minimally acceptable as unacceptable (U) if they are not corrected within the time period in the notification, unless work is scheduled or in progress. This may lead to an overall rating of unacceptable (U), resulting in loss of Public Law 84-99 eligibility.

Maintenance areas (see Section 5.4.1) and LMAs with levees ranked unacceptable because of vegetation will be expected to remedy deficiencies. To remain eligible for the Public Law 84-99 program, DWR will expect issues to be addressed expeditiously, and in compliance with all appropriate environmental laws.

5.4 Maintenance

Maintenance of SPFC facilities is performed by the State and 81 different LMAs. USACE Regulation 33, CFR 208.10, separates responsibilities into two categories – levees and channels. In addition, the State and LMAs are responsible for satisfying all environmental and resource agency requirements or laws that apply during performance of maintenance activities.

5.4.1 Maintenance by the State

On the Sacramento River portion of the system, DWR maintains levees and roads in accordance with USACE O&M manuals for about 293 miles of levees under DWR jurisdiction. The State also maintains 14 project structures and all project channels for proper operation during floods. Channel maintenance can include erosion repairs and vegetation, debris,

and sediment removal for flow capacity. The State performs maintenance through its Sacramento and Sutter maintenance yards on a continual basis.

For the San Joaquin River portion of the system, the State generally has passed all maintenance responsibility to the LMAs. However, the State has performed some critical erosion repairs identified under the Governor's Executive Order S-01-06, which were funded through a legislative appropriation by Assembly Bill (AB) 142 (Nunez, 2006).

State Responsibility in Water Code 8361

CWC 8361 specifies the portions of the SRFCP with State responsibility for O&M:

> *8361. The department shall maintain and operate on behalf of the state the following units or portions of the works of the Sacramento River Flood Control Project, and the cost of maintenance and operation shall be defrayed by the state:*
>
> *(a) The east levee of the Sutter Bypass north of Nelson Slough.*
>
> *(b) The levees and channels of the Wadsworth Canal, Willow Slough Channel downstream from the Southern Pacific Railroad from Davis to Woodland except that portion of the north levee thereof lying within Reclamation District No. 2035, Putah Creek downstream from Winters, the intercepting canals draining into them, and all structures incidental thereto.*
>
> *(c) The collecting canals, sumps, pumps, and structures of the drainage system of Project No. 6 east of the Sutter Bypass.*
>
> *(d) The bypass channels of the Butte Slough Bypass, the Sutter Bypass, the Tisdale Bypass, the Yolo Bypass, and the Sacramento Bypass with all cuts, canals, bridges, dams, and other structures and improvements contained therein and in the borrow pits thereof.*
>
> *(e) The levees of the Sacramento Bypass.*
>
> *(f) The channels and overflow channels of the Sacramento River and its tributaries and the major and minor tributaries' flood control projects as authorized and defined in Sections 12648, 12648.1, and 12656.5.*
>
> *(g) The Knights Landing ridge cut flowage area.*

(h) The flood relief channels controlled by the Moulton and Colusa Weirs and the training levees thereof.

(i) The levee on the left bank of the Sacramento River adjoining Butte Basin, from the Butte Slough outfall gates upstream to a point four miles northerly from the Moulton Weir, after completion.

(j) All weirs and flood relief structures.

(k) The west levee of the Yolo Bypass, extending from the west end of the Fremont Weir southerly to the Cache Creek Settling Basin and from Willow Slough Channel to Putah Creek and the east levee of the Yolo Bypass from Fremont Weir southerly two miles.

(l) The levee on the west bank of Feather River extending a distance of about two miles southerly from the Sutter-Butte Canal headgate.

(m) The levees of Cache Creek and the easterly and westerly levees of Cache Creek Settling Basin; excepting the portion of the southerly levee of Cache Creek lying upstream from State Highway Route 7 (U.S. 99W).

(n) The flowage area of Western Pacific Intercepting Canal extending northerly for a distance of five miles from Bear River.

(o) The levees of Tisdale Bypass from Tisdale Weir 4.5 miles easterly to Sutter Bypass.

(p) The flood relief structures or weirs and other structures or facilities essential for their proper functioning in the vicinity of the Sacramento River between Big Chico Creek and the north boundary of Glenn County Levee District No. 3.

Channel Maintenance

DWR's channel maintenance responsibilities include monitoring channels to be certain that the banks of a channel are not being damaged by rain or wave wash, and that no sloughing of banks has occurred, and to make appropriate repairs. In addition, DWR is responsible for maintaining all project channels to control vegetation, sedimentation, fallen trees, and other debris affecting design capacity.

O&M Manual SAC165 is a supplement to the standard O&M Manual for the SRFCP. This O&M manual covers channel clearing for the waterway

that lies between the levees of the Sacramento River from Ord Ferry to Collinsville, the channels of the lower reaches of the Feather and American rivers, and all tributary and distributary streams included in the SPFC.

Maintenance Areas

When an LMA is not able to operate or maintain project levees permitted by the Board to acceptable standards, DWR or the Board is authorized to form a maintenance area and take responsibility for the levee when in the best interest of the State. CWC Section 12878 defines a maintenance area as:

> *"Maintenance area" means described or delineated lands that are found by the board or department to be benefited by the maintenance and operation of a particular unit of a project.*

The procedure for forming a maintenance area is covered in CWC Sections 12878 through 12878.21. The flood benefit of this program is that it addresses sections of levee that are not being maintained through either (1) identifying another maintaining agency willing to accept the maintenance responsibility, or (2) turning over maintenance responsibilities to the State to be paid for by local beneficiaries. Ten maintenance areas (1, 3, 4, 5, 7, 9, 12, 13, 16, and 17) are currently active within the jurisdictional boundaries of the Board (see Figures 5-1 and 5-2). Based on their location, levees within these maintenance areas are maintained by either the Sacramento or Sutter maintenance yards.

5.4.2 Maintenance by Local Maintaining Agencies

Most levees in the SPFC are maintained by LMAs that fund maintenance activities through assessing landowners within their boundaries. These LMAs are composed primarily of levee districts and RDs. A variety of cities, counties, and other public agencies and municipalities also maintain project levees. In addition, DWR is the LMA for specific facilities defined in CWC Section 8361 and for specific maintenance areas (see Section 5.4.1). Maintaining agencies are shown in Figures 5-1 and 5-2, and listed in Table 5-1 along with the SPFC facilities they maintain.

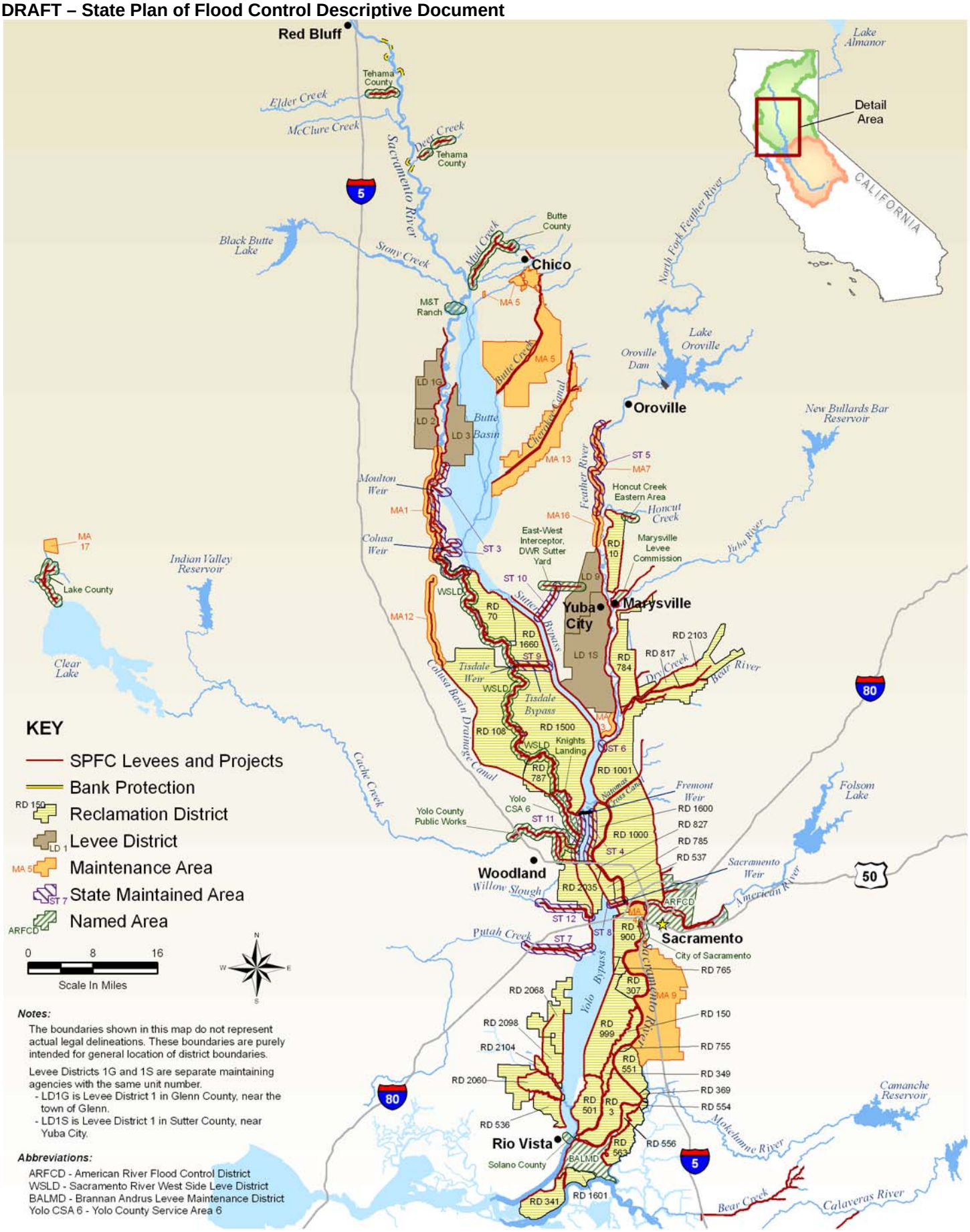


Figure 5-1. Locations of Local Maintaining Agencies within the Sacramento River Watershed

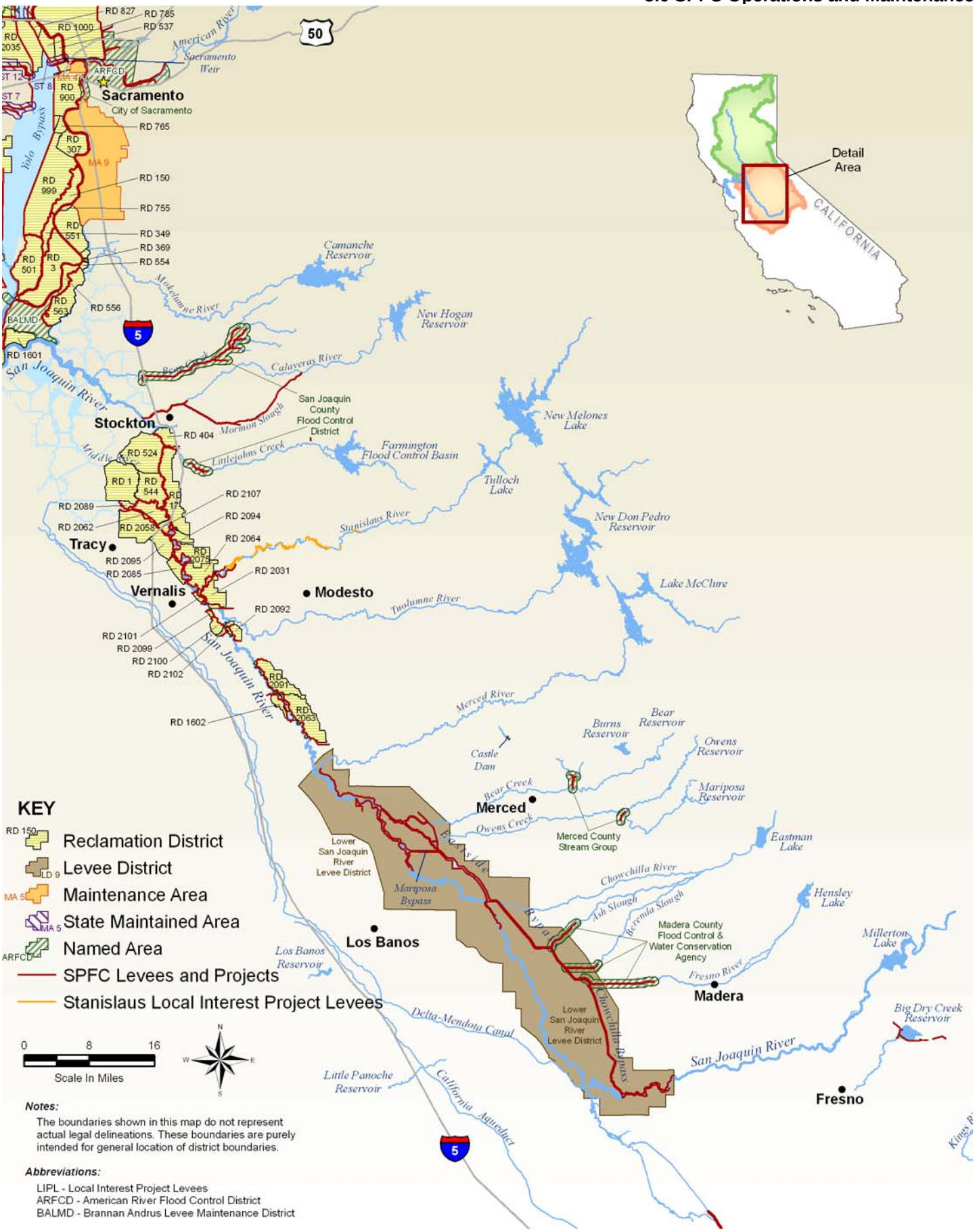


Figure 5-2. Locations of Local Maintaining Agencies within the San Joaquin River Watershed

Table 5-1. Local Maintaining Agencies for State Plan of Flood Control Facilities

State Plan of Flood Control Facility	Local Maintaining Agency
North Fork Feather River channel improvements, including a diversion structure, an excavated rock-lined diversion channel, seven drop structures, and levees	Plumas County Department of Public Works
Feather River right-bank levee, High ground to Yuba City	LD 9
Feather River right-bank levee, Yuba City to Sutter Bypass	LD 1 (Sutter County)
Feather River left-bank levee, Honcut Creek to Jack Slough	RD 10
Feather River left-bank levee, Yuba River to Bear River	RD 784
Sutter-Butte Canal Headgate	DWR
Honcut Creek left bank levee, upstream from Feather River confluence	RD 10
Back levee for RD 10, along Jack and Simmerly sloughs	RD 10
Ring levee around City of Marysville	Marysville Levee Commission
Yuba River right-bank levee, upstream from Marysville ring levee	Marysville Levee Commission
Yuba River left-bank levee, upstream from Feather River confluence	RD 784
Feather River left-bank levee	RD 784
Feather River right-bank levee	LD 1 (Sutter County)
Dry Creek left-bank levee, upstream from Bear River confluence	RD 817, RD 2103
Dry Creek right-bank levee, upstream from Bear River confluence	RD 784
Bear River right- and left-bank levees, upstream from Dry Creek confluence	RD 817
Yankee Slough right- and left-bank levee, upstream from Bear River confluence	RD 1001
WPRR Intercepting Channel right bank levee	RD 784
Bear River right-bank levee, downstream from Dry Creek confluence	RD 784
Bear River left-bank levee, downstream from Dry Creek confluence	RD 1001
Feather River right-bank levee from Bear River to Sutter Bypass	LD 1 (Sutter County)
Feather River left-bank levee from Bear River to Sutter Bypass	RD 1001
Nelson BendRock weir on Feather River at Sutter Bypass	DWR – Sutter Yard
Feather River/Sutter Bypass right-bank levee, upstream from Sacramento River confluence	RD 1500
Feather River/Sutter Bypass left-bank levee, upstream from Sacramento River confluence	RD 1001
American River right-bank levee, upstream from Natomas East Main Drainage Canal	American River Flood Control District

Table 5-1. Local Maintaining Agencies for State Plan of Flood Control Facilities (Contd.)

State Plan of Flood Control Facility	Local Maintaining Agency
Vegetation mitigating, five sites between H Street and Watt Avenue	American River Flood Control District
Pumps along American River at H Street and Watt Avenue	County of Sacramento
American River left-bank levee, upstream from Natomas East Main Drainage Canal	American River Flood Control District
Natomas East Main Drainage Canal right-bank levee at Sankey Road	American River Flood Control District
Linda Creek left-bank levee, upstream from Natomas East Main Drainage Canal	American River Flood Control District
Magpie Creek diversion channel	American River Flood Control District
Natomas East Main Drainage Canal right- and left-bank levees, from Arcade Creek to American River	American River Flood Control District
Arcade Creek right- and left-bank levees, upstream from Natomas East Main Drainage Canal	American River Flood Control District
American River right-bank levee, from Natomas East Drainage Canal to Sacramento River	RD 1000
Lower Butte Creek channel improvements and Howard Slough diversion structure	TBD
Butte Slough Outfall Gates	DWR – Sutter Yard
Right-bank levee from Butte Slough Outfall Gates to Sutter Bypass	RD 70
Sutter Bypass pumps and right- and left-bank levees from Highway 20 to Wadsworth Canal	DWR – Sutter Yard, RD 70, RD 1660
Sutter Bypass right-bank levee from Wadsworth Canal to Tisdale Bypass	RD 1660
Sutter Bypass right-bank levee downstream from Tisdale Bypass to Feather River confluence	RD 1500
Feather River/Sutter Bypass right-bank levee, upstream from Sacramento River confluence	RD 1500
Feather River/Sutter Bypass left-bank levee, upstream from Sacramento River confluence	RD 1001
Colusa Basin Drain left-bank levee	RD 108
Knights Landing Outfall Gates	RD 108
Knights Landing Ridge cut channel and right- and left-bank levees	Knights Landing Ridge Drainage District
Middle Creek and Tributaries Project	Lake County Watershed Protection District
Willow Slough diversion weir, right- and left-bank levees to confluence with Yolo Bypass	DWR – Sac Yard

Table 5-1. Local Maintaining Agencies for State Plan of Flood Control Facilities (Contd.)

State Plan of Flood Control Facility	Local Maintaining Agency
South Fork Putah Creek Preserve Restoration	TBD
Yolo Bypass right-bank levee from Fremont Weir to Knights Landing Ridge Cut	TBD
Yolo Bypass left-bank levee from Knights Landing Ridge Cut to Cache Creek Settling Basin	RD 1600
Yolo Bypass right-bank levee from Cache Creek to Sacramento Bypass	RD 2035
Yolo Bypass left-bank levee from Cache Creek to Sacramento Bypass	RD 785, RD 827, RD 2035
Yolo Bypass right-bank levee from Sacramento Bypass to Putah Creek	RD 2068 to RD 536, RD 2060
Yolo Basin Wetlands	TBD
Yolo Bypass right-bank levee from Putah Creek to Sacramento River	RD 536, RD 2060
Yolo Bypass left-bank levee from Putah Creek to Sacramento River	RD 501, RD 999
Ash Creek and Dry Creek channel clearing	Adin Community Services District
Salt Creek channel clearing, upstream from Sacramento River confluence	Tehama County Flood Control and Water Conservation District
Elder Creek channel clearing and left-bank levee upstream from Sacramento River confluence	Tehama County Flood Control and Water Conservation District
McClure Creek channel clearing near Highway 99	Tehama County Flood Control and Water Conservation District
Deer Creek channel clearing and right and left-bank levees upstream from Delany Slough to Sacramento River	Tehama County
Big Chico/Sandy Gulch (Lindo Channel) left-bank levee and Big Chico Creek Gates, Lindo Channel Gates, and Sycamore weir diversion structures	Butte County Public Works
Big Chico/Sandy Gulch (Lindo Channel) channel maintenance	Butte County Public Works
Sycamore, Sheep Hollow and Mud Creeks right- and left-bank levees	Butte County Public Works
Sacramento River right-bank levee from Ord Ferry to Moulton Weir	LD 1 (Glen County), LD 2
Sacramento River left-bank levee from Ord Ferry to Moulton Weir	LD 3
Sacramento River left-bank levee from Moulton Weir to Colusa Weir	LD 3
Sacramento River left-bank levee from Colusa Weir to Tisdale Weir	RD 70, RD 1660

Table 5-1. Local Maintaining Agencies for State Plan of Flood Control Facilities (Contd.)

State Plan of Flood Control Facility	Local Maintaining Agency
Sacramento River right-bank levee from Fremont Weir to Sacramento Weir	RD 1600, RD 827
Sacramento River left-bank levee from Fremont Weir to Sacramento Weir	RD 1000
East Side Canal and Natomas Cross Canal right-bank levee	RD 1001
Pleasant Grove Canal and Natomas Cross Canal left-bank levee	RD 1000
Sacramento River left-bank levee from Sacramento Weir to American River confluence	RD 537
Sacramento River right-bank levee from American River to Elk Slough	MA 4, RD 307, RD 537, RD 900, RD 765, RD 999
Sacramento River left-bank levee from American River to Elk Slough	American River Flood Control District, MA 9
Sacramento River right-bank levee from Elk Slough to Collinsville	RD 3, RD 150, RD 349
Sacramento River left-bank levee from Elk Slough to Collinsville	RD 369, RD 407, RD 551, RD 554, RD 556, RD 755, Brannan Andrus Levee District
Elk Slough right- and left-bank levees	RD 150, RD 999
Sutter Slough right- and left-bank levees	RD 349, RD 999
Miner Slough right- and left-bank levees	RD 501, RD 999
Steamboat Slough right- and left-bank levees	RD 3, RD 349, RD 501
Georgiana Slough right- and left-bank levees	RD 556, RD 563, Brannan Andrus Levee District
Three Mile Slough right- and left-bank levees	RD 341, RD 1601
Chowchilla and Eastside Bypass right- and left-bank levees	Lower San Joaquin Levee District
Castle Dam	Merced Irrigation District

Key:
LD = levee district
RD = reclamation district
TBD = to be determined
WPRR = Western Pacific Railroad

Sixty LMAs perform maintenance for the SRFCP. Twenty-nine LMAs perform maintenance for the SPFC in the San Joaquin River Basin. AB 156 (Laird, 2007), Local Agency Annual Report 2008 (DWR, 2008a), provides maps and available reports for each entity (see reference DVD).

LMA Responsibility in California Water Code 8370

The LMAs are responsible for maintaining facilities not included in the section on State responsibility in CWC 8361. CWC 8370 specifies responsibilities of the LMAs:

> *8370. It is the responsibility, liability and duty of the reclamation districts, levee districts, protection districts, drainage districts, municipalities, and other public agencies within the Sacramento River Flood Control Project limits, to maintain and operate the works of the project within the boundaries or jurisdiction of such agencies, excepting only those works enumerated in Section 8361 and those for which provision for maintenance and operation is made by Federal law.*

Local Reporting Requirements

An example of the evolving nature of the SPFC is the additions to the CWC resulting from the adoption of AB 156 (Laird, 2007), Flood Control. AB 156 was enacted during the 2007-2008 legislative session. Additions to the CWC include requirements for LMAs to submit to DWR, by September 30 of each year, specific information relative to the project levees they operate and maintain. In turn, DWR is required to summarize this information in an annual report to the Board by December 30 of each year.

Required information includes the following:

- Information known to the LMA that is relevant to the condition or performance of a project levee.
- Information identifying known conditions that might impair or compromise the level of flood protection provided by a project levee.
- Summary of maintenance performed by the LMA during the previous fiscal year.
- Statement of work and estimated cost for O&M of a project levee for the current fiscal year.
- Any other readily available information contained in records of the LMA relevant to the condition or performance of a project levee.

5.5 Operations

The standard O&M manuals and unit-specific O&M manuals specify necessary operations during high water. In most cases for levees, the operation is limited to patrolling at specified river stages and floodfighting, as necessary. Other facilities, such as pumping plants, control structures, and the Sacramento Weir, require more active operations.

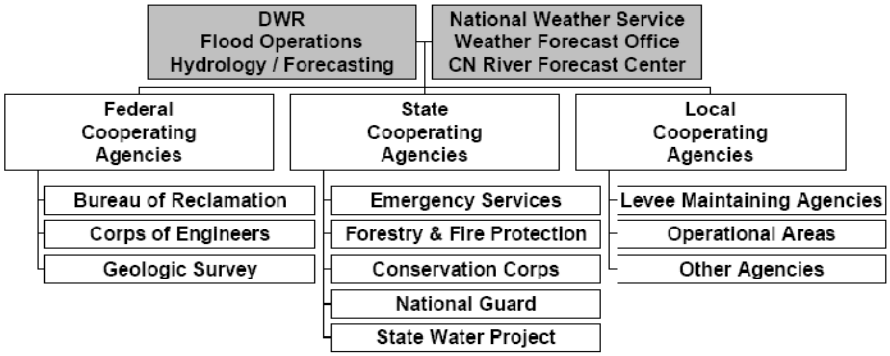
5.5.1 Stream Gages

Gages for stream stage and flow are essential to successful operation of SPFC facilities. Most unit-specific O&M manuals include specific stream gages (called hydrographic facilities in most manuals). The condition or existence of these gages may have changed over time, evolving to the set of stream gages, precipitation stations, snow accumulation stations, and other tools used by the State-federal Flood Operations Center (FOC) (see Section 5.5.2) during flood operations. These tools and historical records can be found on the California Data Exchange Center (CDEC) Web site: http://cdec.water.ca.gov/. These represent base data that may be revised after analysis. Data for DWR-maintained gages can be found on DWR's Water Data Library Web site: http://www.water.ca.gov/waterdatalibrary/ and data for U.S. Geological Survey (USGS)-maintained gages can be found on the USGS Web site: http://waterdata.usgs.gov/ca/nwis/rt.

5.5.2 State-Federal Flood Operations Center

The FOC, located in Sacramento, California, is a component of the Flood Operations Branch of DWR's Division of Flood Management. While not specifically for the SPFC, actions of the FOC are essential for SPFC operations.

As major storm systems approach California, forecasters from the National Weather Service (NWS) and DWR forecast the location, amount, and timing of expected precipitation, make river forecasts, and prepare emergency notifications. In addition to the NWS, many agencies cooperate with DWR during flood emergencies and some send representatives to work at the FOC. Figure 5-3 provides an overview of local, State, and federal cooperating agencies with co-located agencies depicted by shaded boxes.



Key:
CN = California-Nevada
DWR = California Department of Water Resources

Figure 5-3. Cooperating Agencies in State-Federal Flood Operations Center

5.5.3 High-Water Levee Patrols

Each unit-specific O&M manual provides information on required high-water patrols, generally keyed to water stages at stream gages. These patrols are performed by LMAs beginning at river stages specified in the unit-specific O&M manuals.

5.5.4 Flood Fights

Each of the standard O&M manuals contains methods for combating floods.

5.5.5 Facilities Requiring Active Operations

The following SPFC facilities require active operation by DWR or local agencies. The procedures for operation are included in the unit-specific O&M manuals.

Pumping Plants

The following SPFC pumping plants require active operation:

- Two pumping plants along the American River (see O&M Manual SAC518)
- Magpie Creek
- Three pumping plants along the Sutter Bypass (see O&M Manual SAC159)
- Pumping plant along the lower San Joaquin River between the Merced and Tuoloume rivers (see O&M Manual SJR6A)

- Pumping plant along the lower San Joaquin River between Paradise Cut and Old River (see O&M Manual SJR3A)

- Three pumping plants along the Mormon Slough Diversion Channel (see O&M Manual SJR611.2)

Weirs

Two SPFC weirs require operation to release flow:

- Howard Slough Diversion (see O&M Manual 153)

- Sacramento Weir (see O&M Manual 158)

Dams

Two SPFC dams control flow in the system:

- Oroville Dam on the Feather River (see Oroville Dam and Reservoir Report on Reservoir Regulation for Flood Control, Appendix IV, dated August 1970)

- Castle Creek Dam (see O&M Manual SJR607A)

Control Structures

Several SPFC water control structures require active manual operation:

- Sutter-Butte Canal Headgate (see O&M Manual SAC160)

- Butte Slough Outfall Gates (see O&M Manual SAC161)

- Knights Landing Outfall Gates (see O&M Manual SAC162)

- Lindo Channel and Big Chico Creek diversion gates (see O&M Manual SAC504)

- Chowchilla Bypass Control Structure (see O&M Manual SJR601B)

- San Joaquin River Control Structure (see O&M Manual SJR601B)

- Mariposa Bypass Control Structure (see O&M Manual SJR601A)

- Eastside Bypass Control Structure (see O&M Manual SJR601A)

- San Joaquin River Control Structure (see O&M Manual SJR601)

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6.0 SPFC Conditions

By providing assurances of cooperation to the federal government, the State has agreed to abide by the conditions, or terms, set forth in various federal documents.

6.1 Summary

Conditions that accompany a flood management project are generally in place before project development, but also continue to assure the safe O&M of project facilities in the long term. These conditions include assurances provided by State and local sponsors, federal flood control regulations, provisions of the standard and unit-specific O&M manuals, flood profiles that influence channel maintenance, and project cooperation agreements.

6.2 Assurances

State assurances to the federal government are a condition for federal participation in a flood management project. As mentioned in Section 1.3, at a minimum, the assurances include that the State provide without cost to the United States, all lands, easements, and rights-of-way necessary for completion of the project; bear the expense of necessary highway, railroad, and bridge alterations; hold and save the United States free from claims for damages resulting from construction of the works; and operate and maintain all works, after completion. Depending on when a facility was authorized (Congressional authorization) and constructed, there could be additional assurances.

Similarly, local project sponsors provide assurances to the State.

6.3 Federal Flood Control Regulations

Nonfederal sponsors abiding by the federal flood control regulations are a condition for federal projects. Federal flood control regulations are contained in 33 CFR Section 208. Federal requirements for O&M are contained in 33 CFR Section 208.10. The regulations apply to both State and LMA O&M of SPFC facilities.

6.4 Standard O&M Manuals

As mentioned in Section 5.2.1, the standard O&M manuals present requirements that apply to all maintaining agencies that operate and maintain the various geographical SPFC units. Fulfilling the requirements outlined in the standard O&M manuals is a condition for federal projects.

6.5 Unit-Specific O&M Manuals

As mentioned in Section 5.2.2, unit-specific O&M manuals supplement information included in the standard O&M manuals with O&M requirements applicable to each unit. Fulfilling the requirements outlined in the unit-specific O&M manuals is a condition for federal projects.

6.6 Design Profiles

USACE has prepared water elevation profiles based on design flows for both the Sacramento River and the San Joaquin River portions of the flood management system. Flood system improvements that have occurred subsequent to the 1950s are not reflected in the design profiles discussed below. The State operates SPFC facilities based on the 1957 and 1955 profiles rather than on design flows from the O&M manuals. The profiles are on the reference DVD included in this document or can be viewed on the Board Web site at http://recbd.ca.gov/profiles/index.cfm.

The Board uses designated floodways (see Section 2.4.3) as a management tool for passage of design flows shown by the 1957 and 1955 profiles described below.

It should be noted that the USACE now uses uncertainty analyses that no longer uses a single flow value for a river reach. This may require revisions to how the following flow profiles are used in the future.

6.6.1 1957 Profile

For the Sacramento River and tributaries, USACE requires that the channels pass the design flows at stages at or below the 1957 design profile. The reference DVD contains 1969 and 2006 letters from USACE to the Board with this directive (USACE, 1969 and 2006). The 1957 profile is shown in the *Sacramento River Flood Control Project, California, Levee and Channel Profiles* (USACE, 1957a) (re-created 2006). The profiles are contained on four sheets identified as File No. 50-10-3334. The profiles include the design flows at various locations throughout the system, and are listed in Table 3-1.

The profiles for the Middle Creek Project are shown in *Cache Creek Basin California, Middle Creek Project, Stream Profiles* (USACE, 1957b) on one sheet, File No. CC-4-20-16 (re-created 2006).

6.6.2 1955 Profile

For the San Joaquin River and tributaries, USACE requires that the channels pass the design flows at stages at or below the 1955 design profile. The 1955 profile for the Merced River and downstream is shown in the *San Joaquin River and Tributaries Project, California, Levee Profiles* (USACE, 1955). The profiles are contained on one sheet identified as Sheet SJ-20-60. The profiles do not include the design flows. Table 3-2 includes design capacities listed in the unit-specific O&M manuals.

The profiles for the Mormon Slough Project are shown on *Mormon Slough Project, San Joaquin County, Plan of Improvement, Profile and Flood Plane* on six sheets (USACE, 1965), File No. 3-20-142 (re-created 2006).

6.7 Project Cooperation Agreements

Project cooperation agreements specify other conditions that must be met by parties to the agreements. These project cooperation agreements have evolved over time, and are especially important before a new project is started.

6.7.1 Federal/State Project Cooperation Agreement

The project cooperation agreement between the Department of the Army and the State of California (The Reclamation Board or Central Valley Flood Protection Board, depending on the date of the agreement) is a contract for project development. While these vary by time and project, a project cooperation agreement contains specific contract provisions. Examples include the following:

- Obligations of both parties, including cost sharing amounts
- Compliance requirements for lands
- Project coordination
- Method of payment
- Dispute resolution
- Requirement for nonfederal operation, maintenance, repair, replacement, and rehabilitation

- Indemnification of the federal government
- Other contract terms

Upon completion of a project, USACE transfers the project to the State through a letter. The State sends USACE a letter that may accept the project as constructed or accept a portion of the project while other portions are completed.

6.7.2 State/Local Project Cooperation Agreement

The project cooperation agreement between the State of California (The Reclamation Board or Central Valley Flood Protection Board, depending on the date of the agreement) and the local sponsor is a contract for project development. Among many provisions, the agreement outlines specific conditions for the local sponsor to fulfill such as cost share, O&M, State hold harmless, and other conditions. Recent agreements have included requirements to participate in federal floodplain management and flood insurance programs, publicize floodplain information, and for the local sponsor to pay the total cost of betterments requested by the local sponsor.

After the State sends a letter of acceptance to USACE, the State sends a letter to the local sponsor transferring project responsibility for O&M, repair, replacement, and rehabilitation of project facilities and related features.

6.8 State-Adopted Conditions

Successful operation of the SPFC requires many other conditions that do not meet the strict definition of the SPFC provided by the Legislature (see Section 1.1). One of the most important conditions for operation of the SPFC is that the upstream reservoirs operate in compliance with the flood storage rules established by USACE. Except for Oroville Dam (see Section 3.2.1) and Castle Dam (see Section 3.3.1), the State has no direct responsibility for operation or maintenance for flood control reservoirs that regulate flow to the SPFC – federal agencies and local agencies are responsible for their operation. Similarly, the State has no direct operational responsibility for many of the other non-SPFC facilities. The State has, however, adopted two important conditions that it believes are essential to success of the SPFC, namely its designated floodway program and regulation of overflow to the Butte Basin.

6.8.1 Designated Floodway Program

The Board considers its Designated Floodway Program (see Section 2.4.3) as a condition for successful operation of the SPFC. Where implemented, the program is important and necessary in helping to limit further development into the active floodways. The program is also considered necessary to help provide for the passage of project design flows (see Section 6.6) along many reaches of the SPFC system. As mentioned, Figure 2-3 shows the location of designated floodways within the Sacramento and San Joaquin river basins. Maps of designated floodways by county can also be found at the Board's Web site: http://recbd.ca.gov/maps/index.cfm.

6.8.2 Regulation of Overflow to Butte Basin

The Butte Basin has historically served as one of the natural overflow areas for the Sacramento River. Based on USACE design of the SRFCP levees downstream from Ord Ferry, Sacramento River overflow to the Butte Basin is an important condition (see Section 3.2.5) to maintain the effectiveness of the project. The USACE-designed levees downstream from Ord Ferry to carry 160,000 cfs, while the design capacity of the Sacramento River, just 10 miles upstream, is 260,000 cfs – an obvious reduction in flow capacity that requires outflow from the river.

In 1960, the USACE notified the Board about unauthorized private levees that were obstructing flow into the Butte Basin. The USACE advised the Board that if the Board did not take action to alleviate the hazardous conditions by removing the unauthorized private levees, the USACE would advise Congress that the State was not fulfilling its obligations (Resources Agency, 1964). The USACE suggested that such action may bring federal enforcement and endanger all flood control appropriations for California. This notification by USACE suggests that the USACE believed that maintenance of the flow capacity of the overflow area was necessary for the State to fulfill its assurances to the federal government to operate and maintain the SRFCP.

The State prepared the Master Plan for Flood Control in the Butte Basin (Resources Agency, 1964), ordered the unauthorized private levees to be degraded, and included regulation of overflow to the Butte Basin in 23 CCR (see http://recbd.ca.gov/regulations/CCRTitle23WatersDiv1.pdf). The standards for the Butte Basin are contained in Section 135, Division 1, 23 CCR. In general, these standards require approval from the Board for any encroachment that could reduce or impede flood flows, or would reclaim any of the floodplain within the Butte Basin.

The Board has flowage easements over all flooded areas in the Butte Basin. The Board considers the regulation of flow to the Butte Basin as a condition for successful operation of the SPFC.

7.0 Programs and Plans Related to the SPFC

To complete the description of the SPFC, a presentation of its related programs and plans is necessary. These programs and plans also include the responsible oversight and management of the flood system. As additional programs and plans related to the SPFC are developed in the future, information will be incorporated into updates to the FCSSR as necessary, and not in updates to this document.

7.1 Summary

Program and plans for the SPFC are both historical and ongoing. Historical documents include the authorizing federal legislation, as-constructed documents, and O&M manuals. DWR, the Board, and USACE are the main partners in SPFC oversight and management. Ongoing and future programs to improve flood management include the FloodSAFE California (FloodSAFE) initiative, the California Levee Roundtable, the FCSSR, CVFPP, and California Water Plan. In addition, regional entities are working on plans to improve local portions of the SPFC.

7.2 State Oversight and Management of SPFC

The Board is the State agency responsible for the State-federal flood management project in the SPFC Planning Area. DWR serves as the primary technical resource to the CVFPP through DWR's Division of Flood Management. Other State agencies assist the Board and DWR.

7.2.1 Central Valley Flood Protection Board

Following is the mission of the Board[2]:

- To control flooding along the Sacramento and San Joaquin rivers and their tributaries in cooperation with USACE.

[2] The Central Valley Flood Protection Board was formerly known as The Reclamation Board. Correspondence, O&M manuals, and other documents prepared before mid-2007 are cited as from The Reclamation Board.

- To cooperate with various agencies of local, State, and federal governments in establishing, planning, constructing, operating, and maintaining flood control works.

- To maintain the integrity of the existing flood control system and designated floodways through the Board's regulatory authority by issuing permits for encroachments.

The Board requires permits for any project that may affect how the existing flood system functions. A permit is required for any project or plan of work that meets the following criteria:

- Is within federal flood control project levees and within a Board easement.

- May have an effect on the flood control functions of project levees.

- Is within a Board-designated floodway.

- Is within regulated Central Valley streams listed in Table 8.1, Title 23, CCR.

These projects include any project that proposes to work in a regulated stream, designated floodway on federal flood management project levee slopes, within 10 feet of a levee toe, or in a location that may have an effect on the flood control facilities. Examples of activities might include, but are not limited to, boat docks, ramps, bridges, sand and gravel mining, placement of fill, fences, and landscaping and irrigation facilities. Streams regulated by the Board are listed in Table 8.1, Title 23, CCR.

With this responsibility, the Board issues encroachment permits when encroachment will not affect O&M of the flood management system. The Board also approves or adopts the flood-related technical work prepared by DWR or other agencies.

7.2.2 Department of Water Resources

DWR’s Division of Flood Management provides technical support to the Board and is responsible for most of the work related to the flood management system. Other DWR divisions, such as the Division of Engineering, provide technical support. Examples of work performed by the Division of Flood Management include the following:

- Developed and maintain the CLD

- Emergency preparedness, response, and recovery planning and action

- O&M, including inspections
- Floodplain management, planning, and delineation
- Flood project funding and grants
- Evaluation and engineering for flood project improvements
- Systemwide planning and analysis

DWR's FloodSAFE initiative will guide improvements of the flood management system in the Sacramento and San Joaquin valleys over the next 20-plus years.

7.2.3 California Department of Fish and Game

The California Department of Fish and Game (DFG) assists DWR in its environmental stewardship responsibilities, including the following:

- Providing input on mitigation strategies, including banking opportunities and possible partnerships
- Identifying specific habitat and species restoration and enhancement opportunities
- Providing input on modeling for impact assessment
- Providing input on and reviewing environmental documentation under the California Environmental Quality Act (CEQA)
- Permitting under California Endangered Species Act and DFG Code 1600 for implementation of FloodSAFE projects

7.2.4 Other Assisting State Agencies

Several other State agencies assist the Board and DWR in their management and oversight of the SPFC:

- The California Emergency Management Agency (CALEMA)
- California Building Standards Commission

7.3 Federal Oversight and Management of SPFC

Federal agencies are partners with State agencies in oversight and management of the SPFC.

7.3.1 U.S. Army Corps of Engineers

USACE is the nation's flood control agency. The USACE Sacramento District is the district directly involved with the SPFC and in assisting DWR with studies, analyses, and overall project implementation. USACE has prepared O&M manuals that guide O&M of the various SPFC units.

Public Law 84-99 Rehabilitation Assistance of Flood Control Works

Federal and nonfederal flood control works in the Rehabilitation and Inspection Program (RIP) damaged by floods may be repaired at up to 100% federal cost for federal projects. For nonfederal projects, the repairs are cost shared at 80% federal and 20% nonfederal sponsor. To be eligible for these repairs, the projects must be in "Active" status and the assistance is limited to restoration of pre-disaster condition and level of protection. Any deferred maintenance is the responsibility of the sponsor. The intent of the program is to ensure that damaged flood control works are operationally effective before the next flood season. See ER 500-1-1 and EP 500-1-1 for details.

Eligible projects must have an overall system rating of Acceptable or Minimally Acceptable. A Minimally Acceptable project must have deficiencies corrected within 2 years. An Unacceptable system is inactive in the RIP, and the status will remain inactive until the sponsor submits proof that all items rated Unacceptable have been corrected. Inactive systems are ineligible for rehabilitation assistance.

Part of the assurances that the State provided to the federal government is that the State will maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army. Title 33 CFR, Chapter II Corps of Engineers, Part 208, prescribes flood control regulations that the SPFC must follow. In addition, USACE headquarters in Washington, D.C., prepares, and periodically updates, policies, standards, and guidance documents on special flood-related subjects.

The State inspects levees maintained by many separate local agencies, and then reports findings of the inspections to USACE, which performs quality assurance (QA) work. From the inspection information submitted, USACE may choose to conduct follow-up inspections in certain areas. USACE uses its own follow-up inspections and the State's inspection findings to make Public Law 84-99 eligibility determinations for each local agency.

USACE provides the following other assistance:

- Assists in statewide and regional planning efforts
- Cooperates in project development, including providing authorized federal cost-sharing, crediting, and reimbursement
- Applies existing federal programs such as the Sacramento River Bank Protection and Public Law 84-99 programs
- Inspects and coordinates inspection of completed works and rehabilitation to ensure compliance with regulations and O&M manual requirements to maintain active status for Public Law 84-99

- Regulates projects with regard to Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act

- Reviews and, as necessary, modifies reservoir water control manuals for improved flood management, including consideration of climate change

- Certifies levees that meet design criteria and assists in levee certification process

- Maintains current O&M manuals for each construction unit of the project

7.3.2 Federal Emergency Management Agency

The Federal Emergency Management Agency (FEMA) assists DWR with floodplain issues in the following ways:

- Produces digital flood hazard data, provides access to flood hazard data and maps via the Internet, and Map Modernization Program. DWR is a FEMA Cooperating Technical Partner for floodplain mapping.

- Continues partnership with DWR to provide accurate flood hazard maps, develops and maintains a GIS database of California levees and flood management structures, provides technical outreach to communities and citizens on floodplain management issues, and supports the National Flood Insurance Program (NFIP).

- Provides other services, including levee accreditation.

7.3.3 National Weather Service

NWS and the River Forecast Center work with DWR on technical studies, flood forecasting and warning, and related activities. NWS is a co-lead agency with DWR in the FOC.

7.3.4 Other Assisting Federal Agencies

Several other federal agencies assist the Board and DWR in their management and oversight of the SPFC:

- U.S. Department of the Interior, Bureau of Reclamation
- U.S. Fish and Wildlife Service (USFWS)
- National Marine Fisheries Service (NMFS)

7.4 Authorizing Legislation

The authorizing federal legislation and supporting the USACE Chief of Engineers reports for each of the projects in the SPFC are summarized in Section 2.2.

7.5 As-Constructed Drawings

As-constructed drawings are on file with USACE Sacramento District for each unit of the SPFC, but some O&M manuals include as-constructed drawings. In general, these are large-sized drawings that are physically detached from the O&M manuals. These include original drawings prepared when a unit was accepted into the project and modifications, repairs, and other changes made since originally constructed. The drawings often include profiles along the project reach. The State has collected copies of the as-constructed drawings for preparation of electronic copies for its records.

In many cases within the SRFCP, levees and other facilities were originally constructed by local interests before a federally authorized project. In some cases, facilities met or exceeded project standards and were made part of the project by USACE without modification. In other cases, USACE repaired, enlarged, or otherwise modified these existing facilities to bring them to project standards, or USACE constructed new facilities.

8.0 SPFC Updates

This SPFC Descriptive Document is intended to describe what the SPFC is at a given time, and is not a plan for future modifications. However, as the ongoing FloodSAFE initiative makes changes in the SPFC, updates to this SPFC Descriptive Document will be necessary. DWR will prepare future updates when requested by the Board.

8.1 Summary

No specific schedule has been set for preparing updates to this SPFC Descriptive Document. However, several ongoing activities will likely lead to making improvements to existing SPFC facilities, adding new facilities to the SPFC, and potentially physically, or in name, removing existing facilities from the SPFC.

FloodSAFE is DWR's overall initiative for integrated flood management throughout California. The FloodSAFE Implementation Plan describes the work that needs to be accomplished to make flood system improvements (DWR, 2009b). The SPFC is a major focus of this work.

DWR's management works closely with managers from other local, State, and federal agencies. The California Levees Roundtable (Roundtable) provides a venue for agencies to cooperatively address the multiagency issues facing the flood management system.

FCSSR provides information on physical deficiencies and recommendations for improving performance of the flood management system, including the SPFC, in the Sacramento and San Joaquin valleys.

The CVFPP, which will cover the entire flood system including the SPFC, will be a sustainable, integrated flood management plan describing existing flood risk in the Central Valley, and will recommend actions to reduce the probability and consequences of flooding. The CVFPP will rely on information from the FCSSR and from ongoing evaluations. The first issue of the CVFPP is due in 2012, with updates every 5 years.

8.2 FloodSAFE Implementation Plan

FloodSAFE, a statewide multifaceted initiative to improve public safety through integrated flood management, builds on the State's ongoing flood management work.

8.2.1 FloodSAFE Definition

FloodSAFE is an initiative to improve integrated flood management in California through a systemwide approach, while reducing flood risk at the local and regional level. Flood management improvements will, therefore, be achieved through three processes:

1. Improve basic flood management functions, including flood emergency response, O&M of flood management facilities, management of floodplains, repair of erosion sites, and implementation of local projects.

2. Implement regional projects to reduce flood risks including "early implementation projects" and implementation of USACE projects.

3. Implement a systemwide approach in which broad system evaluation is conducted (i.e., map floodplains and evaluate levee conditions throughout the system) to determine flood system deficiencies and define feasible projects/programs to remedy system deficiencies by developing a comprehensive systemwide flood protection plan for the Central Valley (i.e., CVFPP).

8.2.2 Implementation Plan

The FloodSAFE Implementation Plan (DWR, 2009b) defines authorities, responsibilities, timelines, budgets, priorities, and expected outcomes of flood management programs as they are currently known. The implementation plan was prepared at a strategic level of detail to describe the overall objectives of the FloodSAFE initiative and how the work will be accomplished in seven functional areas to achieve these objectives. The seven functional areas describe the type of work being done, rather than organizational structure within the Division of Flood Management.

The implementation plan focuses on flood management work required over approximately the next 5 years, but also provides long-term direction to 2025 and beyond. Much of this work is directly related to improving the SPFC. The seven functional areas are as follows:

1. Emergency response.
2. O&M.

3. Floodplain risk management.
4. Flood protection projects and project grants.
5. Evaluation and engineering.
6. System flood management planning.
7. Legislation, budget, and communication.

8.3 California Levees Roundtable

The Roundtable was created through an effort by officials at the Board following the successful Levee Vegetation Science Conference organized by SAFCA, DWR, and USACE in August 2007. The Roundtable is composed of senior-level officials representing USACE from Headquarters, the South Pacific Division, and the Sacramento District; the Board, DWR, NMFS, USFWS, DFG, RD 2068, and SAFCA. The Roundtable agencies worked together to prepare a short-term framework, the California's Central Valley Flood System Improvement Framework (California Levees Roundtable, 2009), for flood system improvements that are already underway or will be initiated before a comprehensive plan is ready in 2012. The report was adopted by the Board.

The Roundtable continues to meet at the management level to cooperatively address the multiagency issues facing the flood management system.

8.4 Flood Control System Status Report

In 2007, the State Legislature authorized DWR, in Section 9120 of the CWC, to prepare a FCSSR for the SPFC, which is to provide a complete description and analysis of the SPFC, identification of evident deficiencies, and recommendations for improving the performance of the system.

Section 9120 of the CWC states the following:

> *§9120. (a) The department shall prepare and the board shall adopt a flood control system status report for the State Plan of Flood Control. This status report shall be updated periodically, as determined by the board. For the purpose of preparing the report, the department shall inspect the project levees and review available information to ascertain whether there are evident deficiencies.*
>
> *(b) The status report shall include identification and description of each facility, an estimate of the risk of levee*

> *failure, a discussion of the inspection and review undertaken pursuant to subdivision (a), and appropriate recommendations regarding the levees and future work activities.*
>
> *(c) On or before December 31, 2008, the board shall advise the Legislature, in writing, as to the board's schedule of implementation of this section.*

The FCSSR contains information on the current condition of the SPFC.

8.5 Central Valley Flood Protection Plan

The CVFPP will be a sustainable, integrated flood management plan describing existing flood risk in the Systemwide Planning Area and recommending actions to reduce the probability and consequences of flooding. The CVFPP will include the entire flood management system of which the SPFC is a part. The CVFPP will also identify mutual goals, objectives, and constraints important in the planning process; distinguish plan elements that address mutual flood risks; and recommend improvements to the State-federal flood management system.

As the initial installment of this long-term planning document, the 2012 CVFPP will accomplish the following:

- Document and promote understanding of integrated flood management factors, including existing conditions and likely future challenges, problems, and opportunities, goals and objectives, and potential solutions for improving integrated flood management in the Sacramento-San Joaquin valleys. These factors will be described from multiple perspectives, including local, regional, State, federal, tribal, and other interest-based groups.

- Develop a broadly supported vision for how to improve integrated flood management in the Sacramento-San Joaquin valleys.

The CVFPP will support and guide many implementation activities by local, State, and federal agencies for subsequent feasibility studies, environmental compliance, design, and construction. Development of the CVFPP will be coordinated closely with USACE's Central Valley Integrated Flood Management Study.

The CVFPP will be a sustainable, integrated flood management plan that DWR is required to prepare by January 1, 2012, for adoption by the Board by July 1, 2012. The CVFPP will be a descriptive document and will reflect

a systemwide approach to protecting areas of the Systemwide Planning Area currently receiving protection from flooding by existing facilities of the SPFC. In addition, the CVFPP will include a prioritized list, schedule of implementation, and recommendations on both structural and nonstructural means for improving performance and eliminating deficiencies of flood management facilities, and addressing ecosystem and other water-related objectives. The CVFPP will be updated every 5 years (years ending in 7 and 2).

8.6 Ongoing Evaluations

As part of DWR's FloodSAFE initiative, work is underway by the Division of Flood Management on evaluation and engineering assessments of existing flood management facilities to identify deficiencies and needed improvements. Levee evaluations are being conducted for urban and nonurban areas with the rationale that urban and nonurban areas perform different functions and need to be evaluated under different standards.

8.6.1 Urban Levee Evaluations

One of the highest priorities of the FloodSAFE initiative is the evaluation of project levees protecting urban areas with populations greater than 10,000 residents. The Urban Levee Evaluations (ULE) will perform a geotechnical evaluation on approximately 350 miles of the State-federal levee system of the Sacramento and San Joaquin Flood Control Projects (project levees), focusing on levees protecting the approximate urban areas of Sutter Basin, Marysville, RD 784, Woodland, Natomas, West Sacramento, Davis, San Joaquin Area Flood Control Agency, RD 404, and RD 17. This project consists of geotechnical exploration, testing, and analysis required to evaluate the performance and safety of existing urban project levees, and prefeasibility designs and cost estimates for potential levee repairs where deficiencies are noted.

In general, most urban areas in the Sacramento and San Joaquin valleys currently provide less than the 200-year level of protection called for by legislation.

8.6.2 Non-Urban Levee Evaluations

DWR's Non-Urban Levee Evaluations (NULE) Project will evaluate more than 1,200 miles of nonurban State-federal project levees and approximately 400 miles of appurtenant nonurban nonproject levees to determine if they meet defined geotechnical criteria and, where needed, to identify remedial measures and develop corresponding cost estimates to meet those criteria.

Systemwide Modeling

DWR and USACE are evaluating hydrology and hydraulic information throughout the system to determine flood flows and elevations during different frequency flood events. A variety of other system evaluations will assist work to prepare the CVFPP.

Early Implementation Projects

Some communities have begun levee improvements to correct deficiencies before a comprehensive systemwide CVFPP analysis is completed. Modifications and improvements to the State-federal flood management system are typically accomplished through a partnership among the State, a local sponsor, and USACE. However, in recent years, USACE's budget for capital projects has not been sufficient for flood management system requirements, and necessary system modifications and improvements have not been initiated or have had their completion date severely delayed. To continue the forward progress of these much-needed projects, DWR is using Proposition 1E and 84 funding to direct funds, or competitively award Local Assistance funds, to local flood control agencies in a cost-sharing arrangement to advance projects ready to proceed.

Many of these improvements will eventually become part of the SPFC. The Board has indicated that it will give assurances in the future. From 2007 to 2009, Early Implementation Projects (EIP) have been identified and are in planning, design, construction, or are completed, including the following:

- Setback Levee at Star Bend on the Lower Feather River Right Bank (River Mile 18.0)
- Bear River North Levee Rehabilitation Project
- Natomas Cross Channel South Levee Project
- Feather River Levee Repair Project
- West Sacramento Area Flood Control Agency Project
- Sacramento River East Levee (SREL) and Pleasant Grove Creek Canal

Levee Repairs

Existing levees can have critical problems that could lead to failure during high-water events. Repair of these sites is needed regardless of other planned system improvements. Repairs can be made if the benefit/cost ratio is greater than 1. The Critical Levee Repair Program was established by DWR to carry out the critical levee repair work authorized by the 2006 Disaster Preparedness and Flood Prevention Bond Act. Certain levees have

already been identified as needing repair as a result of existing inspection programs and problems encountered during recent high-water events. Completed repairs are expected to correct deficiencies, including, but not limited to, underseepage, insufficient freeboard, unchecked erosion, and stability. This work will complete levee and erosion repairs begun under AB142 funding and correct deficient levees identified by other programs.

- **Levee Repairs** – Levee repairs can be made when urgent underseepage and slope instability problems exist in an existing levee. The work includes repairs of levee structural problems, exclusive of erosion repairs under the following component. Designs will be developed to repair basic levee deficiencies but not necessarily to increase levels of protection beyond the original levee design. This includes Levee Stability Repairs and Public Law 84-99, Rehabilitation Assistance.

- **Erosion Repairs** – This is an ongoing program that includes the Sacramento River Bank Protection Program and San Joaquin River Erosion Protection Program. Since 2006, the State has spent about $277 million for repairs to 102 sites. Approximately 161 additional Orders 2, 3, 4, and 5 damaged sites are eligible for repair and rehabilitation by USACE.

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9.0 Observations

Because this SPFC Descriptive Document is intended as a reference document for the existing SPFC, no recommendations for improvements are provided. However, during compilation of material for the document, some observations could be made to facilitate presentation of SPFC materials.

1. While SPFC property rights records are based on physically accessing information about a specific parcel of land, electronic access to that information and electronic representation would make the information more useful.

2. Easements along levee toes appear incomplete. A plan for securing missing easements, including access to various levee reaches, as part of the CVFPP, could improve long-term O&M of the SPFC.

3. Some of the bank protection sites along the Red Bluff to Chico Landing reach of the Sacramento River (O&M Manual SAC512) are no longer effective but are still part of the SPFC. These may be candidate features for removal from the SPFC.

4. Although the SRBPP is considered a part of the SPFC in this document, consideration may warrant not including the project in the future. This is because the intent of the SRBPP is to address ongoing erosion problems and may not qualify as a project within the definition of the SPFC.

5. While some O&M manuals include information on improvements and repairs since original construction, other O&M manuals may not be up to date and could benefit from this supplemental information.

6. There may be supplemental O&M manuals that have either not been located or have not been produced.

7. Unpermitted encroachments on SPFC facilities continue to be a problem.

8. Some projects like Salt Creek, McClure Creek, and Dry Creek at Adin currently meet the definition of the SPFC, but clearly perform no significant function to the major project features along the Sacramento River and perhaps should be removed from the SPFC.

9. On average, the flood management system has performed well, but it is not performing to current expectations primarily because of dated design standards, aging infrastructure, residual environmental needs, and floodplain land uses.

10. River mile numbers for the 1957 Profile for the SRFCP and other sources are not consistent (USACE, 1957a).

11. The State and LMAs may not have the necessary land rights to operate and maintain SPFC facilities as intended.

12. Design flows contained in O&M manuals are often different than design flows obtained from the 1957 profile. In addition, results from State, federal, and local agency studies indicate that actual flow capacities do not agree with either the O&M design capacities or 1957 design capacities in many cases.

13. The State operates SPFC facilities based on the 1957 and 1955 profiles rather than on design flows from the O&M manuals, but it is unknown if the Board ever officially adopted the profiles.

14. USACE use of uncertainty analysis may require revisions to how design capacities are used in maintenance of SPFC facilities.

15. The Butte Basin and the State's designated floodways are both necessary for the State to fulfill its obligation to maintain the project to pass design flows.

10.0 Acronyms and Abbreviations

AB	Assembly Bill
Board	The Reclamation Board or Central Valley Flood Protection Board
CALEMA	California Emergency Management Agency
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic foot per second
CLD	California Levee Database
CVFPP	Central Valley Flood Protection Plan
CWC	California Water Code
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DVD	digital versatile disc
DWR	California Department of Water Resources
EIP	Early Implementation Projects
EIS	Environmental Impact Statement
EM	Engineering Manual
ETL	Engineering Technical Letter
FCSSR	Flood Control System Status Report
FEMA	Federal Emergency Management Agency
FloodSAFE	FloodSAFE California initiative
FOC	Flood Operations Center
GIS	geographic information system
GRR	General Reevaluation Report
HD	U.S. House document
LIPL	local interest project levee
LMA	local maintaining agency
MOU	Memorandum of Understanding

NFIP .....National Flood Insurance Program
NGVD .....National Geodetic Vertical Datum
NMFS.....National Marine Fisheries Service
NULE .....Non-Urban Levee Evaluation
NWS .....National Weather Service
O&M .....operations and maintenance
PRC .....Public Resources Code
Proposition 1E .....Disaster Preparedness and Flood Prevention Act of 2006
QA .....quality assurance
RD .....Reclamation District
RIP.....Rehabilitation and Inspection Program
Roundtable .....California Levees Roundtable
SAFCA.....Sacramento Area Flood Control Agency
SD.....U.S. Senate document
SPFC .....State Plan of Flood Control
SRBPP .....Sacramento River Bank Protection Project
SREL .....Sacramento River East Levee
SRFCP.....Sacramento River Flood Control Project
SSJDD.....Sacramento-San Joaquin Drainage District
TRLIA .....Three Rivers Levee Improvement Authority
ULE.....Urban Levee Evaluation
USACE .....U.S. Army Corps of Engineers
USFWS.....U.S. Fish and Wildlife Service
USGS .....U.S. Geological Survey
WPRR.....Western Pacific Railroad
WRDA.....Water Resources Development Act

11.0 References

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Attachment A – State Plan of Flood Control Index and Location Maps

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Attachment A – State Plan of Flood Control Index and Location Maps

On the following pages are an index map and eight location maps that illustrate features of the State Plan of Flood Control (SPFC) and important related features in the Central Valley. Following the map showing Details 1A, IB and 1C are seven maps of SPFC facilities all at the same scale starting from the northern end of the Central Valley near Red Bluff and continuing south to the San Joaquin River near Gravelly Ford. In addition to showing levees and related SPFC features, these maps also show important non-SPFC levees as they are on the ground in a geographic coordinate system using Geographic Information System (GIS) data.

- Details 1A – 1C. Map of three outlying projects: North Fork Feather River Near Chester, Middle Creek, and Adin Channel Clearing.
- Detail 2. Sacramento River from Red Bluff to the Parrott Plug Relief Structure.
- Detail 3. Sacramento River from the Parrott Plug Relief Structure to the Tisdale Bypass, Sutter Bypass, Butte Overflow Basin, and the Feather River.
- Detail 4. Sacramento River from Tisdale Bypass to Elk Slough, the American River, and Yolo Bypass.
- Detail 5. Sacramento River from Elk Slough to Collinsville.
- Detail 6. San Joaquin River from Disappointment Slough to Old River.
- Detail 7. San Joaquin River from Old River to the Mariposa Bypass.
- Detail 8. San Joaquin River from the Mariposa Bypass to high ground near Gravelly Ford, and Eastside and Chowchilla bypasses.

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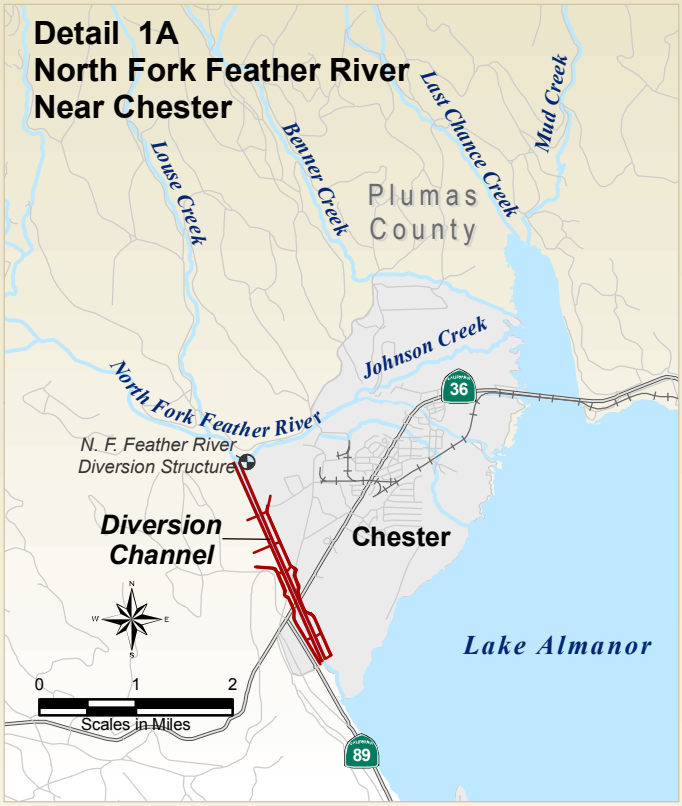
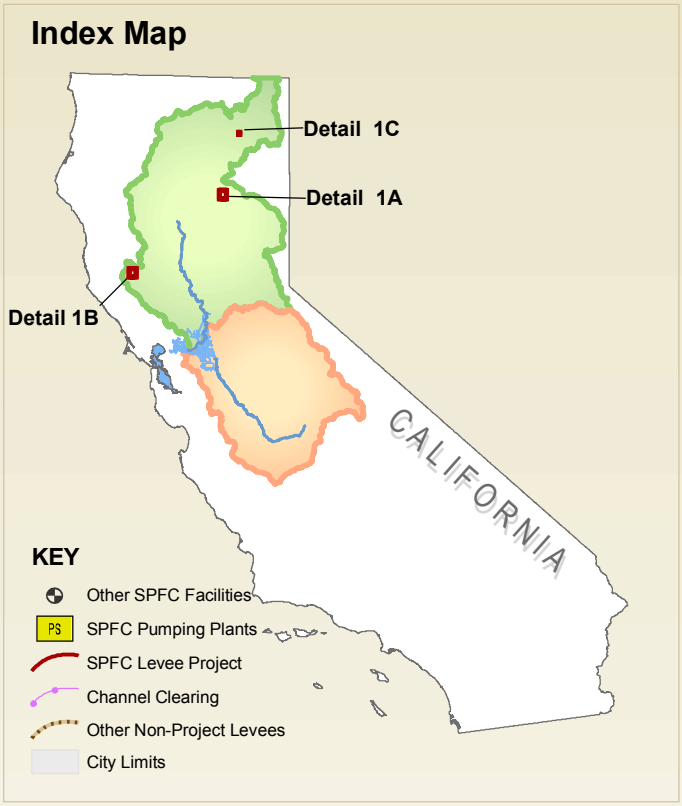
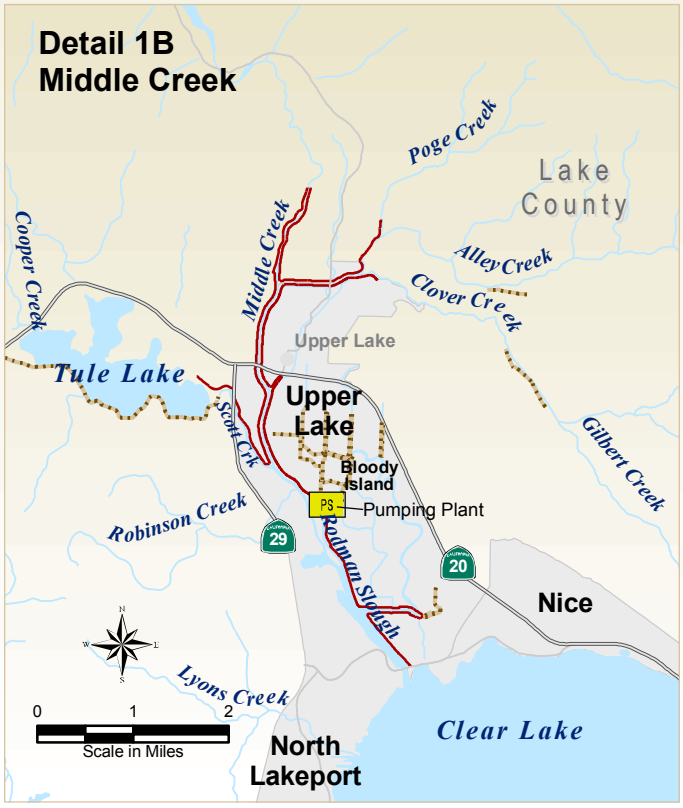
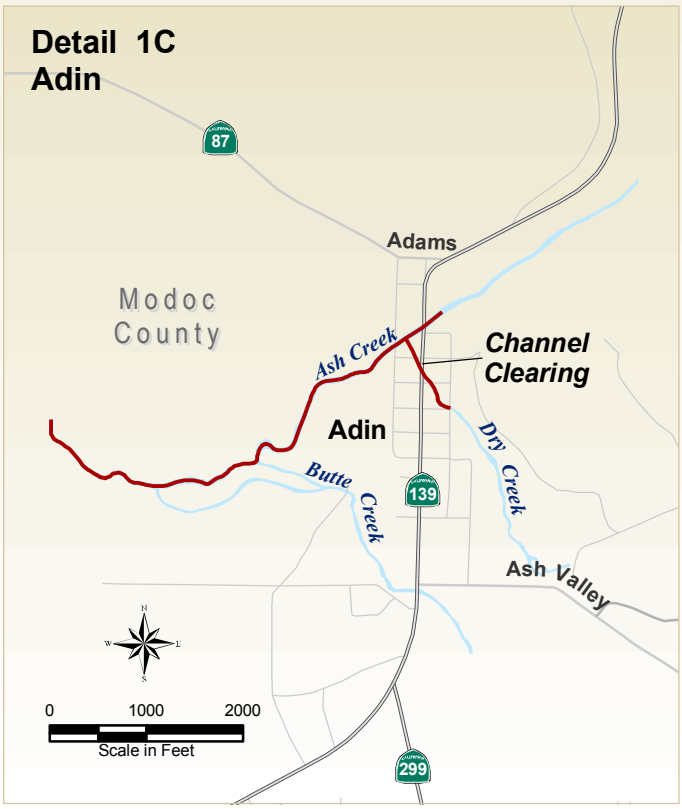
Index Map of the Sacramento and San Joaquin River Basins Showing the Areal Extents of Details 1A through 8

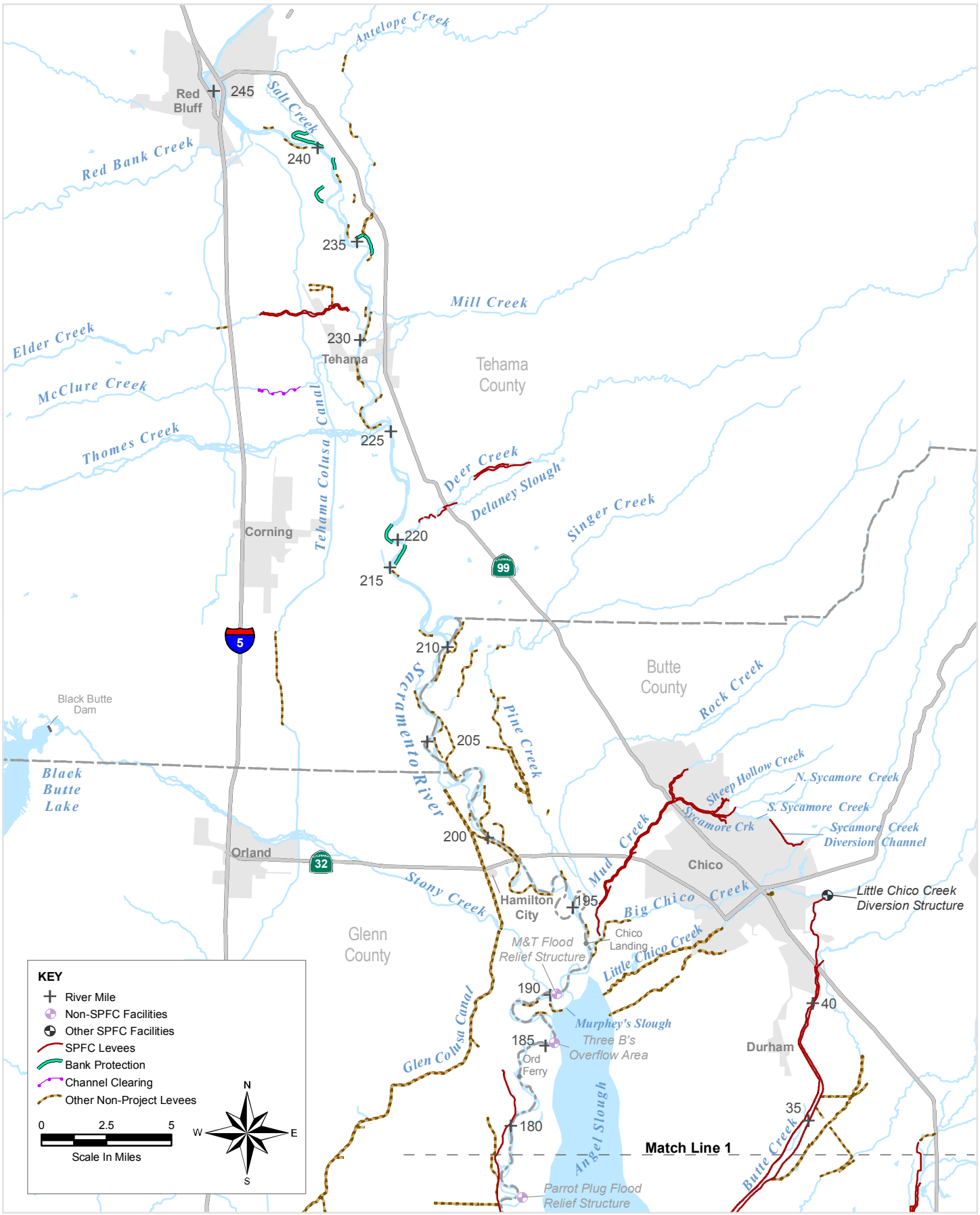




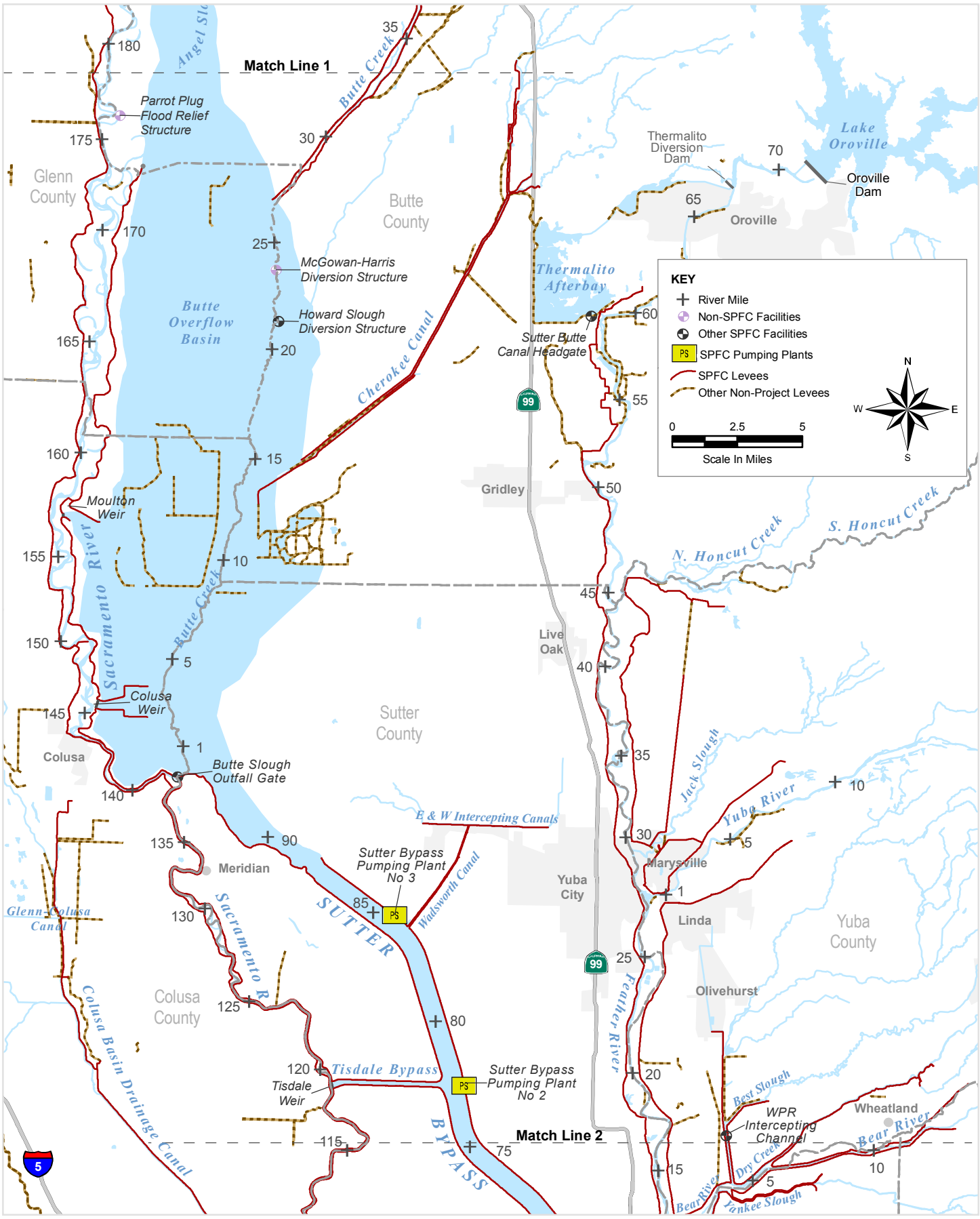




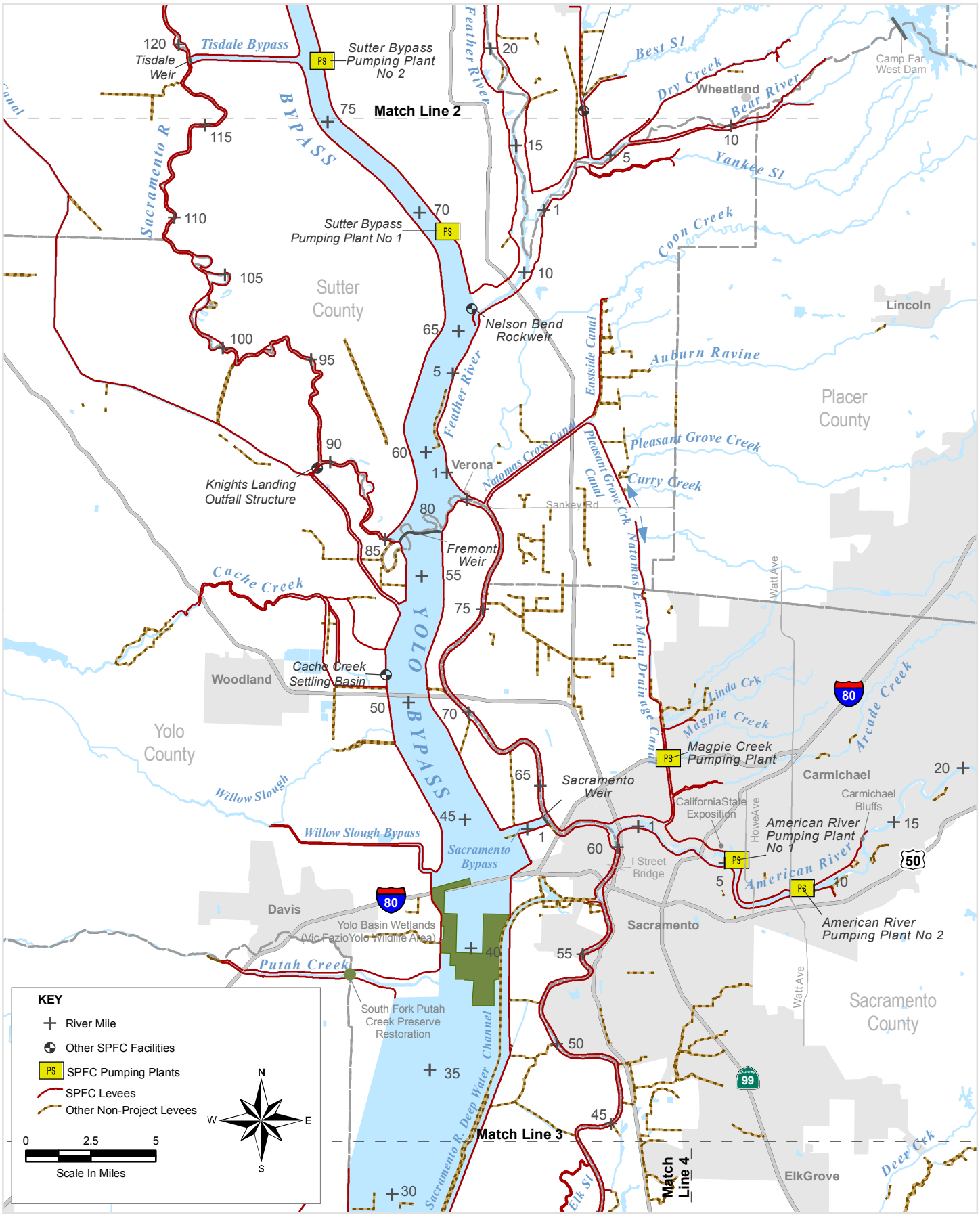
Details 1A – 1C. Map of three outlying projects, North Fork Feather River Near Chester, Middle Creek and Adin Channel Clearing.



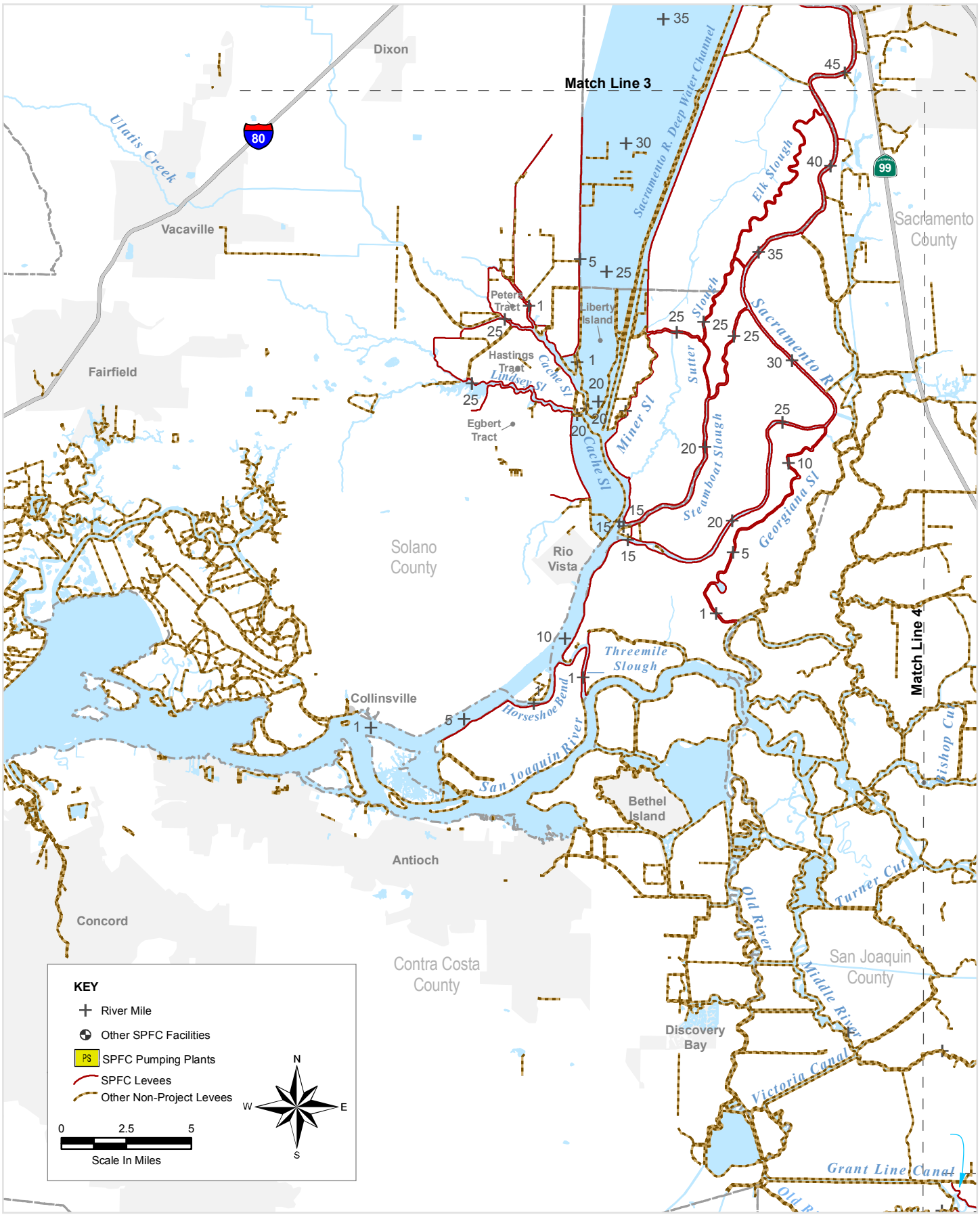
Detail 2. Sacramento River from Red Bluff to the Parrott Plug Relief Structure.



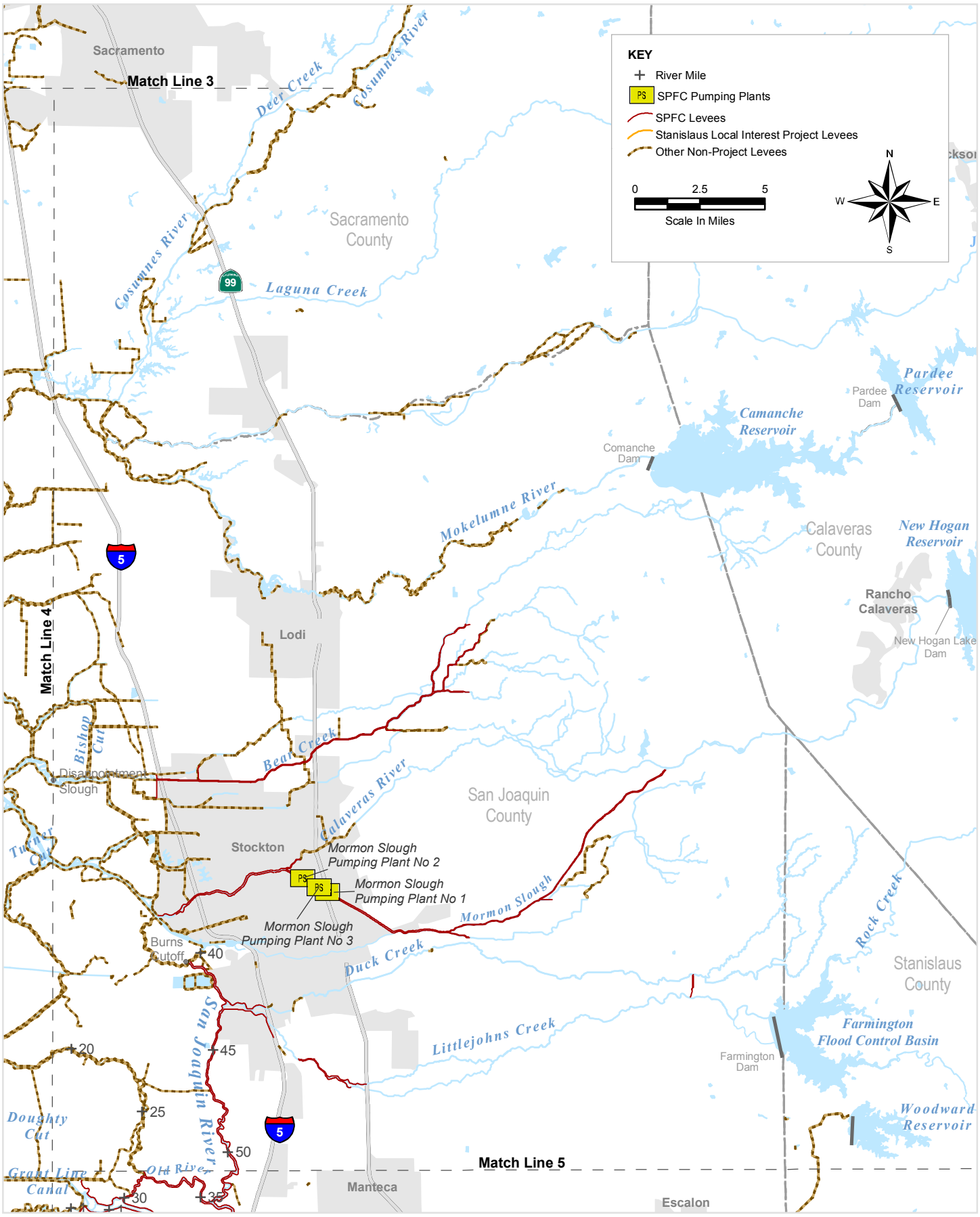
Detail 3. Sacramento River from the Parrott Plug Relief Structure to the Tisdale Bypass, Sutter Bypass, Butte Overflow Basin and the Feather River.



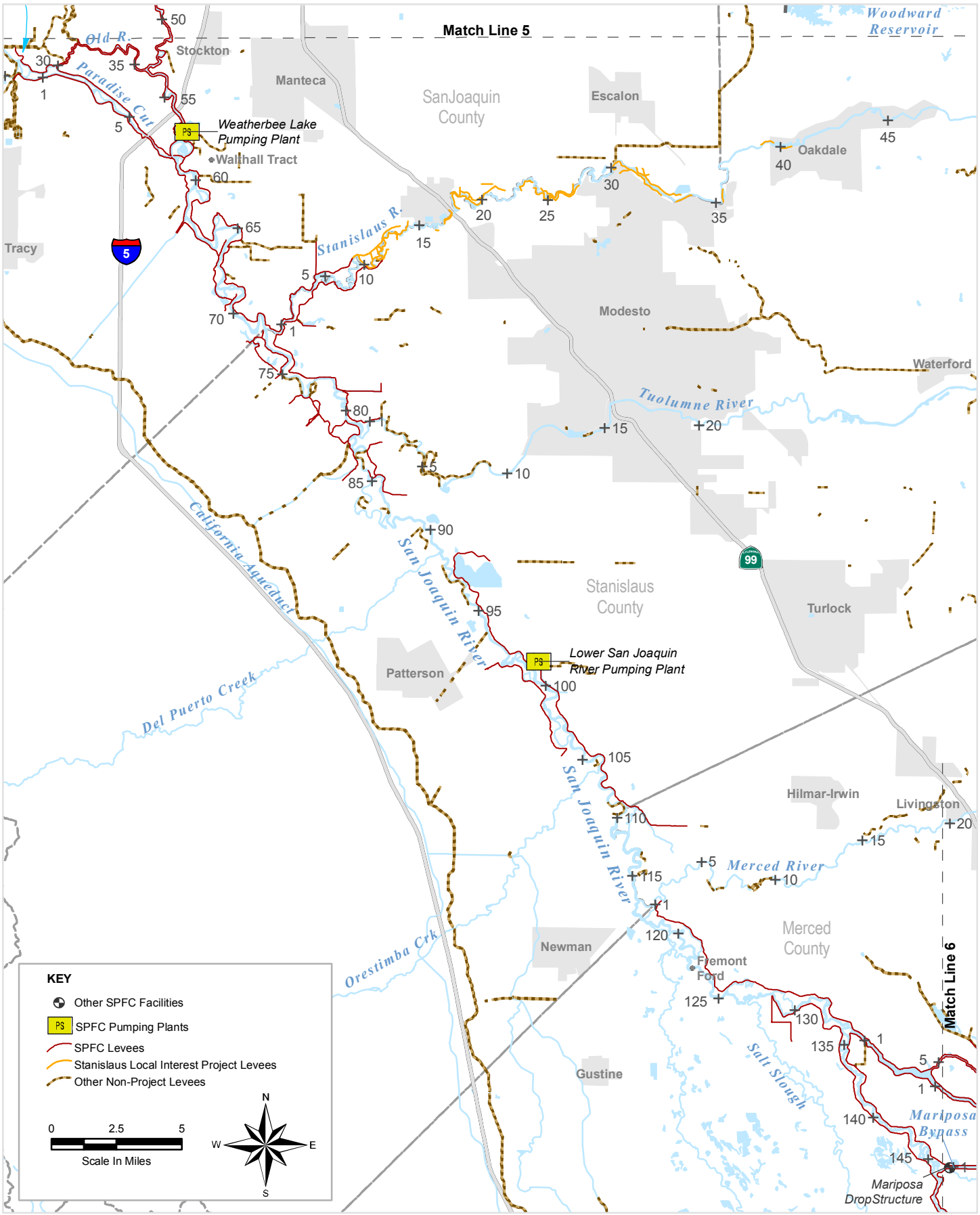
Detail 4. Sacramento River from Tisdale Bypass to Elk Slough, the American River and Yolo Bypass.



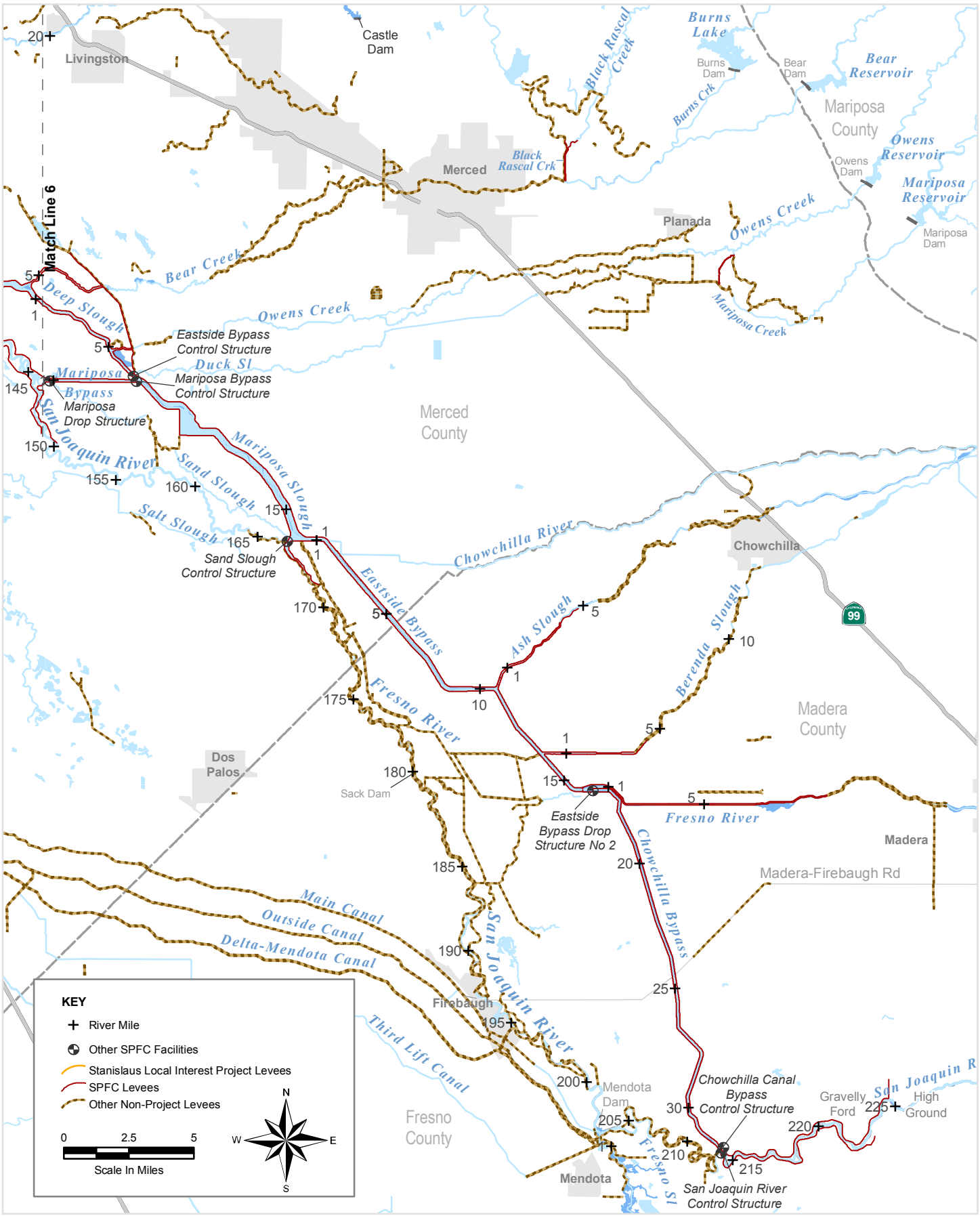
Detail 5. Sacramento River from Elk Slough to Collinsville.



Detail 6. San Joaquin River from Disappointment Slough to Old River.



Detail 7. San Joaquin River from Old River to the Mariposa Bypass.



Detail 8. San Joaquin River from the Mariposa Bypass to high ground near Gravelly Ford, Eastside and Chowchilla Bypasses.

Attachment B – SPFC Reference DVD

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Contents of Reference DVD

The 13 documents listed below are included on the reference DVD, which may be found on the following page. Items 1 and 7 are draft reports that have been prepared as part of the Central Valley Flood Management Planning Program. Item 4 is a collection of O&M manuals for SPFC facilities in the Sacramento and San Joaquin river basins. Item 5 is a collection of interactive maps that show the location of facilities and associated O&M manuals within the geographic areas displayed. The electronic file for an O&M manual can be opened by clicking on the O&M manual labels shown on the maps. Item 6 contains tables for each O&M manual that summarize, in tabular form, the contents of the O&M manuals. Items 8 through 12 contain information that served as the basis for design of the SPFC facilities.

1. Draft State Plan of Flood Control Descriptive Document.

2. Federal authorizations and supporting Chief of Engineers reports.

3. 1953 Memorandum of Understanding (USACE and The Reclamation Board, 1953) and Supplements.

4. Operations and maintenance (O&M) manuals (standard and unit-specific).

5. O&M manual map book.

6. O&M tables (summary of facilities and ancillary features).

7. Draft Technical Memorandum, Historical Reference Document for the State Plan of Flood Control (DWR, 2009a).

8. Cache Creek Basin California, Middle Creek Project, Stream Profiles (USACE, 1957b).

9. Sacramento River Flood Control Project, California, Levee and Channel Profiles (USACE, 1957a) also know as 1957 profile.

10. San Joaquin River and Tributaries Project, California, Levee Profiles (USACE, 1955).

11. Mormon Slough Project, San Joaquin County, Plan of Improvement, Profile and Flood Plane (USACE, 1965).

12. Sacramento River Flood Control System, Project Design Flows (form letter from A. Gomez to The Reclamation Board) (USACE, 1969).

13. 2006 letter from USACE to The Reclamation Board regarding allowable vegetation within floodways (USACE, 2006).

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