9. Flood Control and Management

9.1 Introduction

This chapter describes the flood hydrology, control, and management system in the Extended, Secondary, and Primary study areas, with particular focus on the Primary Study Area and Sacramento River Basin. Descriptions and maps of these three study areas are provided in Chapter 1 Introduction.

The regulatory setting for flood hydrology, control, and management is presented in Appendix 4A Environmental Compliance.

Based on the nature of the Project, potential impacts in the Secondary Study Area, particularly impacts related to the Sacramento River Flood Management System, are not expected and were, therefore, evaluated and discussed qualitatively. The portions of the Extended Study Area that are located outside of the Sites Reservoir Project (Project) flood control and management impacted areas were not evaluated or discussed. Potential local and regional impacts from constructing, operating, and maintaining the alternatives were described and compared to applicable significance thresholds.

9.2 Environmental Setting/Affected Environment

This section describes flood control and management facilities in the three study areas, with particular focus on the Primary Study Area (including local flood management facilities) and the Secondary Study Area (including the Sacramento River flood management system).

9.2.1 Extended Study Area

The Extended Study Area includes the entire statewide Central Valley Project (CVP) and State Water Project (SWP) service areas. This study area is extensive and includes hundreds, if not thousands, of federal, State, regional and local flood control and management facilities. This study area encompasses the CVP and SWP service areas outside of the greater Sacramento River Basin and south of the Sacramento-San Joaquin Delta. The only Extended Study Area reservoir included in Project operations modeling is San Luis Reservoir. However, San Luis Reservoir is operated entirely as a joint CVP and SWP supply storage reservoir and is not operated for flood control purposes. The portions of the Extended Study Area that are outside of the greater Sacramento River Basin, and south of the Sacramento-San Joaquin Delta, would also be outside of the affected environment for Project flood impacts, and are, therefore, not discussed.

9.2.2 Secondary Study Area

9.2.2.1 Sacramento River Flood Control and Management

The Sacramento River flood control and management system is a complex network of dams and reservoirs, levees, weirs, bypasses and other flood control features. A portion of this complex flood protection system includes State- and federally authorized projects for which the Central Valley Flood Protection Board (CVFPB), formerly known as the Reclamation Board, has provided assurances of cooperation to the federal government. This portion of the flood protection system is known as the State Plan of Flood Control (SPFC). A summary of features of the SPFC is provided on Figure 9-1.

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 and 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 9-1
Overview of SPFC Project Works
Sites Reservoir Project EIR/EIS

The CVFPB or DWR has not provided assurances of cooperation for all parts of the flood protection system. Projects without CVFPB assurances are not part of the SPFC (i.e., they are non-SPFC facilities). Although these facilities are not part of the SPFC, their operation does influence operation of the SPFC, especially in reducing peak flood flows through the SPFC levee system. Non-SPFC facilities include multipurpose reservoir projects (with the exception of Lake Oroville, which is the only major multipurpose project discussed in this chapter that is part of the SPFC), local and regional projects, non-project levees, local pumping plants, and State-designated floodways (DWR, 2010).

Multipurpose flood management reservoirs in the greater Sacramento River Basin are listed in Table 9-1 in chronological order of construction.

Table 9-1
Sacramento River Basin Multi-Purpose Flood Management Reservoirs

Reservoir	Total Reservoir Capacity (acre-feet)	Maximum Flood Storage Capacity (acre-feet)	Operator
Shasta	4,550,000	1,300,000	Reclamation
Black Butte	160,000	137,000	USACE
Folsom	1,010,000	650,000	Reclamation
Oroville	3,540,000	750,000	DWR
New Bullards Bar	960,000	170,000	Yuba County Water Agency
Indian Valley	300,000	40,000	Yolo County Flood Control and Water Conservation District

Notes:

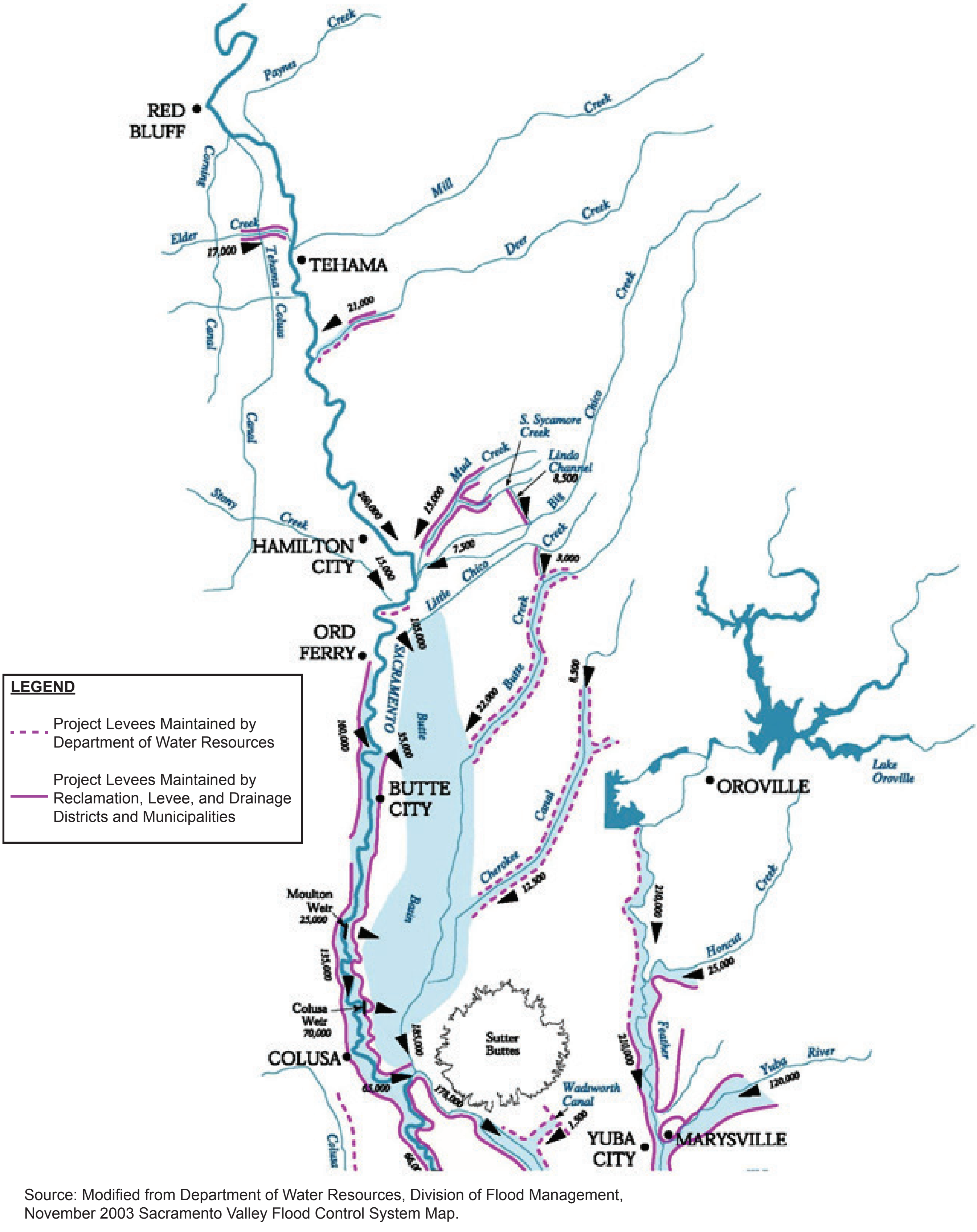
USACE = U.S. Army Corps of Engineers
DWR = California Department of Water Resources
Reclamation = U.S. Bureau of Reclamation

Other major SPFC facilities in the Sacramento River flood control and management system include project levees and flood control weirs, flood control structures, bypasses, channels, and pumping stations, as shown on Figures 9-2A and 9-2B. These figures also indicate system capacities and flood flow routing.

The 100-year floodplain delineations for the Sacramento River Valley north of the Sacramento-San Joaquin Delta are illustrated on Figure 9-3. Major federal, State and local non-SPFC projects impacting flood hydrology or providing flood management for the Sacramento Valley are located on the Trinity River, Sacramento River, Feather River, Yuba River, Bear River, American River, and within the Delta. These areas are discussed in Sections 9.2.2.2 through 9.2.2.6.

9.2.2.2 Trinity River (Including Trinity Lake, Lewiston Lake, Whiskeytown Lake, Clear Creek and Spring Creek)

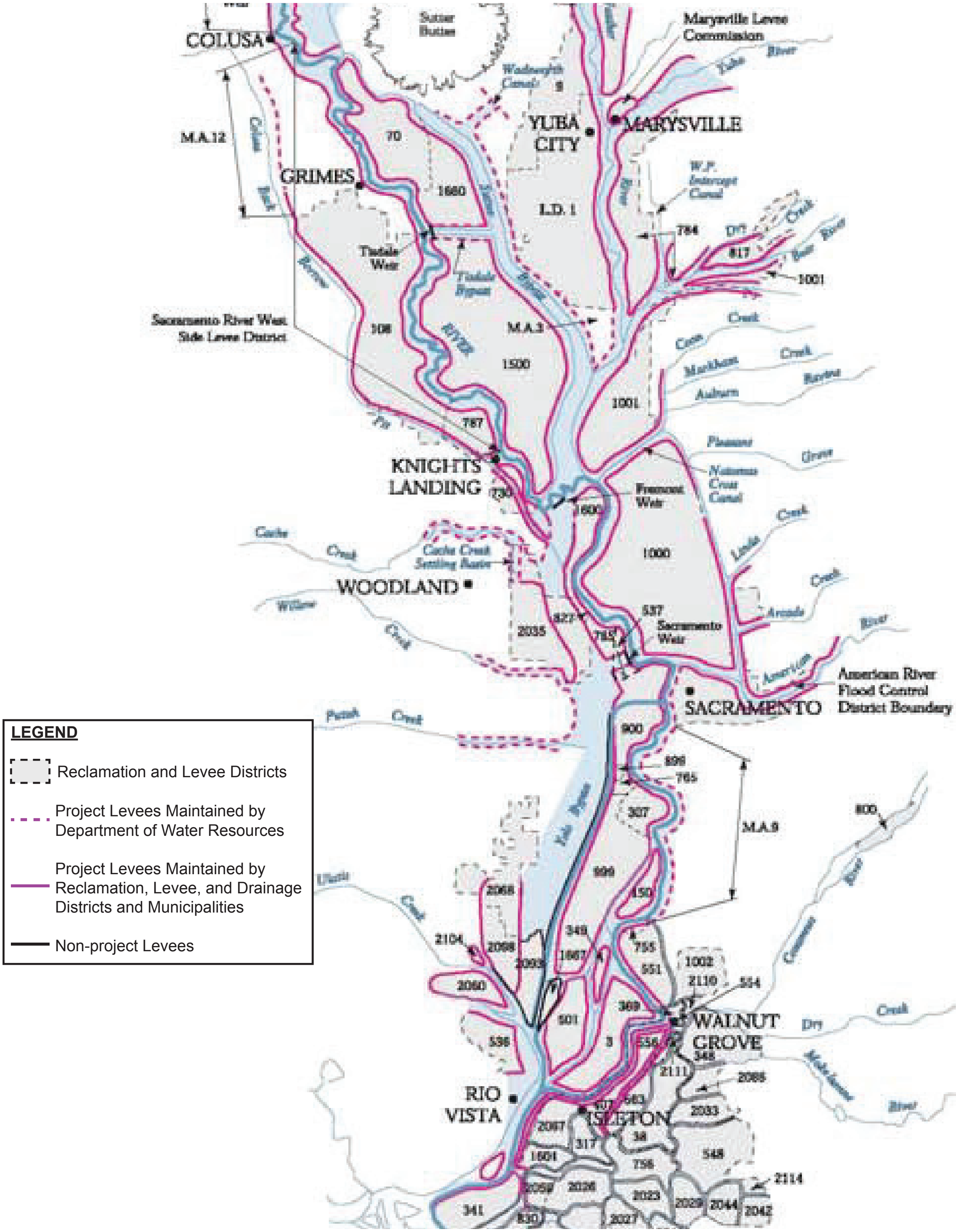
The Trinity River is the largest tributary to the Klamath River. The Trinity River Diversion includes Trinity Dam, Lewiston Dam, and facilities to transfer water from the Trinity River Basin to the Sacramento River Basin. Trinity Dam was completed in 1962. The dam forms Trinity Lake, which has a capacity of approximately 2.4 million acre-feet (MAF). Releases from Trinity Dam are regulated downstream at Lewiston Lake for downstream flow requirements and diversions through the Clear Creek Tunnel to Whiskeytown Lake on Clear Creek. From Whiskeytown Lake, water is delivered through the



Source: Modified from Department of Water Resources, Division of Flood Management, November 2003 Sacramento Valley Flood Control System Map.

FIGURE 9-2A
Sacramento Valley Flood Control System Estimated Channel Capacity (North)

Sites Reservoir Project EIR/EIS



Source: Modified from Department of Water Resources

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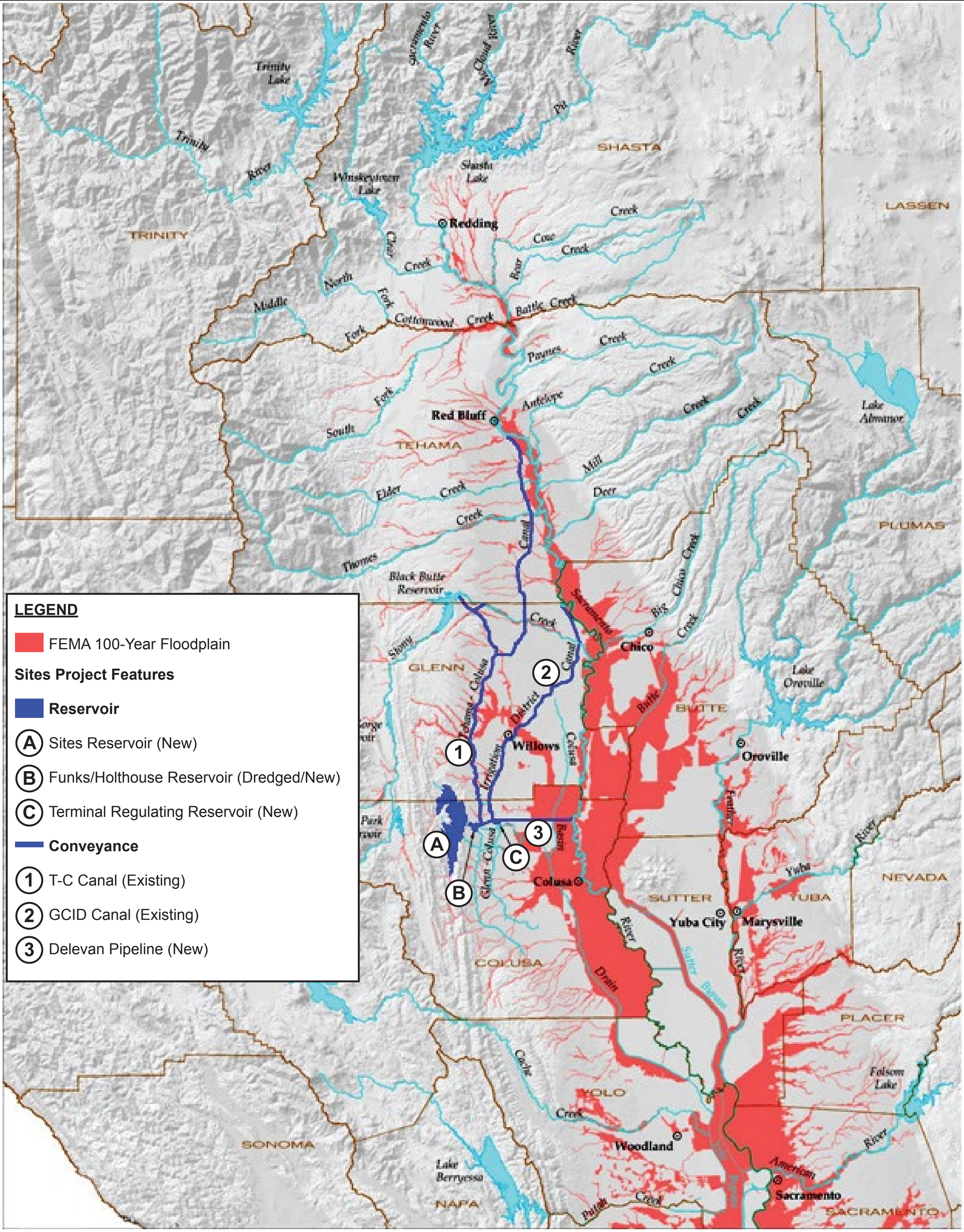
FIGURE 9-2B
Sacramento Valley
Flood Control System
Estimated Channel Capacity (South)
Sites Reservoir Project EIR/EIS



Source: Federal Emergency Management Agency (FEMA), Q3 Flood Data.

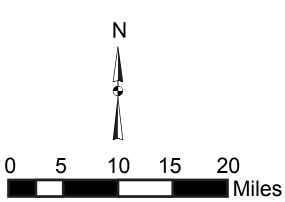


FIGURE 9-3
100-Year Floodplain Delineation Relative to the Project Facilities
Sites Reservoir Project EIR/EIS

Spring Creek tunnel to Keswick Reservoir. The outflow from Trinity and Lewiston reservoirs provides water to meet temperature objectives for special-status fish species in the Trinity and Sacramento rivers (Reclamation, 2009).

Flood control was not an original project purpose of the two dams. However, because of its large storage and spillway surcharge capacities, Trinity Lake has the potential to provide flood control storage, and Reclamation's Safety of Dams criteria stipulate flood control releases November through March if the overall storage is forecasted to exceed 2.0 MAF (Reclamation, 2004). In addition, Trinity Lake is operated in conjunction with Shasta Lake, when necessary, as part of Shasta's Sacramento River flood control operations.

9.2.2.3 Sacramento River (Including Shasta Lake and Keswick Reservoir)

A complex system of dams and associated reservoirs, levees, weirs, bypasses and other features have been constructed over the last 150 years to help manage flooding along the Sacramento River. The primary flood control features on the Sacramento River system are Shasta Dam and the federally authorized Sacramento River Flood Control Project.

Regulating inflows from the Sacramento, McCloud, and Pit rivers, as well as numerous other tributaries and creeks, Shasta Lake provides flood control to the Sacramento River through Shasta Lake's 1.3-MAF of flood control storage. Each year, the reservoir is drawn down to allow for approximately 1.3 MAF of additional flood capacity. The reservoir is managed for flood control from October 1 through March 30. In non-emergency flood conditions, Shasta Dam releases are restricted to 79,000 cfs at the tailwater of Keswick Dam (79,000 cfs is the estimated safe channel carrying capacity of the Sacramento River downstream of Keswick through Redding) and by a flood stage of 27.0 feet at the Sacramento River at Bend Bridge gage (flood stage of 27.0 feet equates to approximately 100,000 cfs). The Sacramento River Flood Control Project area spans from Red Bluff to Verona (north of Sacramento on the Sacramento River) and includes levees, cleared channels, bypasses, and overflow flood control facilities (Figures 9-2A and 9-2B).

The Red Bluff to Chico Landing reach of the Sacramento River (River Mile [RM] 244 to RM 194) is relatively unaffected by flood control facilities. The river naturally meanders through alluvial deposits, and tributaries contribute unregulated flood inflows. This reach of the Sacramento River Flood Control Project was authorized in 1958 for bank protection and incidental channel modification. Floodway designation and floodplain planning and zoning are used to prevent encroachment into the natural floodplain. Most of the floodplain along this reach is used primarily for either agricultural production or riparian habitat. The 100-year floodplain can range up to 4 miles wide. Some rural residential development has occurred along the river, with concentrated urban development around the City of Tehama and Hamilton City. The in-channel capacity of the river upstream of Chico Landing is 260,000 cfs. A significant levee project is underway to alleviate ongoing historical flood issues in and around Hamilton City.

The Chico Landing to Colusa reach of the Sacramento River (RM 194 to RM 143) consists of levees, natural overflow areas, and flood relief structures leading into Butte Basin. Black Butte Reservoir regulates Stony Creek flood flows, which enter the Sacramento River downstream of Hamilton City. Right bank levees extend south from Ord Ferry through Colusa to prevent Sacramento River flood water from entering the Colusa Basin, except when flows exceed 300,000 cfs near Ord Ferry (USACE, 1999). Two flood relief structures and one natural overflow, downstream of Chico Landing, spill flood flows to the Butte Basin Overflow Area, which consists of lands that have historically flooded prior to flood control development. The left bank levee begins midway between Ord Ferry and Butte City and extends south through Verona. The leveed capacity of the Sacramento River near Butte City is 160,000 cfs. Moulton and Colusa weirs divert flood flows to the Butte Basin Overflow Area at RM 158 and 146, respectively. The capacity of Moulton and Colusa weirs is 25,000 and 70,000 cfs, respectively. These weirs provide relief to meet the downstream river capacity of 65,000 cfs at Colusa.

The natural Sutter Basin overflow to the east of the Sacramento River and downstream of the Sutter Buttes was included in the Sacramento River Flood Control Project by confining the extent of overflow through a leveed bypass. The Sutter Bypass conveys floodwaters from the Butte Basin Overflow Area, Butte Creek, Wadsworth Canal, Reclamation Districts 1660 and 1500 drainage plants, State drainage plants 1, 2 and 3, and Tisdale Weir to the juncture of the Sacramento and Feather rivers. The capacity of the Sutter Bypass is 216,000 cfs upstream of its juncture with the Feather River, where the combined capacity of the Feather River and Sutter Bypass is 416,500 cfs upstream of its confluence with the Sacramento River at Fremont Weir and the Yolo Bypass.

The natural Yolo Basin overflow to the west of the Sacramento River was included in the Sacramento River Flood Control Project by confining the extent of overflow through a leveed bypass. The Yolo Bypass conveys floodwaters around the Sacramento metropolitan area and reconnects to the Sacramento River at Rio Vista (RM 14), near Suisun Bay (USACE, 1999). Overflow into the bypass occurs at Fremont Weir to the north and at Sacramento Weir near Sacramento. Fremont Weir flow begins when flows in the Sacramento River combined with Sutter Bypass and Feather River flows reach 60,000 cfs. Capacity of the bypass increases from 343,000 cfs at Fremont Weir to 500,000 cfs near the mouth of the bypass at Rio Vista.

The Colusa to Verona reach (RM 143 to RM 98) consists of a leveed river channel. Downstream of Colusa, Tisdale Bypass routes a portion of the river flow in excess of 23,000 cfs at Tisdale Weir (RM 119) to the Sutter Bypass (USACE, 1999). Reclamation Districts 70, 108, and 787 pump flood waters from adjacent closed basin lands into the river. The Knights Landing Outfall is a gravity flow structure and prevents the Sacramento River from flowing into the Colusa Basin. The Knights Landing Ridge Cut conveys Colusa Basin drainage and flood flows into the Yolo Bypass several miles downstream of Fremont Weir. Flood flows passing through the Knights Landing Ridge Cut are somewhat restricted at times by backwater conditions when the Yolo Bypass is at full capacity. Sources of Yolo Bypass inflow downstream of the Knights Landing Ridge Cut include the Cache Creek Detention Basin, Willow Slough, Putah Creek, and Sacramento Weir (combination of Sacramento and American river flood flows). Near Verona, the Sacramento River, Feather River, Sutter Bypass, and Natomas Cross Canal join together, and flows in excess of 60,000 cfs spill into the Yolo Bypass at Fremont Weir.

Downstream of Verona, the leveed Sacramento River meanders past the City of Sacramento to the Sacramento-San Joaquin Delta. The Yolo Bypass is located to the west of the Sacramento River. The Sacramento Bypass routes excess flows at Sacramento Weir (RM 63) to the Yolo Bypass (USACE, 1999). The American River flows into the Sacramento River at RM 60. Flows from the Yolo Bypass combine with the Sacramento River near Rio Vista (RM 14). Between the American River and Yolo Bypass junction, portions of the Sacramento River water are divided among several sloughs.

The capacity of the leveed Sacramento River at various locations is listed in Table 9-2.

Table 9-2
Sacramento River Leveed Capacity

Location	Flow (cfs)
Upstream of Moulton Weir	160,000 cfs
Moulton Weir to Colusa Weir	135,000 cfs
Colusa Weir to Butte Slough Outfall Gates	65,000 cfs
Butte Slough Outfall Gates to Tisdale Weir	66,000 cfs
Tisdale Weir to Freemont Weir	30,000 cfs
Freemont Weir to Sacramento Weir	107,000 cfs
Sacramento Weir to Sutter Slough	110,000 cfs
Sutter Slough to Steamboat Slough	85,000 cfs
Steamboat Slough to Georgiana Slough	56,500 cfs
Georgiana Slough to Yolo Bypass Junction	35,900 cfs
Yolo Bypass Junction to Threemile Slough	579,000 cfs
Threemile Slough to Collinsville	514,000 cfs

Source: DWR, 2009.

9.2.2.4 Feather River (Including Lake Oroville and the Thermalito Complex)

The mainstem of the Feather River is regulated by Oroville Dam, which is part of the SWP and SPFC. The dam was completed in 1968 and forms the 3.5-MAF Lake Oroville. From Lake Oroville, the Feather River flows south through the Sacramento Valley where it is joined by two major tributaries. The Yuba River joins the Feather River at Marysville; the Bear River confluence is approximately 15 miles downstream from Marysville. The Feather River joins the Sacramento River at RM 80 at Verona.

Operation of the Oroville facilities varies depending upon hydrology and DWR's objectives. Similar to Shasta, Lake Oroville stores winter and spring runoff for release to the Feather River, as necessary, for project purposes. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, diversions, and water quality. The Oroville spillway experienced significant damage in early 2017, during water releases to provide flood storage, which resulted in the need to use the emergency spillway. These releases resulted in temporary evacuations and significant erosion downstream. Emergency repairs were initiated in early 2017. Lake Oroville's flood control storage volume varies from 375,000 to 750,000 acre-feet, depending on hydrologic conditions. Flood management releases are based on a schedule and diagram prepared by USACE (DWR, 2007). Pursuant to USACE's flood control regulations, the maximum controlled release capacity is 150,000 cfs, subject to all spillways being fully operational.

The right bank (looking downstream) of the Feather River is leveed downstream of the Thermalito Afterbay to Honcut Creek. Both banks of the river are leveed downstream of Honcut Creek. These levees and the river are part of the Sacramento River Flood Control Project. The capacity of the leveed Feather River at various locations is listed in Table 9-3.

Table 9-3
Feather River Leveed Capacity

Location	Flow (cfs)
Upstream of Yuba River	210,000
Yuba River to Bear River	300,000
Bear River to Sutter Bypass	320,000

Source: DWR, 2009.

9.2.2.5 American River (Including Folsom Lake and Lake Natoma)

Folsom Lake has a maximum capacity of approximately 1 MAF and is located on the American River approximately 15 miles northeast of the City of Sacramento, near the City of Folsom. Construction of the dam was completed in 1956. It is managed by Reclamation to provide flood control, recreation, power, water supply, Delta water quality protection, and fish flows in the American River and Delta (Reclamation, CCWD, and WAPA, 2009). Lake Natoma is located downstream of Folsom and functions primarily as a regulating reservoir to lessen Folsom releases.

The flood control storage volume of Folsom Lake varies from 400,000 to 670,000 acre-feet. The objective release[1] to the American River is 115,000 cfs (Reclamation, 2008). The American River downstream of Carmichael Bluffs is part of the Sacramento River Flood Control Project. The capacity of the leveed reach upstream of Cal Expo (RM 5) is 115,000 cfs, and downstream to the Sacramento River, the capacity is 180,000 cfs.

9.2.2.6 Sacramento-San Joaquin Delta (Including Suisun, San Pablo, and San Francisco Bays)

The Sacramento-San Joaquin Delta, located to the east of San Francisco Bay, represents the point of discharge for the Sacramento-San Joaquin River system. Water flows out of the Delta, through Suisun and San Pablo bays, into San Francisco Bay, and to the Pacific Ocean, creating an extensive estuary where salty ocean water and fresh river water mix. In sum, water from over 40 percent of the State's land area is discharged into the Delta (Reclamation, CCWD, and WAPA, 2009).

The Delta is a complex system of islands, levees, constructed waterways, and control facilities. The levee system is composed entirely of local levees maintained by local interests (DWR, 2009). These levees were initially constructed to control island flooding during high flow, but because of island subsidence, they now have to prevent inundation during normal runoff and tidal cycles (Reclamation and DWR, 2005). There are approximately 1,100 miles of levees providing protection to 76 islands and tracts. Construction and operation of the CVP and SWP has decreased the frequency of levee failure due to overtopping during flood events (Reclamation and DWR, 2005).

9.2.3 Primary Study Area

The primary watercourses in the Primary Study Area are Funks Creek, Stone Corral Creek, and the Colusa Basin Drain, which are discussed in Sections 9.2.3.1 and 9.2.3.2. The Colusa Basin Drain is a designated floodway according to the Central Valley Flood Protection Board (CVFPB). The 100-year floodplain delineations for the Primary Study Area, depicting areas subjected to flooding and areas with undetermined flood hazards,[2] are shown on Figure 9-4. Areas with undetermined flood hazards include the national wildlife refuges, which are not subject to the Federal Emergency Management Agency (FEMA) National Flood Insurance Program regulations.

[1] The objective release designates the maximum reservoir release rate during a flood, as listed in the operations manual. It is set based on the conveyance capacity of channels below the dam to ensure that discharge at a downstream point(s) (referred to as a control point, impact point, or damage center) remains below the project flood stage, a level that could cause damage.

[2] Neither peak flow nor base flood elevations are available from the FEMA Flood Insurance Study. Instead, areas subject to flooding are depicted.

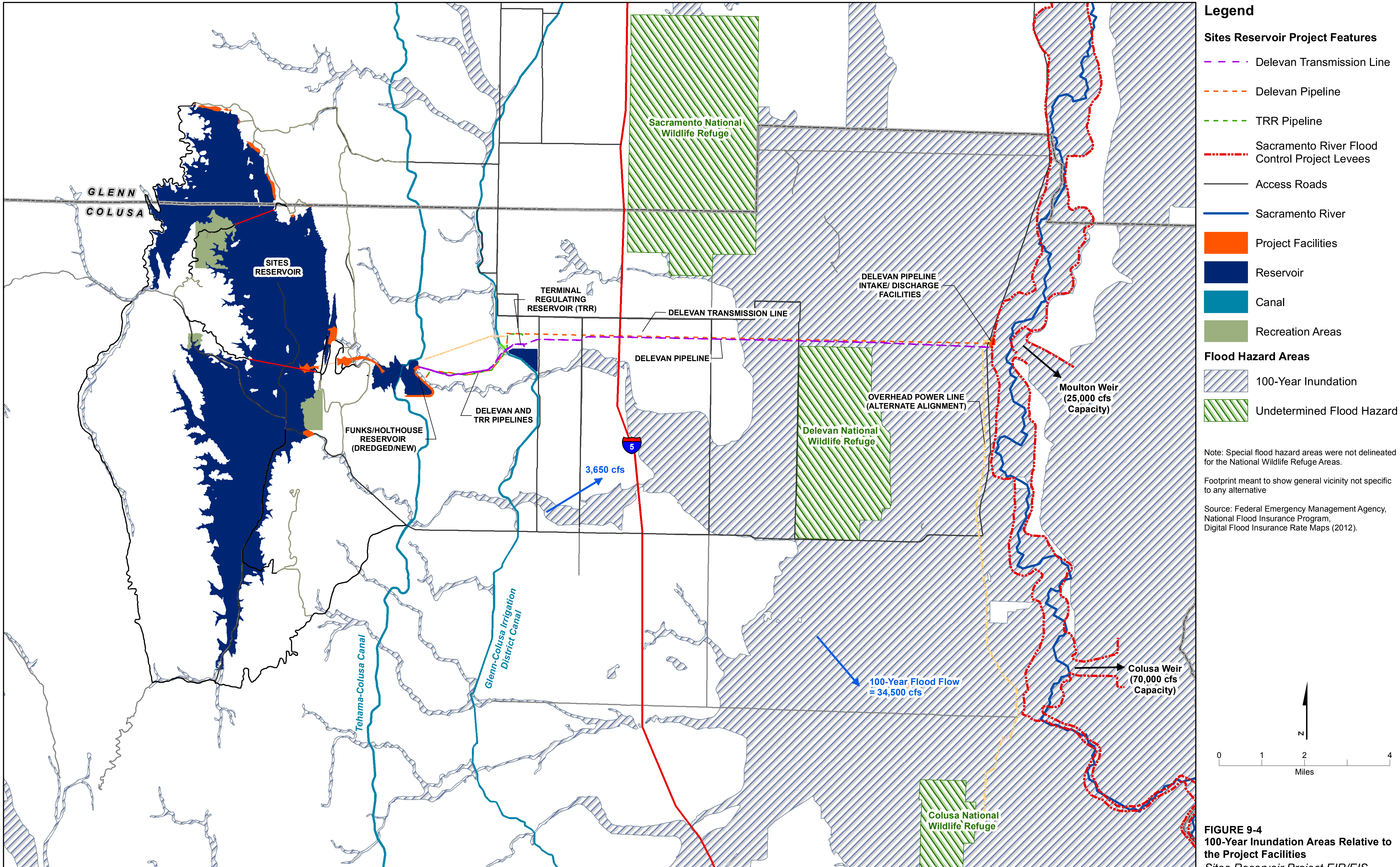


FIGURE 9-4
100-Year Inundation Areas Relative to the Project Facilities
Sites Reservoir Project EIR/EIS

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9.2.3.1 Funks and Stone Corral Creeks

Funks and Stone Corral creeks are ephemeral streams that originate on the westside foothills and are tributary to the Colusa Basin Drain. Snow pack is non-existent due to the low elevation of the watershed. Flood runoff is generated directly from large precipitation events. This area is primarily agricultural with rural farmsteads and small communities. The gentle sloping lands are ideal for rice production and managed wetlands, which also contribute to large areas of inundation during flood events. Road, bridge, railroad, and canal alignments can affect the movement of flood water in this area.

The drainage area of Funks Creek at Funks Dam is 43 square miles. Funks Reservoir is not operated for flood control purposes. There are no stream gages on Funks Creek downstream of Funks Dam because a historical stream gage was washed out and not replaced due to the constantly degrading channel. Peak winter flows of approximately 2,000 cfs are common (Weathers, 2005). Because the topography and soil composition of the watershed are similar to those of Stone Corral Creek, where stream flow records are available, and given the comparable drainage areas of the two watersheds, it is reasonable to assume that the 100-year discharge on Funks Creek is similar to that of Stone Corral Creek.

During a 100-year flood event, Funks Creek overflows its bank downstream of the Tehama-Colusa Canal and Funks Reservoir. Flood waters flow to the north along the creek and to the south where they join with Stone Corral Creek. Stone Corral Creek overflows its bank downstream of the town of Sites. The floodplains of both Funks and Stone Corral creeks are intersected by the GCID Main Canal, which has levees along each bank.

The drainage area of the Stone Corral Creek watershed is 38.2 square miles at a former gaging station near the town of Sites. Twenty-five years of discharge measurements were collected, with interruption from 1958 through 1985 by the U.S. Geological Survey. During that time, there were three years of zero flow: 1972, 1976, and 1977. A maximum mean daily flow of 2,230 cfs occurred on December 24, 1983. An instantaneous peak flow of 5,700 cfs was recorded on January 26, 1983. The 100-year peak discharge upstream of Sutton Road (also known as Cemetery Road), west of Maxwell, is 3,650 cfs, and the 100-year peak discharge downstream of the California Northern Railroad is 3,330 cfs (FEMA, 2003). Flooding in the town of Maxwell occurs directly from Stone Corral Creek and overland flow from Funks Creek. Both I-5 and the Union Pacific Railroad significantly impede the movement of flood flows through Maxwell. Downstream of I-5, Funks and Stone Corral creeks combine and create a single floodplain that moves in a southeasterly direction toward the Colusa Basin Drain.

In early 2017, the town of Maxwell and the surrounding area were partially inundated by floodwaters, causing damage to property and disruption to residents. Approximately one-third of Maxwell was inundated by a foot or more of floodwater, and local residents were evacuated. Interstate 5 was also flooded, causing traffic impacts and delays.

9.2.3.2 Colusa Basin Drain

Runoff from 11 stream systems draining the foothill and valley floor watersheds contribute flow to the Colusa Basin Drain. This natural historic drainage system for the Colusa Basin has been almost entirely cut off from receiving floodwaters of the Sacramento River by an extensive levee system (except when flood flows on the Sacramento River exceed 300,000 cfs near Ord Ferry). In general, the Colusa Basin Drain conveys flood flows from November through March and agricultural irrigation and drainage flows from April through October. Its northern half is not leveed. Beginning south of Colusa, left bank levees extend southward to its confluence with the Sacramento River at the Knights Landing Outfall Gates. Both

Reclamation District 787 and Reclamation District 108 pump drainage from interior lands surrounded by levees to either the Sacramento River or the Colusa Basin Drain.

Both flood and drainage flows are regulated by the Knights Landing Outfall Gates. These gates prevent Sacramento River water from entering the basin. The magnitude of gravity flow from the Colusa Basin Drain is controlled by the water surface elevation in the Sacramento River and the gate openings.

The Knights Landing Ridge Cut provides flood relief to the Colusa Basin Drain by conveying flood and drainage water to the Yolo Bypass if discharge to the river cannot occur. The Knights Landing Ridge Cut design capacity is 20,000 cfs (DWR, 2010). The combined capacity of the Ridge Cut and the Outfall gates are insufficient at times to carry flood flows out of the basin, resulting in backwater conditions and inundation along the drain, especially in its lower reaches. Areas of 100-year flood inundation (Figure 9-4) reflect the limited capacity of the Knights Landing Ridge Cut and the Colusa Basin Drain's 100-year flood flow at SR 20 of 34,500 cfs (FEMA, 2003). These problems have been the focus of ongoing studies by the Colusa Basin Drainage District to reduce damages to agricultural production.

9.3 Environmental Impacts/Environmental Consequences

9.3.1 Evaluation Criteria and Significance Thresholds

Significance criteria represent the thresholds that were used to identify whether an impact would be significant. Appendix G of the *CEQA Guidelines* suggests the following evaluation criteria for flood control and management:

Would the Project:

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows?
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

The evaluation criteria used for this impact analysis represent a combination of the Appendix G criteria and professional judgment that considers current regulations, standards, and/or consultation with agencies, knowledge of the area, and the context and intensity of the environmental effects, as required pursuant to NEPA. For the purposes of this analysis, an alternative would result in a significant impact if it would result in any of the following:

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows?
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

9.3.2 Impact Assessment Assumptions and Methodology

Combinations of Project facilities were used to create Alternatives A, B, C, C_1, and D. In all resource chapters, the Sites Project Authority and Reclamation described the potential impacts associated with the construction, operation, and maintenance of each of the Project facilities for each of the five action alternatives. Some Project features/facilities and operations (e.g., reservoir size, overhead power line alignments, provision of water for local uses) differ by alternative, and are evaluated in detail within each of the resource areas chapters. As such, the Sites Project Authority has evaluated all potential impacts with each feature individually, and may choose to select or combine individual features as determined necessary.

Impacts associated with the construction, operation, and maintenance for Alternative C_1 would be the same as Alternative C. These are, therefore, not discussed separately below.

Chapter 25 Climate Change and Greenhouse Gas Emissions details potential effects of climate change, including flooding, related to the Project.

9.3.2.1 Assumptions

The following assumptions were made regarding Project-related construction, operation, and maintenance impacts to flood control and management:

- Direct Project-related construction, operation, and maintenance activities would occur in the Primary Study Area.
- Direct Project-related operational effects would occur in the Secondary Study Area.
- The only direct Project-related construction activity that would occur in the Secondary Study Area is the installation of two additional pumps into existing bays at the Red Bluff Pumping Plant.
- The only direct Project-related maintenance activity that would occur in the Secondary Study Area is the sediment removal and disposal at the two intake locations (i.e., GCID Main Canal Intake and Red Bluff Pumping Plant).
- No direct Project-related construction or maintenance activities would occur in the Extended Study Area.
- Direct Project-related operational effects that would occur in the Extended Study Area are related to San Luis Reservoir operation; increased reliability of water supply to agricultural, municipal, and industrial water users; and the provision of an alternate Level 4 wildlife refuge water supply. Indirect effects to the operation of certain facilities in the Extended Study Area, and indirect effects to the consequent water deliveries made by those facilities, would occur as a result of implementing the alternatives.

- The existing bank protection located upstream of the proposed Delevan Pipeline Intake/Discharge Facilities would continue to be maintained and remain functional.
- No additional channel stabilization, grade control measures, or dredging in the Sacramento River at or upstream of the Delevan Pipeline Intake/Discharge Facilities would be required.
- Design, construction, and operation of all facilities would account for: Department of Dam Safety (DSOD) requirements, as appropriate; potential for anticipated seismic activity including fault rupture, ground shaking, ground failure, and liquefaction; and, the potential for reservoir triggered seismicity.
- All three proposed reservoirs (Sites, Holthouse, and TRR) would be designed with emergency spillways to prevent overtopping the dams. Details of the spillway design capacities and Emergency Action Plan are included in Chapter 3 Description of the Sites Reservoir Project Alternatives.
- Sites Reservoir, given its proposed storage capacity, would be designed for a required maximum emergency drawdown release of 15,200 cfs, which would be released through the inlet/outlet works to quickly drain the reservoir, if needed. In addition, the Holthouse Reservoir design would require a spillway sufficient to pass the required Sites Reservoir maximum emergency drawdown release flow of 15,200 cfs as described in Chapter 3 Description of the Sites Reservoir Project Alternatives.

9.3.2.2 Methodology

Existing conditions and the future No Project/No Action alternatives were assumed to be similar in the Primary Study Area, given the generally rural nature of the area and limited potential for growth and development in Glenn and Colusa counties within the 2030 study period used for this EIR/EIS, as further described in Chapter 2 Alternatives Analysis. As a result, within the Primary Study Area, it is anticipated that the No Project/No Action Alternative would not entail material changes in conditions as compared to the existing conditions baseline.

With respect to the Extended and Secondary study areas, the effects of the proposed action alternatives would be primarily related to changes to available water supplies in the Extended and Secondary study areas and the Project's cooperative operations with other existing large reservoirs in the Sacramento watershed, and the resultant potential impacts and benefits to biological resources, land use, recreation, socioeconomic conditions, and other resource areas. DWR has projected future water demands through 2030 conditions that assume the vast majority of CVP and SWP water contractors would use their total contract amounts, and that most senior water rights users also would fully use most of their water rights. This increased demand in addition to the projects currently under construction and those that have received approvals and permits at the time of preparation of this EIR/EIS would constitute the No Project/No Action Condition. As described in Chapter 2 Alternatives Analysis, the primary difference in these projected water demands would be in the Sacramento Valley; and as of the time of preparation of this EIR/EIS, the water demands have expanded to the levels projected to be achieved on or before 2030.

Accordingly, existing conditions and the No Project/No Action alternatives are assumed to be the same for this EIR/EIS and as such are referred to as the Existing Conditions/No Project/No Action Condition, which is further discussed in Chapter 2 Alternatives Analysis. With respect to applicable reasonably foreseeable plans, projects, programs, and policies that may be implemented in the future but that have not yet been approved, these are included as part of the analysis of cumulative impacts in Chapter 35 Cumulative Impacts.

The CVP and SWP operations model (water resources simulation model known as CALSIM II) was used to simulate CVP and SWP operations to determine the surface water flows, storages, and deliveries associated with the Existing Conditions/No Project/No Action Condition, and the action alternatives (Alternatives A, B, C, and D). A detailed description of the assumptions used for modeling the baselines and the alternatives is included in Appendix 6A Modeling of Alternatives. The water resources system models used are described in Appendix 6B Water Resources System Modeling. The CALSIM II model was used to simulate system operations for an 82-year period using a monthly time-step. The model included assumptions regarding facilities, land use, water supply contracts, and regulatory requirements for the Existing Conditions/No Project/No Action Condition. The historical 82-year flow record (1922 to 2003), adjusted for the influences of land use changes and upstream flow regulation, was used to represent the possible range of water supply conditions. CALSIM II modeling followed all flood control operations rules for existing reservoirs and flood management facilities (i.e., encroachments into the flood control space of existing reservoirs was not allowed).

Because lake elevation values are output from the monthly time step CALSIM II model, it was determined that incremental changes of 5 percent or less were related to the uncertainties in the model processing. Therefore, changes in reservoir storage of 5 percent or less are considered to be not substantially different, or “similar” in this comparative analysis.

Of the five large reservoirs in the Secondary Study Area included in the CALSIM II operations modeling, only Shasta, Oroville, and Folsom reservoirs are operated officially with flood control as a primary objective.

9.3.3 Topics Eliminated from Further Analytical Consideration

As described in Chapter 3 Description of the Sites Reservoir Project Alternatives and in the following sections, the Project would alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river. Potential impacts relating to erosion or siltation on- or off-site (**Impact Flood-4**) are discussed in Chapter 7 Surface Water Quality and Chapter 16 Geology, Soils, Mineral, and Paleontology.

The Project facilities would all be located in rural and agricultural areas that are not serviced by existing or planned stormwater drainage systems. Therefore, the potential impact to a stormwater drainage system (**Impact Flood-5**) from Project implementation is not relevant to the Project, and is not discussed in this chapter.

In addition, no new housing is proposed as part of the Project. Therefore, potential impacts from placing housing within a flood hazard area (**Impact Flood-6**) from Project implementation is not relevant to the Project, and is not discussed in this chapter.

9.3.4 Impacts Associated with Alternative A

9.3.4.1 Extended Study Area – Alternative A

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use, and San Luis Reservoir

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

There would be no direct Project-related construction or maintenance within the CVP and SWP service areas of the Extended Study Area; therefore, no Project-related flooding would occur, resulting in **no impact** in the Extended Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

If Alternative A is implemented, changes in CVP and SWP service area water supply deliveries and surface water elevation fluctuations at San Luis Reservoir would not alter existing drainage patterns, stream courses, or surface runoff within the Extended Study Area. Therefore, operation of Alternative A would result in **no impact** on existing drainage patterns, stream courses, or surface runoff within the Extended Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

If Alternative A is implemented, no new Project-related structures would be constructed within the Extended Study Area, thus no 100-year flood flows would be impeded or redirected by their placement. Therefore, operation of Alternative A would result in **no impact** on 100-year flood flows within the Extended Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

San Luis Reservoir is operated entirely as a joint CVP and SWP supply storage reservoir and is not operated for flood control purposes. If Alternative A is implemented, water level fluctuations that would occur at San Luis Reservoir would remain within the historical range of operation and would not expose people or structures to any additional flooding risks related to dam failure. Thus, operation of Alternative A would result in **no impact** related to increased flooding risks, including potential flooding due to a levee or dam failure, within the Extended Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

9.3.4.2 Secondary Study Area - Alternative A

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

If Alternative A is implemented, no direct Project-related construction would occur at any of the above-listed facilities or areas within the Secondary Study Area other than the installation of two additional pumps into existing bays at the Red Bluff Pumping Plant. The additional pump would not alter the existing drainage pattern of the site, alter a stream course, or increase the amount of surface runoff. Therefore, the installation of the pumps in the existing bays at Red Bluff Pumping Plant would result in **no impact** on existing drainage patterns, stream courses, or surface runoff within the Secondary Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

If Alternative A is implemented, two new pump would be installed into existing bays at the Red Bluff Pumping Plant. This would not impede or redirect 100-year flood flows. Therefore, construction, operation, and maintenance of Alternative A would result in **no impact** on 100-year flood flows within the Secondary Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If Alternative A is implemented, two additional pumps at the Red Bluff Pumping Plant would be installed in existing bays and would not modify any existing levees. Therefore, installation of the additional pumps would have no effect on existing dams or levees within the Secondary Study Area. When compared to the Existing Conditions/No Project/No Action Condition, construction, operation and maintenance of Alternative A would result in **no impact** due to increased flooding risks, including potential flooding due a levee or dam failure**.**

Appendix 6B Water Resources System Modeling provides average surface water elevation of several flood control reservoirs in the Secondary Study Area to evaluate operations with implementation of Alternative A.

As indicated by the water surface elevation data, cooperative operation with Sites Reservoir would not increase flood risks due to significantly higher water surface elevations in flood control reservoirs in the Secondary Study Area during Wet and Above Normal water year types. Therefore, compared to the Existing Conditions/No Project/No Action Condition, construction, operation and maintenance of Alternative A would result in a **less-than-significant impact** related to the potential for increased flooding risks, including potential flooding due to a levee or dam failure, within the Secondary Study Area. See the discussion of **Impact Flood-3** in Section 9.3.4.3 Primary Study Area – Alternative A for additional information.

9.3.4.3 Primary Study Area – Alternative A

<u>Construction, Operation, and Maintenance Impacts</u>

Sites Reservoir Inundation Area and Sites Reservoir Dams

Most reservoirs are designed as "on-stream" reservoirs. On-stream reservoirs are sited to directly dam up an active river channel or in a location where they would receive most of their inflow by capturing natural runoff. By comparison, off-stream reservoirs are not designed to dam up a natural river course and are not sited in a location where they receive the majority of their inflow naturally. Instead, off-stream reservoirs receive their inflow primarily via human-made diversions and are sited in ideal locations where they can store much-needed water for flexible distribution. Examples of California off-stream reservoirs are the CVP and SWP jointly-used San Luis Reservoir, Contra Costa Water District's Los Vaqueros Reservoir, and Metropolitan Water District's Eastside Reservoir (Diamond Valley Lake).

Sites Reservoir is also designed as an off-stream storage facility. Sites Reservoir would receive very little natural runoff from its 83-square-mile watershed. Average annual natural inflow into the reservoir would be approximately 15,000 acre-feet which is little more than 1 percent of the Alternative A designed 1.3-MAF reservoir storage capacity. By comparison, the average annual inflow for Lake Oroville is approximately 4.2 MAF, or approximately 120 percent of Lake Oroville's approximately 3.5-MAF storage capacity. Sites Reservoir would be filled predominantly by diversions directly or indirectly from the Sacramento River using existing or new conveyances. Construction of the 1.3-MAF reservoir includes building two main dams and seven saddle dams. The crest elevation of all dams would be 500 feet, providing 20 feet of freeboard above the maximum operating level of 480 feet. The designed emergency spillway elevation would be at 486.5 feet.

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

Flows from Funks and Stone Corral creeks would be impounded and diverted during the construction of Golden Gate and Sites dams. Diversion of Funks and Stone Corral creeks would likely be accomplished by passing storm flows through buried corrugated metal pipe or concrete pipe around the construction areas.

During Project construction, a cofferdam would be installed upstream of the Sites and Golden Gate dams around the dams' construction work areas to retain storm flows entering the reservoir basin from Funks Creek and Stone Corral Creek and thereby keep the dam construction work area dry. These cofferdams would be designed to retain anticipated creek runoff in the reservoir basin during the construction period. During the construction period, storm flows would collect within the proposed reservoir basin behind the cofferdam and be released incrementally through a bypass around the Sites Dam area and discharged downstream. Storm flows would be managed during dam construction so as not to increase the downstream flood potential, resulting in a **less-than-significant impact** when compared to the Existing Conditions/No Project/No Action Condition.

Post-construction, Sites and Golden Gate dams would collect inflows on Funks and Stone Corral creeks; and release water to match pre-project flows (other than flood level flows) through the reservoir inlet/outlet works. While operation of Sites and Golden Gate dams would result in alteration of a river or stream course, one of the secondary objectives of the Project is incremental flood damage reduction improvements to areas located immediately downstream of the reservoir that are prone to flooding and downstream of the diversions from the Sacramento River. Historical flooding conditions and management would be improved in the Funks Creek and Stone Corral Creek watersheds, including the town of Maxwell, below the Project, by limiting the outflows during the typical winter flood season.

Operation of Sites Reservoir would decrease the magnitude of the 100-year peak flow event on Funks and Stone Corral creeks downstream of the dams by having the capacity to contain flood flows and control the release of water downstream. With implementation of Alternative A, of the 22,200 acres of land prone to flooding downstream of the proposed Sites and Golden Gate dam locations, approximately 21 percent

(4,660 acres) would experience a reduction in flood-related damages. In addition to increasing the level of protection in the Funks Creek and Stone Corral Creek watersheds, a 100-year level of protection would be achieved for approximately 4,025 acres in the Colusa Basin. Based on a 100-year flood event, the flood risk would be reduced for a total of 8,685 acres (Reclamation, 2012). Therefore, operation of Sites Reservoir would result in a **beneficial effect** by reducing the amount and rate of surface water runoff that has historically flooded areas downstream of the dams, when compared to the Existing Conditions/No Project/No Action Condition

Maintenance activities associated with the reservoir (e.g., law enforcement and garbage removal) and dams (equipment, foundation, and embankment inspections and repairs; debris and vegetation removal) would not alter existing drainage patterns or the course of a stream and would, therefore, have **no impact**, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

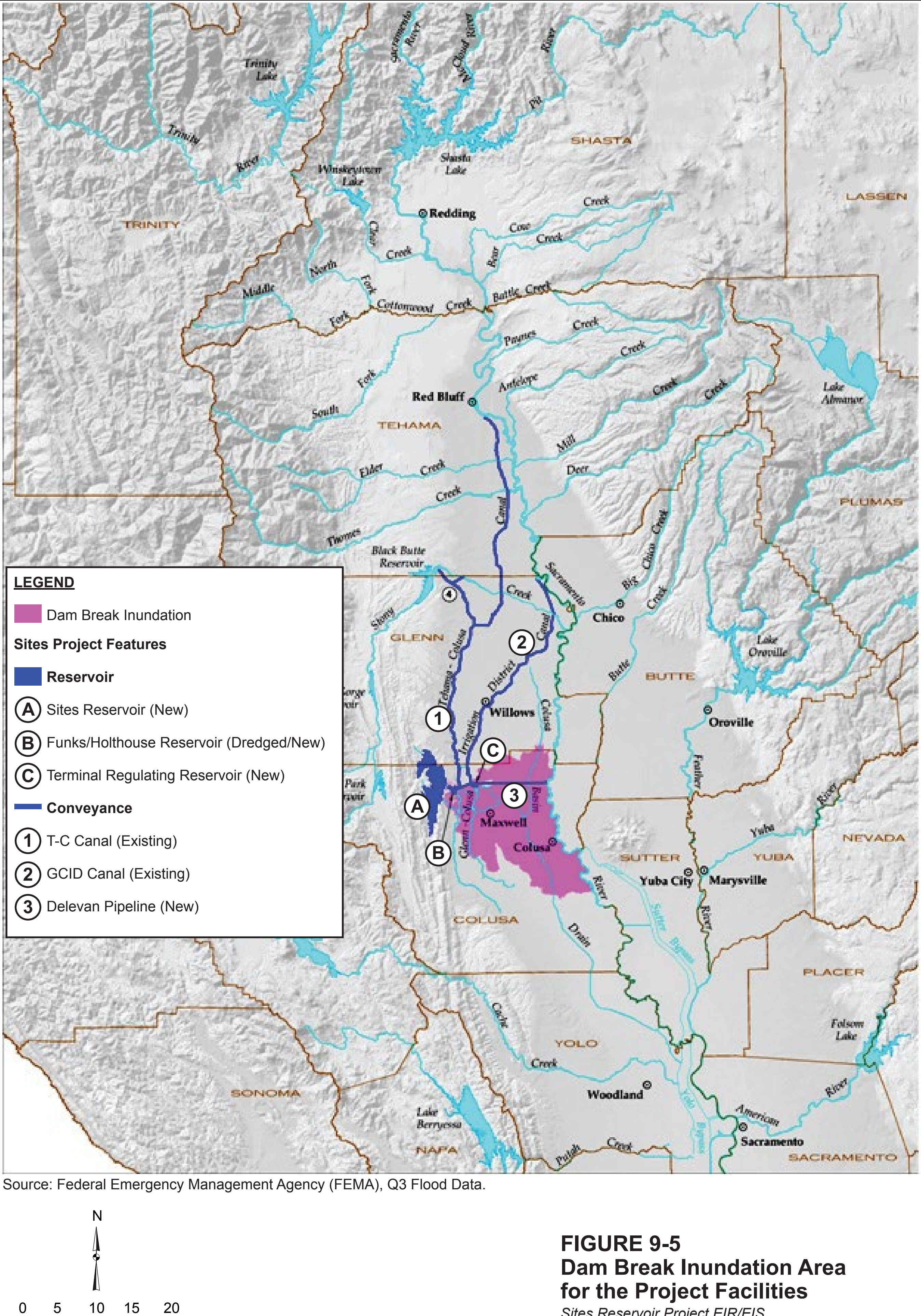
Both Golden Gate and Sites dams would be located within 100-year flood hazard areas associated with Funks and Stone Corral creeks. Neither dam would impede or redirect flood flows in a manner that would increase potential downstream flood impacts. In contrast, both creeks would be impounded and diverted in a controlled manner during the construction of the dams, and operation of the dams would help to alleviate potential downstream flood flows on these creeks by capturing watershed runoff. Therefore, construction and operation of both dams would result in a **beneficial effect** on 100-year flood flows downstream of the dam, when compared to the Existing Conditions/No Project/No Action Condition.

Maintenance activities associated with the dams, including equipment, foundation, and embankment inspections and repairs would not impede or redirect flood flows and would, therefore, have **no impact**, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

A potential dam break inundation map that reflects the inundation scenario associated with the future facility (Figure 9-5) was prepared to evaluate potential flooding impacts (DWR, 2014). The flood wave that would result from a hypothetical breach of Golden Gate Dam or Sites Dam has a very small probability of occurring, but would present a significant hazard to both occupied and non-occupied structures downstream of Sites Reservoir. The peak outflow from a breach of Sites Reservoir is estimated at 2,078,000 cfs. The flood wave would flow east following the natural streambeds and would fan out to the relatively flat terrain of the Sacramento Valley before reaching the City of Maxwell and I-5. The estimated flow velocity at Maxwell and I-5 would be 4.5 feet per second and the maximum depth would be 10 feet. The flood wave would then continue approximately 13 miles east to the City of Colusa and the Sacramento River. The flood wave would then be impeded by the west levee of the Sacramento River. The flood would reach a depth of 22 feet (upslope of the Sacramento River levee) (DWR, 2005).

The Sites Reservoir dams would be designed and constructed pursuant to conservative guidelines and criteria designed to prevent failure. The designs would incorporate multiple lines of defense or design redundancy as required to meet both DWR's Division of Safety of Dams (DSOD) and Reclamation design standards. The dams would be designed to withstand the largest and strongest expected earthquake (Maximum Credible Earthquake), as well as the largest possible expected flood (Probable Maximum Flood). These design standards would protect the dams from seismic or other catastrophic failure.



Source: Federal Emergency Management Agency (FEMA), Q3 Flood Data.

FIGURE 9-5
Dam Break Inundation Area for the Project Facilities
Sites Reservoir Project EIR/EIS

In addition, operation of Golden Gate and Sites dams would be monitored by instrumentation measuring such parameters as seepage, settlement, and earthquake-induced accelerations, which could provide early warning signs of potential dam failure. With modern design criteria, construction practices, and post-construction monitoring, the probability of dam failure and subsequent impacts is extremely small. Additionally, removal of all existing structures in the Project Buffer (subsequently discussed under “Project Buffer”) would reduce the number of people and structures exposed to dam failure. An emergency action plan (Section 3.5.8 Emergency Action Plan) would be implemented for Project construction and operation. The plan would include emergency notification flowcharts, notification procedures, inundation maps, and a variety of other important emergency response protocols for notifying downstream entities, including the other project facilities listed below, if an emergency release is anticipated. Therefore, Sites Reservoir and Dams would result in a **less-than-significant impact** related to the risk of loss, injury, or death due to flooding caused by dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Both DSOD and Reclamation dam safety guidelines establish criteria for handling the emergency evacuation of a reservoir and the design of related facilities, such as the Sites Dam emergency spillway and outlet structure, required to handle the evacuation flows. Although the Sites Reservoir Project Feasibility Study follows DSOD design standards, DSOD’s emergency evacuation criteria are more conservative than Reclamation’s evacuation criteria. Thus, Sites Dam and the associated facilities required to handle the emergency evacuation flows would meet both DSOD and Reclamation standards (Reclamation, 2012; Reclamation, 1990).

Based on DSOD guidelines, Sites Reservoir would include an emergency spillway to release flows with an elevation set to the potential probable maximum flood water surface elevation. However, as an offstream reservoir, Sites Reservoir would be filled by Project-controlled diversions and would receive little inflow from the local creeks. Generally, Sites Reservoir would fill to its highest operating levels by spring to early summer, and then the levels would be drawn down during summer for water supply uses. By the time of the rainy season, when a 100-year flood is generally anticipated, the reservoir would have more than enough capacity to handle large storm events from the local creeks, even at full operating capacity.

In addition, both DSOD and Reclamation require that large reservoirs, such as Sites Reservoir, have facilities capable of allowing rapid emergency drawdown of the water in the reservoir in the event of an unsafe condition at the dam. DSOD emergency drawdown (or “evacuation”) guidelines for a large reservoir require that the dam facilities have the capability to lower the reservoir level by an amount equal to 10 percent of the hydraulic head[3] behind the dam in 10 days, and to evacuate the entire reservoir in 120 days. Sites Reservoir would accomplish this drawdown via the outlet tunnel in the inlet/outlet structure, which could discharge emergency release flows directly into Funks Creek; some of this drawdown could be attenuated by Holthouse Reservoir or released via the Delevan Pipeline, the Tehama-Colusa Canal, or the GCID Main Canal. The designed maximum discharge rate is 15,200 cfs, which exceeds the required 10-day average discharge rate. However, the risk of an event requiring such an emergency release remains very small because inflow is controlled primarily through pumping for off-stream storage reservoirs. Because the probability of the emergency release event occurring is so remote, Sites Reservoir and Dams would have a **less-than-significant impact** on the risk of loss, injury, or death due to flooding caused by emergency reservoir releases, when compared to the Existing Conditions/No

[3]The hydraulic head is the difference between the normal maximum water surface elevation and the dead pool (i.e., the water level below which water can no longer be discharged) elevation.

Project/No Action Condition. Additionally, an Emergency Action Plan would be prepared to comply with FEMA, Federal Energy Regulatory Commission, and DSOD regulations.

Sites Pumping/Generating Plant and Electrical Switchyard, Tunnel, Sites Reservoir Inlet/Outlet Structure, and Field Office Maintenance Yard

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The Sites Pumping/Generating Plant, Tunnel, Electrical Switchyard, and Field Office Maintenance Yard would not be located directly on the Funks Creek channel alignment. Therefore, construction activities associated with these facilities would not alter existing drainage patterns or alter the course of Funks Creek. Post-construction, the footprint for these proposed facilities is not expected to substantially alter the existing drainage patterns in that area. In addition, the new impervious areas associated with these facilities would not be large enough to cause a potentially significant increase in surface runoff. Maintenance activities, including washing and cleaning of equipment, inspections, and fence maintenance, would not alter drainage patterns or stream courses. Therefore, construction, operation, and maintenance of these facilities would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Most of the footprint of the Sites Reservoir Inlet/Outlet Structure would not be located directly on the Funks Creek channel alignment. However, the footprint of the outlet approach channel to Holthouse Reservoir would cross the Funks Creek channel and would permanently remove approximately 0.5 mile of Funks Creek immediately upstream of the existing Funks Reservoir. During construction, Funks Creek would be diverted. During operation, Funks Creek would flow into the approach channel upstream of the existing Funks Reservoir. Although slight alteration of the course of the creek would occur, it would not result in flooding because diverted flows would be controlled during construction, and upstream flows would be controlled by releases from Sites Reservoir during operation. Maintenance activities, such as inspections, would not alter drainage patterns or stream courses. Therefore, construction, operation, and maintenance of the inlet/outlet structure would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

The proposed Sites Pumping/Generating Plant, Tunnel, Reservoir Inlet/Outlet Structure, Electrical Switchyard, and Field Office Maintenance Yard would be constructed within the 100-year flood hazard area associated with Funks Creek. However, during construction, the flows from Funks Creek would be controlled with a diversion system. During operation, Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. The maintenance activities would not place structures within a flood hazard area. Therefore, these facilities are not expected to significantly impede or redirect 100-year flood flows. Construction, operation, and maintenance of these facilities would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with these proposed facilities. Therefore, construction, operation, and maintenance of these facilities would result in **no impact** related to increased flood risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Recreation Areas

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The proposed Recreation Areas would encompass a total of approximately 500 acres, which is less than 1 square mile. Assuming the 1 square mile was completely covered by new impervious surface areas, such as asphalt parking lots, this would still account for less than approximately 2 percent of the 83-square-mile Sites Reservoir watershed drainage area, which is too small to cause a significant difference in runoff from the runoff that occurs in that area (Reclamation, 2012). Therefore, construction, operation, and maintenance of the proposed Recreation Areas would not substantially alter the existing drainage patterns or a stream or river course, nor substantially increase surface runoff, resulting in a **less-than-significant impact**, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

If Alternative A is implemented, the proposed Recreation Areas would not be developed within a 100-year flood hazard area. Therefore, their construction, operation, and maintenance would result in **no impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If Alternative A is implemented, there would be no dams or levees associated with the proposed Recreation Areas. Therefore, construction, operation, and maintenance of the proposed Recreation Areas would result in **no impact** related to increased flood risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Road Relocations and South Bridge

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

If Alternative A is implemented, construction activities would include the relocation of portions of the existing Maxwell Sites Road and Sites Lodoga Road, and construction of the South Bridge across Sites Reservoir. This road relocation alignment, which includes the new South Bridge crossing, would be paved during construction and maintained as such during operation, but would not add significant new paved road area relative to the existing roadway alignment. In addition, this road relocation alignment would not cross any streams, and therefore, would not alter the course of a stream during construction or operation.

The temporary construction roads and additional permanent access roads, such as those to the proposed Recreation Areas and Project facilities, would be constructed and operated as unpaved (gravel) roads, and in turn, would not significantly contribute to surface runoff. In addition, these roads would not cross any streams, and therefore, would not alter the course of a stream during construction or operation. The only exception would be the proposed Eastside Road, which would be paved for approximately 4 miles at its southern end, and would cross Funks Creek approximately 0.4 mile downstream of the proposed Golden Gate Dam. The portion of the road that would be paved during construction and maintained as such during operation would not add significant new paved road area. The Funks Creek crossing would require the installation of a culvert; this activity would occur during the period that the creek is diverted. Although slight alteration of the course of the creek would occur during diversion, it would not result in flooding because bypass flows would be controlled during construction, and the course of the stream would be restored prior to operation. During operation, upstream flows would be controlled by releases from Sites Reservoir.

Road maintenance activities, such as chip sealing, patching, grading, vegetation control, and repair of damaged guardrails or fencing, and minor bridge or culvert maintenance, would consist of debris removal, and would not alter existing drainage patterns or alter the course of a stream. Therefore, construction, operation, and maintenance of the road relocations, new South Bridge, and new access roads combined would not substantially alter existing drainage patterns or stream courses and would not increase surface runoff, resulting in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

If Alternative A is implemented, the northeast end of the proposed Sulphur Gap Road, where it would connect with the existing Maxwell Sites Road, would be constructed within a portion of Stone Corral Creek's 100-year flood hazard area. However, only a small portion of flood hazard area would be affected by the proposed roadway during construction, and during operation, Sites Reservoir would substantially reduce flood flows associated with Stone Corral Creek by capturing runoff from a large portion of the upstream watershed. Road maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the proposed road would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

If Alternative A is implemented, there would be no dams or levees associated with the proposed Road Relocations and South Bridge. Therefore, the construction, operation, and maintenance of the Road Relocations and the South Bridge would result in **no impact** related to increased flood risks including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Glenn-Colusa Irrigation District Canal Facilities Modifications

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The proposed GCID Main Canal Facilities modifications (including the new headgate structure, 200 feet of canal lining, and railroad siphon replacement) would not drastically alter the existing canal structure. In addition, operation and maintenance activities are expected to be similar to those of the existing canal. Construction, operation, and maintenance activities associated with the GCID Main Canal Facilities modifications would not alter the course of a natural stream or river and would not substantially alter existing drainage patterns or increase runoff. Therefore, construction, operation, and maintenance of the proposed GCID Main Canal Facilities modifications would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

Most of the existing GCID Main Canal does not pass through a 100-year flood hazard area except for the north end, which passes through a 100-year flood hazard area associated with primarily Colusa Basin Drain flows. However, the proposed GCID Main Canal Facilities modifications that would occur during Project construction would be made to the existing canal and thus would not further impede or redirect 100-year flood flows more than the existing canal. In addition, operation and maintenance activities would be similar to those performed at the existing canal. Therefore, construction, operation, and maintenance of the proposed GCID Main Canal Facilities modifications would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

The existing GCID Main Canal Facilities are located on a non-leveed bypass channel that diverts Sacramento River flows. Because no levees or dams are associated with the GCID Main Canal Facilities, construction, operation, and maintenance the proposed modifications would have no impact on levees or dams, and therefore, no associated potential flood risk impacts due to levee or dam failure. Therefore, construction, operation, and maintenance of the proposed GCID Main Canal Facilities modifications would result in **no impact** related to increased flood risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Holthouse Reservoir Complex

Preliminary feasibility studies indicate that Holthouse Reservoir would need an active storage of approximately 6,250 acre-feet (approximately three times larger than the existing Funks Reservoir storage), covering a surface area of approximately 450 acres (approximately two times larger than the existing Funks Reservoir surface area) and with maximum dam embankment heights of 48 feet above existing grade (Reclamation, 2012).

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

Dredging of the existing Funks Reservoir, as well as the construction of the Holthouse Reservoir Complex, would require the diversion of Funks Creek. Although alteration of the course of the creek would occur, it would not result in flooding because bypass flows would be controlled during construction.

The proposed Funks Reservoir enlargement that would result from construction of the adjacent Holthouse Reservoir would not be a large enough increase to substantially alter drainage patterns around the existing Funks Reservoir. In addition, during operation, the upstream Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Operation and maintenance activities associated with the larger Holthouse Reservoir Complex are expected to be similar to those of the existing Funks Reservoir and would not increase the risk of flooding from existing conditions in the area. Maintenance of the existing Funks Reservoir would include road, vegetation, and fence maintenance, and debris removal. Funks Reservoir is also drained annually. These maintenance activities are expected to be the same for Holthouse Reservoir. Therefore, construction, operation, and maintenance of the Holthouse Reservoir Complex and dredging of the existing Funks Reservoir, would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Action/No Project Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

Funks Reservoir is an existing structure; an evaluation of **Impact Flood-2** is therefore not applicable to that Project feature. The Holthouse Reservoir Complex would be constructed within a Special Flood Hazard Area associated with Funks Creek 100-year flood flows. However, during construction, the flows from Funks Creek would be controlled with a diversion system. During operation, the larger Holthouse Reservoir would likely not impede 100-year flood flows more so than the existing Funks Reservoir, which is located within the same Special Flood Hazard Area. In addition, operation of Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities are expected to be similar to those of the existing Funks Reservoir for Holthouse Reservoir, and would involve washing and vegetation control for associated facilities; these activities would not place additional structures within the Special Flood Hazard Area.

Therefore, construction, operation, and maintenance of the Holthouse Reservoir Complex would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/ No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

As designed, the 6,250-acre-foot Holthouse Reservoir, which is an expansion of the existing Funks Reservoir, would be a jurisdictional reservoir.[4] For jurisdictional reservoirs, DSOD oversees the dam design and permitting processes and usually requires a dam break analysis as part of the design and permitting process. However, Holthouse Dam would be designed and constructed pursuant to the same conservative guidelines and criteria designed to prevent failure as described for Sites Reservoir. These design standards would protect the dam from seismic or other failure, and would, therefore, result in a **less-than-significant impact** on the risk of loss, injury, or death related to flooding caused by dam failure, when compared to the Existing Conditions/No Project/No Action Condition. Holthouse Reservoir would also be constructed with a maximum emergency spillway discharge capacity of 15,200 cfs to pass the equivalent Sites Reservoir emergency drawdown flows required by DSOD, which would be discharged directly into Funks Creek via the inlet/outlet works (Reclamation, 2012). Some of this emergency drawdown could also be attenuated by the TRR, or could be released via the Delevan Pipeline, the Tehama-Colusa Canal, or the GCID Main Canal. However, the risk of an event requiring such an emergency release remains very small. Because the probability of the emergency release event occurring is so remote, the Holthouse Reservoir Complex would have a **less-than-significant impact** on the risk of loss, injury, or death due to flooding caused by emergency reservoir releases, when compared to the Existing Conditions/No Project/No Action Condition.

Maintenance activities associated with Holthouse Reservoir are expected to be similar to those of the existing Funks Reservoir and would not be expected to exposed people to increased flood risks. Therefore, maintenance of the Holthouse Reservoir Complex would result in a **less-than-significant impact** on the exposure of people to increased flood risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Terminal Regulating Reservoir, Terminal Regulating Reservoir Pumping/Generating Plant, Terminal Regulating Reservoir Electrical Switchyard, Glenn-Colusa Irrigation District Canal Connection to the Terminal Regulating Reservoir, Terminal Regulating Reservoir Pipeline, and Terminal Regulating Reservoir Pipeline Road

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The portion of these TRR facilities that would be constructed and operated above ground would not be located near a stream and do not have a large enough footprint to substantially alter existing drainage patterns. In addition, operation of the upstream Sites Reservoir would substantially reduce flood flows in this area associated with Funks Creek by capturing runoff from a large portion of the upstream watershed, as well as by limiting post-construction flows to Funks Creek downstream of Golden Gate Dam.

Maintenance activities, such as vegetation clearing and necessary repairs to the TRR Pipeline Road, would not substantially affect runoff in the area. However, the draining and dredging of the reservoir, which would occur every seven to 10 years depending on sediment accumulation, would require releases from the reservoir to Funks Creek via the TRR to Funks Creek Pipeline. Although these releases would

[4] A Jurisdictional Reservoir is a reservoir for which DSOD has design and construction permitting jurisdiction. A main threshold for DSOD jurisdiction is a minimum 6-foot height requirement.

increase creek flows, releases would be controlled with an energy dissipater and small concrete structure at the terminal end of the pipeline to avoid exceeding the capacity of the creek channel. Therefore, construction, operation, and maintenance of these TRR facilities would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

The TRR, TRR Pumping/Generating Plant, TRR Electrical Switchyard, GCID Main Canal Connection to the TRR, and TRR Pipeline Road would be constructed and operated within a 100-year flood hazard area associated with Funks Creek. These above-ground structures may impede 100-year flood flows; however, Sites Reservoir would substantially reduce these 100-year flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities associated with these facilities would not place additional structures within the flood hazard area. Therefore, construction, operation and maintenance of these TRR facilities would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

The TRR Pipeline and TRR to Funks Creek Pipeline would both be constructed within a 100-year flood hazard area associated with Funks Creek. Both pipelines would be buried a minimum of 10 feet (to top of pipe) below the ground surface. The only above-ground features associated with both pipelines would be blow off and air valves, each of which would occupy a small area of land. Once installed, surface grading would be restored above the pipelines such that operation of these pipelines would not significantly impede or redirect flood flows or increase flooding hazards in other areas. The pipelines would thus not impede 100-year flood flows. Therefore, construction, operation and maintenance of the TRR Pipeline and the TRR to Funks Creek Pipeline would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Because of safety factors that are built into current engineering design practices, the probability of dam failure, in general, is extremely small. The TRR is expected to be considered jurisdictional by DSOD because the preliminary designed embankment height would be greater than six feet. A dam break analysis has not yet been performed, but the TRR would be designed and constructed pursuant to the same conservative guidelines and criteria designed to prevent failure as described for Sites Reservoir. These design standards would protect the dam from seismic or other failure, and would, therefore, result in a **less-than-significant impact** related to the risk of loss, injury, or death due to flooding caused by dam failure, when compared to the Existing Conditions/No Project/No Action Condition. Additionally, an Emergency Action Plan would be prepared to comply with FEMA, Federal Energy Regulatory Commission, and DSOD regulations.

Reservoir design would allow emergency releases during operation first to the GCID Main Canal, and then to Funks Creek via the TRR to Funks Creek Pipeline. Although these releases would increase creek flows, releases would be controlled with an energy dissipater and small concrete structure at the terminal end of the pipeline to avoid exceeding the capacity of the creek channel. In addition, the risk of an event requiring such an emergency release remains very small. Therefore, the TRR facilities would result in a

less-than-significant impact on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Sites/Delevan Overhead Power Line

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The Sites/Delevan Overhead Power Line would be operated as an entirely above-ground Project facility, except for its tower or pole footings. Construction of the required footings for the 13-mile-long overhead power line would create a total permanent ground disturbance of approximately 5 acres. However, given that the footings would not be a continuous strip of concrete (i.e., they would be spaced apart), this land area disturbance would not significantly alter the existing drainage area or runoff patterns of the overhead power line alignment area. In addition, tower or pole footings would be sited to avoid stream crossings, and therefore, would not alter the course of a stream. Maintenance activities, including equipment inspections and vegetation maintenance, would not alter drainage patterns or alter the course of a stream. Therefore, construction, operation, and maintenance of the Sites/Delevan Overhead Power Line would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

Approximately half of the length of the above-ground Sites/Delevan Overhead Power Line would be located within the northern portion of a designated 100-year flood hazard area associated with primarily Colusa Basin Drain flows. Although the overhead power line would be operated as an entirely above-ground facility, the construction of the required overhead power line footings for the entire 13-mile- length of the overhead power line would create a total ground disturbance of approximately 5 acres. Approximately half of these footings would be located within a flood hazard area. However, the footings would be spaced apart, and their individual small footprint would not significantly impede 100-year flood flows. Maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the Sites/Delevan Overhead Power Line would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with the Sites/Delevan Overhead Power Line. Therefore, construction, operation, and maintenance of the Sites/Delevan Overhead Power Line would result in **no impact** related to increased flooding risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Delevan Pipeline

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The Delevan Pipeline would be constructed as an underground facility, generally buried 10 feet below the ground surface. The pipeline would cross the Colusa Basin Drain at the northern end of the drain. Construction at this crossing would likely occur during late fall after the irrigation season ends and before winter rains begin. Despite the timing, a portion of the CBD would likely need to be dewatered, with any existing flows bypassed around the construction site. This construction at the crossing would be accomplished by installing the pipeline in stages and bypassing flows on one side of the channel following the construction of a cofferdam. The slight alteration of the course of this waterway would not substantially alter drainage patterns. After installation of the pipeline, the CBD would be returned to a full channel and would be reconstructed to pre-project conditions. Once installed, surface grading would be restored above the pipeline such that it would not significantly alter the existing area drainage pattern. The only above-ground components associated with the operation of the Delevan Pipeline would be manholes and blow off and air valves, each of which would occupy a small area of land, and would, therefore, not impede or redirect flood flows. Maintenance activities, including periodic inspections, would not affect drainage patterns or runoff. Therefore, construction, operation, and maintenance of the Delevan Pipeline would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

The Delevan Pipeline would cross the northern portion of a designated 100-year flood hazard area associated with Funks Creek and Colusa Basin Drain flows. However, the Delevan Pipeline would be constructed as an underground facility, and therefore, would not impede or redirect flows.

Once the pipeline is installed, surface grading would be restored above the pipeline such that it would not significantly impede or redirect flood flows or increase flooding hazards in other areas. The only above-ground components associated with operation of the Delevan Pipeline would be manholes and blow off and air valves, each of which would occupy a small area of land. These above-ground components would not impede 100-year flood flows. In addition, Sites Reservoir would substantially reduce flood flows associated with Funks Creek by capturing runoff from a large portion of the upstream watershed. Maintenance activities would not place additional structures within the flood hazard area. Therefore, construction, operation, and maintenance of the Delevan Pipeline would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

No dams or levees are associated with the Delevan Pipeline. Therefore, construction, operation, and maintenance of the Delevan Pipeline would result in **no impact** related to increased flooding risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Delevan Pipeline Intake/Discharge Facilities

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

The proposed Delevan Pipeline Intake/Discharge Facilities would be constructed adjacent to the Sacramento River, where an existing flood protection levee separates the river from upland areas. The proposed footprint would not cover an area large enough to substantially alter existing drainage patterns or increase surface runoff. During construction and operation, the facility would be surrounded by a wide berm or ring levee that would have impacts on drainage patterns and surface runoff similar to those of the existing levee, and therefore, would not increase the risk of flooding. The proposed intake would require the construction of a large fish screen, which would be located on the west side of the river channel immediately downstream of the Maxwell ID Pumping Plant. During construction, a sheet-pile cofferdam that would extend approximately 40 feet into the river channel would be required to allow dewatering of the construction area. The cofferdam would be removed when construction is complete, but the operating fish screen would continue to extend into the river channel. In-channel structures have the potential to alter the course of the river. However, the preliminary fish screen was designed to not protrude into the river channel in a manner that would substantially alter the river channel. In addition, the upstream Maxwell ID Pumping Plant is located in a narrow section of the river and consequently acts as a local flow control point (Reclamation, 2012). Maintenance of the facilities would not alter drainage patterns or affect surface runoff.

Therefore, construction, operation, and maintenance of the Delevan Pipeline Intake/Discharge Facilities would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Action/No Project Alternative.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

The Delevan Pipeline Intake/Discharge Facilities would be located adjacent to the Sacramento River within an area protected from the 100-year flood by existing levees along the Sacramento River. The Project includes improvements to the levee in the area of the intake to enhance the flood protection for this facility. An earthen setback levee (or ring levee around the site) would be installed for protection during construction and would remain a permanent structure to provide secondary containment of the Sacramento River in the event of a flood in the area. These above-ground structures would not impede 100-year flood flows during operation.

In addition, preliminary analysis shows that the proposed fish screen would not substantially impact the water surface elevation at high flows. Water surface elevations with the proposed fish screen are not expected to be significantly different than without the fish screen. The existing Maxwell ID Pumping Plant upstream from the proposed intake location would be the controlling structure, causing greater changes on Sacramento River water surface elevations at high flows than the proposed Delevan Pipeline Intake/Discharge Facilities (Reclamation, 2012). Maintenance activities would not place additional structures within a flood hazard area. Therefore, construction, operation, and maintenance of the Delevan Pipeline Intake/Discharge Facilities would result in a **less-than-significant impact** on 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee or Dam

Construction of the Delevan Pipeline Intake/Discharge Facilities would require modification of the existing flood protection levee along the Sacramento River. Construction work along the existing levee has the potential to destabilize adjacent levee segments and, under worst-case conditions, cause their failure. DWR's and Reclamation's construction contractor would use standard geotechnical engineering practices related to the stabilization and compaction of soils during and after work around the levee for the Delevan Pipeline Intake/Discharge Facilities to ensure that the integrity of the levee is not compromised. Such practices include soil densification of foundation soils to improve their stabilization and reduce potential liquefaction. Construction plans, specifications, and inspections would be cooperative with the CVFPB, as appropriate. It is unlikely that these facilities would significantly change the degree of protection of people and property behind the levee or result in an increased risk of levee failure.

Operation of the intake facilities would require the construction and operation of a forebay and afterbay. The forebay would be located on the river side of the existing Sacramento River levee, and would pass water to the concrete-lined afterbay through levee tubes that would pass under the existing levee. A new berm or ring levee would be constructed to enclose the afterbay. The remaining facilities would be constructed and operated on top of the berm. During extreme flood events on the river, the forebay and afterbay would be inundated, but these facilities and the levees would be designed to withstand these conditions. Maintenance activities would include the removal of sediment from the afterbay sediment spoil area. Sediment would be removed using a long arm excavator and suction dredge from within the afterbay and would not affect the levees. Therefore, construction, operation, and maintenance of the Delevan Pipeline Intake/Discharge Facilities would result in a **less-than-significant impact** related to increased flooding risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

Project Buffer

Impact Flood-1: Substantially Alter the Existing Drainage Pattern of the Site or Project Area, Including through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-site

If Alternative A is implemented, construction-related activities within the Project Buffer would include fence construction, demolition of several existing structures, and the creation of a fuelbreak. Ground disturbance associated with fence construction would consist of digging post holes. The existing structures to be demolished within the Project Buffer would include residences, sheds, shops, and barns. A fuelbreak would be created around the perimeter of the buffer. Fence construction, structure demolition, and the creation of a fuelbreak would likely slightly alter the course of a stream but would not increase the rate of runoff in a manner that would result in flooding, because the footprint of the fence posts and structures, as well as the area of the fuelbreak, represent a fraction of the acreage included in the Project Buffer. Therefore, construction activities within the Project Buffer would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff within the Primary Study Area, when compared to the Existing Conditions/No Project/No Action Condition.

Post-construction, Project operations and maintenance activities for the new fence and the fuelbreak within the Project Buffer would result in a **less-than-significant impact** on existing drainage patterns, stream courses, or surface runoff, when compared to the Existing Conditions/No Project/No Action Condition, because the land would be managed as undeveloped open space that would buffer Project facilities from surrounding land uses.

Impact Flood-2: Place within a 100-year Flood Hazard Area Structures Which Could Impede or Redirect Flood Flows

If Alternative A is implemented, the only new structures that would be installed within the Project Buffer would be fence posts. Fence construction, or the presence of the fence posts during operation, would not impede or redirect flood flows because the footprint of the fence posts represents a fraction of the acreage included in the Project Buffer. Maintenance activities would not place additional structures within the Project Buffer. Therefore, construction, operation, and maintenance of the Proposed Project Buffer would result in **no impact** to 100-year flood flows, when compared to the Existing Conditions/No Project/No Action Condition.

Impact Flood-3: Expose People or Structures to a Significant Risk of Loss, Injury, or Death from Flooding, Including Flooding as a Result of the Failure of a Levee *or* ***Dam***

If Alternative A is implemented, no dams or levees would be needed for the land acquisition or demarcation of the Project Buffer, and the Project Buffer would have no effect on an existing levee or dam. Removal of the existing structures would reduce the number of people and structures exposed to dam failure. Therefore, construction, operation, and maintenance of the Project Buffer would result in **no impact** related to increased flooding risks, including potential flooding due to a levee or dam failure, when compared to the Existing Conditions/No Project/No Action Condition.

9.3.5 Impacts Associated with Alternative B

9.3.5.1 Extended Study Area – Alternative B

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use, and San Luis Reservoir

As with Alternative A, there would be no direct Project-related construction or maintenance within the CVP and SWP service areas of the Extended Study Area. There would also be no new Project-related structures located within the Extended Study Area for Alternative B. If Alternative B is implemented water level fluctuations in the San Luis Reservoir would remain within the historical range of operation. Therefore, there would be **no impacts** associated with Alternative B related to drainage patterns, stream courses, or surface runoff (**Impact Flood-1)**, 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**), would be the same as described for Alternative A for the Extended Study Area.

9.3.5.2 Secondary Study Area – Alternative B

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay

There would be no direct Project-related construction at any of these facilities or areas within the Secondary Study Area for Alternative B other than the installation of two additional pumps in existing bays at the Red Bluff Pumping Plant. The additional pumps would not alter the existing drainage pattern or the sites, alter a stream course, or increase the amount of surface runoff. As described for Alternative A, there would be no impacts due to the construction, operation, and maintenance of Alternative B, as related to drainage patterns, stream courses, or surface runoff (**Impact Flood-1)** and 100-year flood flows (**Impact Flood-2**) within the Secondary Study Area.

Impacts from the construction and maintenance of Alternative B due to increased flooding risks (**Impact Flood-3**) within the Secondary Study Area would be similar to those described for Alternative A. Operational changes as a result of the larger 1.8-MAF Sites Reservoir with two conveyances for Alternative B, as opposed to the 1.3-MAF Sites Reservoir with three conveyances for Alternative A, are slightly different. However, the difference in average end-of-month elevation at the Secondary Study Area flood control reservoirs is still less than 5 percent (Appendix 6B Water Resources System Modeling). Therefore, compared to the Existing Conditions/No Project/No Action Condition, operation of Alternative B would result in a **less-than-significant impact.**

9.3.5.3 Primary Study Area – Alternative B

Construction, Operation, and Maintenance Impacts

Many of the same Project facilities are included in both Alternatives A and B (see Table 3-1 in Chapter 3 Description of the Sites Reservoir Project Alternatives). Alternative C would have the same recreation areas, and the Holthouse Complex and TRR Complex would be the same as for Alternative A. These facilities would require the same construction methods and operations and maintenance activities regardless of alternative; they would, therefore, result in the same construction, operation, and maintenance impacts on flood control and management. Therefore, unless explicitly discussed below, impacts for all Project facilities are anticipated to be the same as previously discussed for Alternative A.

The proposed 1.8-MAF Sites Reservoir associated with implementation of Alternative B would require the construction of two main dams and nine saddle dams, as compared with seven saddle dams for Alternative A. The crest elevation of all dams would be 540 feet, providing 20 feet of freeboard above the maximum operating elevation of 520 feet. The signal spillway elevation would be at 525.5 feet. The larger reservoir would have a “morning Glory” spillway that would be constructed pursuant to the same conservative guidelines and criteria designed to prevent failure as described for Alternative A. The larger Alternative B reservoir and associated dams would capture flood flows on Funks and Stone Corral creeks and control downstream releases to these creeks as described for Alternative A, and therefore, would have the same impacts on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**) as described for Alternative A.

The additional saddle dams associated with implementation of Alternative B would require additional saddle dam access roads. However, the slight extension of the saddle dam access roads would result in the same impacts on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**) as described for Alternative A.

If Alternative B is implemented, the proposed Sites/Delevan Overhead Power Line would extend from only the Inlet/Outlet Structure to the existing PG&E or WAPA transmission line and consequently would not cross the Special Flood Hazard Area. The shorter overhead power line would require fewer concrete footings, thus creating a smaller land disturbance footprint than the Alternative A overhead power line configuration. These reduced effects would result in the same level of significance of impacts to drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**) as was described for Alternative A.

The Delevan Pipeline Discharge Facilities would be replaced with the smaller discharge-only facility, which would not extend into the river channel and, therefore, would not alter the course of a stream. The discharge facility would require similar levee modifications as the Delevan Pipeline Discharge Facilities. The smaller footprint would have similar impacts on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks **(Impact Flood-3)** as was described for Alternative A.

The boundary of the Project Buffer would be the same for Alternatives A and B, but because the footprints of some of the Project facilities that are surrounded by the Project Buffer would differ between the Project alternatives, the acreage of land within the Project Buffer would also differ. However, this difference in the size of the buffer would not change the type of construction, operation, and maintenance activities that were described for Alternative A. It would, therefore, have the same impact on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as was described for Alternative A.

9.3.6 Impacts Associated with Alternative C

9.3.6.1 Extended Study Area – Alternative C

<u>Construction, Operation, and Maintenance Impacts</u>

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use, and San Luis Reservoir

As with Alternative A, there would be no direct Project-related construction or maintenance within the CVP and SWP service areas of the Extended Study Area. There would also be no new Project-related structures located within the Extended Study Area for Alternative C. If Alternative C is implemented, water level fluctuations in the San Luis Reservoir would remain within the historical range of operation. Therefore, the impact of Alternative C on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** would be the same as described for Alternative A for the Extended Study Area.

9.3.6.2 Secondary Study Area – Alternative C

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay

There would be no direct Project-related construction at any of these facilities or areas within the Secondary Study Area for Alternative C other than the installation of two additional pumps in existing bays at the Red Bluff Pumping Plant. The additional pumps would not alter the existing drainage pattern or the sites, alter a stream course, or increase the amount of surface runoff. The impact of Alternative C on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**) and 100-year flood flows (**Impact Flood-2**) within the Secondary Study Area would be the same as described for Alternative A.

Impacts from the construction and maintenance of Alternative C due to increased flooding risks (**Impact Flood-3**) within the Secondary Study Area would be similar to those described for Alternative B. Operational changes as a result of the larger 1.8-MAF Sites Reservoir with two conveyances for Alternative C, as opposed to the 1.3-MAF Sites Reservoir with three conveyances for Alternative A, are slightly different. However, the difference in average end of month elevation at the Secondary Study Area flood control reservoirs is still less than 5 percent (Appendix 6B Water Resources System Modeling). Therefore, compared to the Existing Conditions/No Project/No Action Condition, operation of Alternative C would result in a **less-than-significant impact.**

9.3.6.3 Primary Study Area – Alternative C

Construction, Operation, and Maintenance Impacts

Many of the same Project facilities are included in Alternatives A and C (see Table 3-1 in Chapter 3 Description of the Sites Reservoir Project Alternatives). These facilities, mainly the recreation areas and facilities in the Holthouse and TRR complexes, would require the same construction methods and operations and maintenance activities regardless of alternative; they would, therefore, result in the same construction, operation, and maintenance impacts on flood control. Therefore, unless explicitly discussed below, impacts related to all Project facilities are anticipated to be the same as those for Alternative A.

The boundary of the Project Buffer would be the same for all project alternatives, but because the footprints of some of the Project facilities that are included in the Project Buffer would differ between the alternatives, the acreage of land within the Project Buffer would also differ. However, these differences in the size of the area included within the buffer would not change the type of construction, operation, and maintenance activities that were described for Alternative A. They would, therefore, have the same impact on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** as described for Alternative A.

9.3.7 Impacts Associated with Alternative D

9.3.7.1 Extended Study Area – Alternative D

Construction, Operation, and Maintenance Impacts

As with Alternative A, there would be no direct Project-related construction or maintenance within the CVP and SWP service areas of the Extended Study Area. There would also be no new Project-related structures located within the Extended Study Area for Alternative D. If Alternative D is implemented water level fluctuation in the San Luis Reservoir would fall within the historic range of operation. The impact of Alternative D on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3)** would be the same as described for Alternative A for the Extended Study Area.

9.3.7.2 Secondary Study Area – Alternative D

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River Downstream of the Trinity River, Whiskeytown Lake, Spring Creek, Shasta Lake, Sacramento River, Keswick Reservoir, Clear Creek, Lake Oroville, Thermalito Complex (Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay), Feather River, Sutter Bypass, Yolo Bypass, Folsom Lake, Lake Natoma, American River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay

There would be no direct Project-related construction at any of these facilities or areas within the Secondary Study Area for Alternative B other than the instillation of additional pumps in existing bays at the Red Bluff Pumping Plant. The additional pumps would not alter the existing drainage pattern or the sites, alter a stream course, or increase the amount of surface runoff. The impact of Alternative D on drainage patterns, stream courses, or surface runoff (**Impact Flood-1**) and 100-year flood flows (**Impact Flood-2**) within the Secondary Study Area would be the same as described for Alternative A, with minor exceptions.

Impacts from the construction and maintenance of Alternative D due to increased flooding risks (**Impact Flood-3**) within the Secondary Study Area would be similar to those described for Alternative C.

As indicated by the water surface elevation data (Appendix 6B Water Resources System Modeling), cooperative operation with Sites Reservoir would not increase flood risks as a result of significantly higher water surface elevations in flood control reservoirs in the Secondary Study Area during wet and above-normal water year types. Therefore, compared to both the Existing Conditions/No Project/No Action Condition, operation of Alternative D would result in a **less-than-significant impact** as a result of increased flooding risks, including potential flooding from a levee or dam failure, within the Secondary Study Area.

9.3.7.3 Primary Study Area – Alternative D

Construction, Operation, and Maintenance Impacts

Many of the same Project facilities are included in Alternatives A, B, C, and D (see Table 3-1 in Chapter 3 Description of the Sites Reservoir Project Alternatives). These facilities would require the same construction methods and operations and maintenance activities; they would, therefore, result in the same impacts to flood control.

Therefore, unless explicitly discussed below, impacts for Alternative D facilities would have the same impacts described for Alternative A as they relate to drainage patterns, stream courses, and surface runoff (**Impact Flood-1**), 100-year flood flows (**Impact Flood-2**), and flooding risks (**Impact Flood-3**); the following features are exclusive to Alternative D:

- Alternative D would include the development of only two recreation areas (Stone Corral Recreation Area and Peninsula Hills Recreation Area) instead of up to five recreational areas for each of the other alternatives. Alternative D would also include a boat ramp on the western side of the reservoir, where the existing Sites Lodoga Road would be inundated. Only two recreational areas under Alternative D is not expected to substantially change the potential impacts to flood control and management.
- Under Alternative D, the TRR would be slightly smaller; however, this difference is not expected to change the potential impacts related to flood control and management as compared to Alternative C.
- For Alternative D, the Delevan Pipeline alignment would be approximately 50 to 150 feet south of the alignment for Alternatives A, B, and C. This alignment takes advantage of existing easements to reduce impacts on local landowners. The shift in alignment is not expected to change the potential impacts to flood control and management.
- The boundary of the Project Buffer would be the same for all alternatives, but because the footprints of some Project facilities that are included in the Project Buffer would differ among the alternatives, the acreage of land within the Project Buffer would also differ. However, the differences in area included within the buffer would not change the type of construction, operation, and maintenance activities and would have similar impacts as described for all other alternatives.
- Alternative D would include a north-south alignment of the Delevan Overhead Power Line rather than the west-east alignment between the TRR and the Delevan Pipeline Intake/Discharge Facilities. Additionally, Alternative D would include an electrical substation west of Colusa in addition to the substation located near Holthouse Reservoir.
- The Alternative D proposed north-south alignment of the Delevan Overhead Power Line and related substation is not anticipated to result in different impacts on flood control and management than the east-west line alignment described above for the other alternatives. The north-south alignment would be approximately 1 mile longer; however, it would be located in or near an existing transportation and utility corridor for SR 45, and is not expected to change the potential impacts related to flood control and management.
- Under Alternative D, the Lurline Headwaters Recreation Area would not be constructed; therefore an access road to that recreation area would not be required. Alternative D does include an additional 5.2 miles of roadway from Huffmaster Road to Leesville Road; otherwise, the design of the Sites Reservoir Inundation Area and Dams and South Bridge would be the same as Alternative C and is not expected to change the potential impacts related to flood control and management.

9.4 Mitigation Measures

Because no significant or potentially significant impacts were identified, no mitigation is required or proposed. A summary of design criteria and proposed monitoring for potential seismic-related impacts is included in all Project alternatives, and discussed in Chapter 3 Description of the Sites Reservoir Project Alternatives.

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