DEPARTMENT OF WATER RESOURCES
DIVISION OF FLOOD MANAGEMENT
P.O. BOX 219000
SACRAMENTO, CA 95821-9000

Notice of Preparation of an Environmental Impact Report

Environmental Permitting for Operations and Maintenance Project

May 11, 2015

Prepared by:
California Department of Water Resources
Division of Flood Management
Flood Maintenance Office
3310 El Camino Avenue, Suite 100
Sacramento, California 95821

NOTICE OF PREPARATION

ENVIRONMENTAL IMPACT REPORT FOR ENVIRONMENTAL PERMITTING FOR OPERATIONS AND MAINTENANCE

CALIFORNIA DEPARTMENT OF WATER RESOURCES

To: Responsible Agencies and Interested Parties

The California Department of Water Resources (DWR) Flood Maintenance Office (FMO) implements ongoing operations and maintenance (O&M) activities on levees, within channels, and on appurtenant structures that are part of the Sacramento River Flood Control Project (SRFCP), a component of the State Plan of Flood Control (SPFC) along the Sacramento River and tributaries. The goal of O&M is to continue the useful life of the SPFC facilities and provide for public safety and proper functioning of flood control facilities. O&M activities to operate and maintain the SRFCP are the responsibility of FMO's Sutter and Sacramento Maintenance Yards and include: (1) levee maintenance (rodent abatement and damage repair, vegetation management, erosion repair, levee crown and access road maintenance, encroachment removal, seepage and stability berm construction, and fencing/levee protection); (2) channel maintenance (e.g., sediment removal, debris/obstruction removal, vegetation management, and channel scour repair); (3) flood control structure maintenance and repair (pumping plants, weirs and outfall gates, and bridge maintenance and repair, and pipe/culvert repair, replacement and abandonment); and (4) data collection. A detailed description of the proposed O&M activities is included in the attached project description. To support a streamlined approach to permitting of O&M activities associated with flood protection for the SRFCP (summarized above) and required environmental review, DWR is preparing an Environmental Impact Report (EIR). DWR anticipates that the EIR will provide environmental analysis sufficient to support the issuance of state permits and other regulatory decisions (proposed Project) applicable to the conduct of O&M, including but not limited to an agreement pursuant to Fish and Game Code section 1600 et seq. and, if applicable, a "Take" permit pursuant to Fish and Game Code section 2081.

To satisfy California Environmental Quality Act (CEQA) requirements (California Public Resources Code Section 21000 et seq.), DWR, the "Lead Agency" under CEQA, has determined that the proposed project may have potentially significant impacts on the environment and that an EIR will be required. This Notice of Preparation (NOP) for the proposed EIR is issued pursuant to Section 15082 of the State CEQA Guidelines.

DWR is soliciting the views of interested persons, organizations, and agencies regarding the scope and content of the environmental information in connection with the proposed project. In addition, each responsible agency shall provide DWR with specific detail about the scope, significant environmental issues, reasonable alternatives, and mitigation measures related to each responsible agency's area of statutory responsibility that must be explored in the EIR. In accordance with CEQA Guidelines Section 15082(b)(1)(B), responsible and trustee agencies should indicate their respective level of responsibility for the project in their response.

The following is a list of responsible and trustee agencies identified for this project: The U.S. Army Corps of Engineers; U.S. Fish and Wildlife Service; National Marine Fisheries Service; California Department of Fish and Wildlife; Central Valley Flood Protection Board; Central Valley Regional Water Quality Control Board; State Water Resources Control Board; State Lands Commission; California Department of Parks and Recreation; University of California; and the California Department of Conservation.

All comments received will be made available for public review in their entirety, including the names and addresses of the respondents. Individual respondents may request that their name and/or address be withheld from public disclosure. DWR will honor such requests to the extent allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment.

This NOP will be circulated for a public response period beginning Monday May 11, 2015 and ending Tuesday June 9, 2015. At the end of the public response period, DWR will consider all comments received from interested persons, organizations, and agencies in preparing the environmental analysis to be included in the EIR.

A scoping meeting will be held to receive written and oral input on the scope and content of the EIR. The scoping meeting will be held on May 19, 2015 at from 2:00 to 4:00 p.m. at the following location:

May 19, 2015
2 to 4 pm
California Department of Water Resources
Division of Flood Management
3310 El Camino Avenue
Sacramento, CA 95821

Please note that a valid photo identification is required when you check in with building security. Please submit your written comments on the scope of the EIR at the earliest possible date, but no later than 5 p.m. on Tuesday June 9, 2015:

California Department of Water Resources
Division of Flood Management
Attention: Scott Kranhold, Senior Environmental Scientist (Specialist)
3310 El Camino Ave, Room 100
Sacramento, CA 95821
jkranhol@water.ca.gov

The following information includes project background, project objectives, a preliminary project description and a summary of possible environmental effects anticipated to be evaluated in the EIR. Comments received on the NOP could identify additional potential environmental impacts to be evaluated in the EIR.

ENVIRONMENTAL PERMITTING FOR OPERATIONS AND MAINTENANCE

Introduction

The California Department of Water Resources (DWR) on behalf of the State of California, as required by the California Water Code, operates and maintains facilities of the State-federal flood protection system within the Sacramento Valley of California, per assurances provided to the federal government by the State through Central Valley Flood Protection Board (formerly the Reclamation Board). DWR is provided authority and responsibility for this public safety flood protection charge in California Water Code Sections 8361 and 12878. Specifically DWR's Flood Maintenance Office (FMO) implements ongoing operations and maintenance (O&M) activities on levees, within channels, and on appurtenant structures that are part of the Sacramento River Flood Control Project (SRFCP), a component of the SPFC along the Sacramento River and tributaries. The goal of O&M is to continue the useful life of the SPFC facilities and provide for public safety and proper functioning of flood control facilities. O&M activities to operate and maintain the SRFCP are the responsibility of FMO's Sutter and Sacramento Maintenance Yards and include: (1) levee maintenance (e.g. rodent abatement and damage repair, vegetation management, erosion repair, levee crown and access road maintenance, encroachment removal, seepage and stability berm construction, and fencing/levee protection); (2) channel maintenance (e.g., sediment removal, debris/obstruction removal, vegetation management, and channel scour repair); (3) flood control structure maintenance and repair (e.g. pumping plants, weirs and outfall gates, and bridge maintenance and repair, and pipe/culvert repair, replacement and abandonment); and (4) data collection. To support a streamlined approach to permitting of O&M activities associated with flood protection for the SRFCP (summarized above) and required environmental review, DWR is preparing an Environmental Impact Report (EIR). DWR anticipates that the EIR will provide environmental analysis sufficient to support the issuance of state permits and other regulatory decisions (proposed Project) applicable to the conduct of O&M, including but not limited to an agreement pursuant to Fish and Game Code section 1600 et seq. and, if applicable, a "Take" permit pursuant to Fish and Game Code section 2081.

The California Environmental Quality Act (CEQA) requires that all State and local government agencies consider the environmental consequences of projects they propose to carry out, or over which they have discretionary authority, before implementing or approving those projects. Under the CEQA Guidelines, section 15367, DWR must make a discretionary action to consider approval of and has principal responsibility for carrying out the proposed Project; therefore, DWR is the CEQA lead agency.

Project Background

Management of flood water in California has been an evolving process over the past two centuries. Levees and other flood control facilities (i.e., channels and structures [e.g., weirs, pumping plants, outfall gates, etc.]) have been constructed through time to meet specific needs based on varying design standards and construction techniques (DWR, 2012a), though the standards have been more consistently implemented in the past 50 to 75 years. The levee system protects farmland, infrastructure, and communities of people that live in the Central Valley. Over time levees may deteriorate, due to a number of natural and man-made factors, including erosion induced by high flows, rodent burrowing activities, vandalism, and other factors. Flood channels may lose conveyance capacity by sedimentation, encroachment of vegetation, beavers building lodges and dams, encroachments, and unauthorized dumping of debris. Structures of the SRFCP, such as weirs, pump stations, bridges, and culverts may become clogged by aquatic vegetation. Structures may also become damaged as a result of corrosion, inadvertent damage by human activities, and other circumstances. FMO's on-going O&M activities are designed to minimize flood risk by maintaining the structural integrity and extending the useful life of the flood protection system.

Over the past several decades, these O&M activities have been conducted under permits and agreements with regulatory agencies and have been subject to environmental review when such review is required by law. The nature of some O&M activities conducted by DWR (and included in the Project) requires compliance with Fish and Game Code section 1600 et. seq. Compliance with Fish and Game Code section 1600 et seq. results in DWR and the California Department of Fish and Wildlife (CDFW) entering into a stream alteration agreement (SAA). DWRs current SAA will expire on January 6, 2016. Since entering into the current SAA, CDFW has become aware of additional information about special status species that may be present in areas that will be covered by the new SAA. This information indicates that some maintenance activities may have the potential to result in "take" of species listed under California Endangered Species Act (CESA). In connection with its application for a new SAA, DWR will seek a permit from CDFW pursuant to section Fish and Game Code section 2081, where applicable.

Project Location

Ongoing maintenance activities occur on the SRFCP levees, channels and flood control structures that DWR is mandated to maintain and operate on behalf of the State of California per California Water Code Sections 8361 and 12878 *et seq* (see Figures 1-3; Tables 1 and 2). The SRFCP levees are located along the Sacramento River and Tributaries between Chico and just south of Rio Vista. Within the SRFCP, where mandated to DWR by the California Water Code, maintenance is carried out by DWR's two maintenance yards: the Sutter Maintenance Yard and the Sacramento Maintenance Yard (collectively referred to as Maintenance Yards). The Sutter Maintenance Yard conducts maintenance activities along state-maintained flood control facilities of the SRFCP from Red Bluff in the north to Knights Landing in the south. The Sacramento Maintenance Yard covers the state-maintained facilities of the SRFCP from Knights Landing south to Collinsville.

In accordance with Section 8361 of the California Water Code, FMO maintains and operates the following SRFCP levees, channel and structures on behalf of the State of California (see Figures 1 through 3). The Project area includes the features listed in Tables 1 and 2 and landside potential disturbance work areas. These work areas may extend 200 feet landward from the top of bank or, if a levee is present, from the landside toe of the levee. It is expected that most staging areas, borrow and spoil areas, and access routes used during the O&M activities will be within this landside work area. Existing, previously-disturbed, staging areas, roads and spoil/borrow areas will be used to the maximum extent feasible. If previously undisturbed areas are required for staging or spoil/borrow areas, appropriate mitigation measures will be followed.

TABLE 1
PROJECT MAINTENANCE AREAS FOR THE SUTTER YARD

Sutter Bypass Area
East Levee Sutter Bypass (Levee)
Sutter Bypass Channel (Channel)
Butte Slough Wildlife Area (Channel Area)
Butte Slough Outfall Gates (Structure)
Nelson Slough Weir (Structure)
Sutter Basin Drainage- Seepage Ditches and Drainage Canals (Channel)
Sutter Bypass Pumping Plants (Structures) • Pumping plant 1 • Pumping plant 2 • Pumping plant 3
East and West Interceptor Canals (Channel) Wadsworth Canal (Channel)
Wadsworth Canal (Levee)
Weir 4 located on Wadsworth Canal (Structure)
Sutter Bypass Area Bridges (Structures) • Bridge EL-1A • CC-2 • CC-4 • Bridge EL-2 • Bridge EL-5 • Bridge WL-1 • Bridge WL-2 • Bridge EL-2 • Bridge EL-3 • Bridge EL-6 • WL-1
Weir #2 located in the Sutter Bypass (Structure)
Tisdale Bypass • Tisdale Bypass Levees • Tisdale Bypass Channel • Tisdale Weir (Structure)
Willow Slough Weir (Structure)
Feather River Area
Maintenance Area (MA) 3 (Levee)
MA 7 (Levee)
MA16 (Levee)
O'Conner Lakes (Channel Area)
Lake of the Woods (Channel Area)
Nelson Bend Control Structure (Rock Weir) (Structure)
Honcut Creek (Channel)[1]
Hamilton Bend (south of dam) (Levee)[1]

TABLE 1
PROJECT MAINTENANCE AREAS FOR THE SUTTER YARD

Bear River and Tributaries
Bear River(Channel)
Dry Creek (Channel)
Yankee Slough (Channel)
Western Pacific Interceptor Canal (Channel)
Sacramento River Area
East Levee Sacramento River (Levee)
MA1 (Levee)
MA12, Colusa Drain (Levee)
Colusa Bypass Channel (Channel)
Colusa Bypass Levee (Levee)
Colusa Bypass Weir (Structure)
Moulton Bypass Channel (Channel)
Moulton Bypass Levee (Levee)
Moulton Bypass Weir (Structure)
M&T Ranch (Channel Area)
M&T Ranch Flood Relief Structure (Structure)
Murphy Slough (Levee)[1]
Goose Lake Overflow Structure
Cherokee Canal
MA13 (Levee)
Cherokee Canal (Channel)
Chico Area
Lindo Creek (Channel)
Lindo Creek Channel Diversion Weir (Structure)
Sycamore Creek Diversion Structure (Structure)
Sycamore Creek (Channel)
Mud Creek (Channel)
Little Chico Creek (Channel)
Little Chico Creek and Butte Creek Diversion Weirs (Structures)
Big Chico Creek (Channel)
Butte Creek • MA 5 (Butte Creek Levees) • Butte Creek (Channel)
Comanche Creek (Channel)[1]
Tehama County
Deer Creek, Units 1, 2, and 3 (Channel)
Elder Creek (Channel)

TABLE 1
PROJECT MAINTENANCE AREAS FOR THE SUTTER YARD

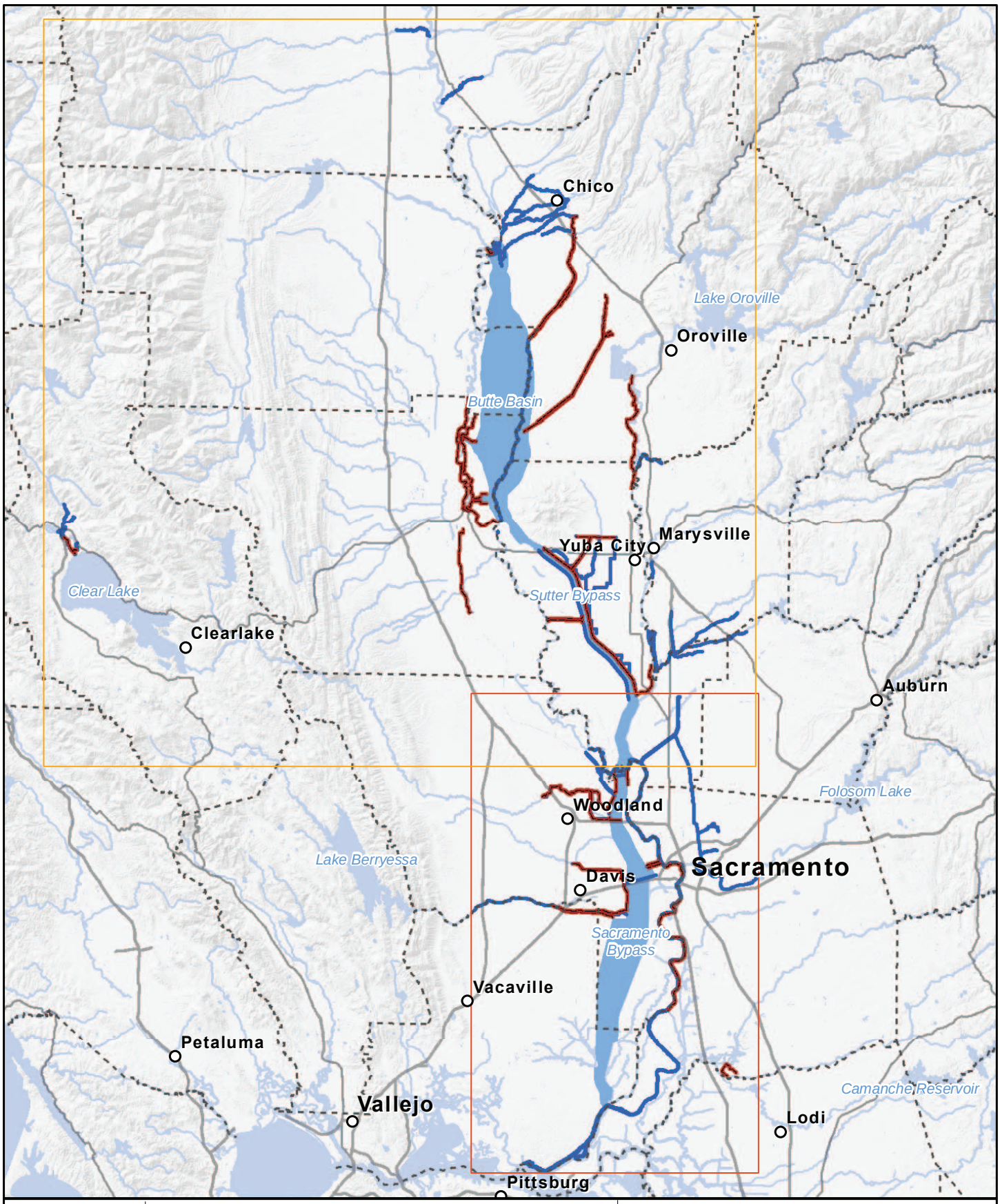
Lake County	
Middle Creek Project (Levee, Channels, Structures) • MA 17 Middle Creek (Levee) • Clover Creek Diversion (Channel) • Middle Creek (Channel) • Middle Creek Pumping Plant (Structure) • Alley Creek (Channel)	• Clover Creek (Channel) • Clover Creek Diversion Channel (Channel) • Poge Creek (Channel) • Scott Creek (Channel) • Highlands Canal (Channel) • Highlands Canal Diversion Structure (Structure)
Yuba River Area	
Yuba River State Cut (Channel)	

[1] DWR has historically conducted some maintenance in these areas; however, the authority of who is required to maintain these areas has not yet been determined.

TABLE 2
PROJECT MAINTENANCE AREAS FOR THE SACRAMENTO YARD

American River (Channel to Mayhew Drain)	
Arcade Creek (Channel, Marysville Blvd. to East Main Drain)	
Cache Creek • Cache Creek (Channel) • Cache Creek low flow outlet (Structure)	• Cache Creek Settling Basin(Channel) • Cache Creek Weir (Structure)
East Side Canal (a.k.a. Coon Creek Interceptor) (Channel)	
Grizzly Slough (Levee)	
MA 19 (Huff's Corner) (Levee)[1]	
Knights Landing • Knights Landing Outfall Gates (Structure)	• Knights Landing Ridge Cut (Channel)
Linda Creek (Channel)	
Magpie Creek Diversion (Channel)	
Natomas Cross Canal (Channel)	
Natomas East Main Drain (Channel)	
Putah Creek (Channel)	
Putah Creek (Levees)	
Sacramento Bypass Channel (Channel)	
Sacramento Bypass Levees (Levee)	
Sacramento Bypass Weir (Structure)	
Sacramento River • Sacramento River (Collinsville to Knight's Landing) (Channel)	• MA 4 (Levees) • MA 9 (Levees)
Schreiner's and Furlon Properties in Sutter Bypass (Channel)	
Willow Slough Bypass (Channel)	
Willow Slough Bypass (Levees)	
Yolo Bypass • Fremont Weir Channel (Channel) • Fremont Weir (Structure) • Yolo Bypass Highway 22 Crossing (Levee) • Yolo Bypass West Levees (Levee Units 1 through 4) (Levees)	• Yolo Bypass East Levee (upper two miles) • Yolo Bypass Union Pacific Crossing (Channel) • Yolo Bypass (Channel)

1. Not currently a DWR levee responsibility, however, the process of maintenance area creation has begun, and DWR may become responsible for this levee area in future.



Division of Flood Management
Flood Maintenance Office

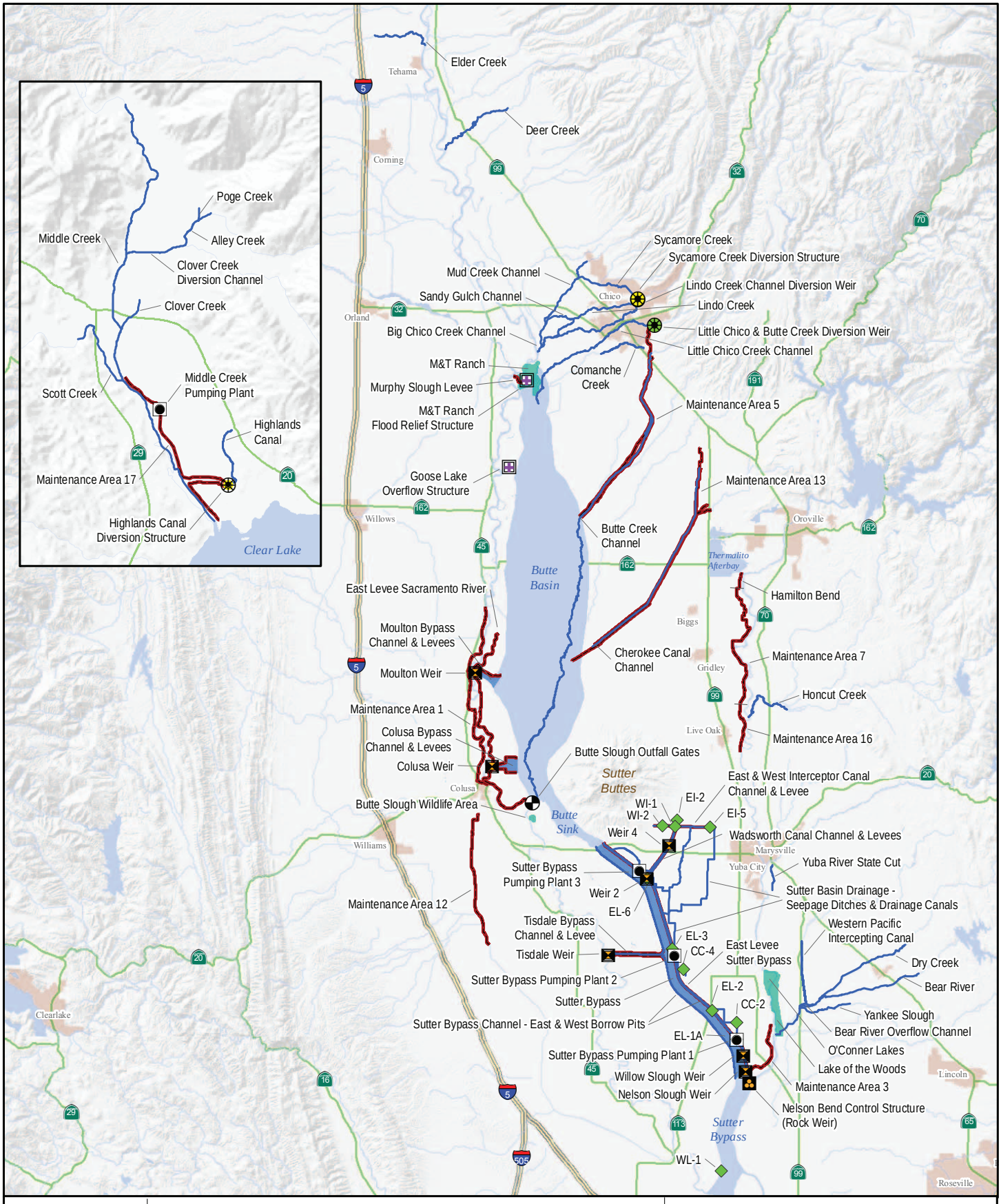
DWR Maintained Levees
DWR Maintained Channels
Flood Bypasses
Sutter Yard Area of Responsibility
Sacramento Yard Area of Responsibility

Figure 1
Maintenance Project Area Location

0 2.5 5 10 15 20 Miles

Date: April 16, 2015

Prepared By: Eryn Pimentel



Division of Flood Management
Flood Maintenance Office

Figure 2
DWR Sutter Yard Maintenance Project Areas

Date: April 16, 2015

Prepared By: Eryn Pimentel

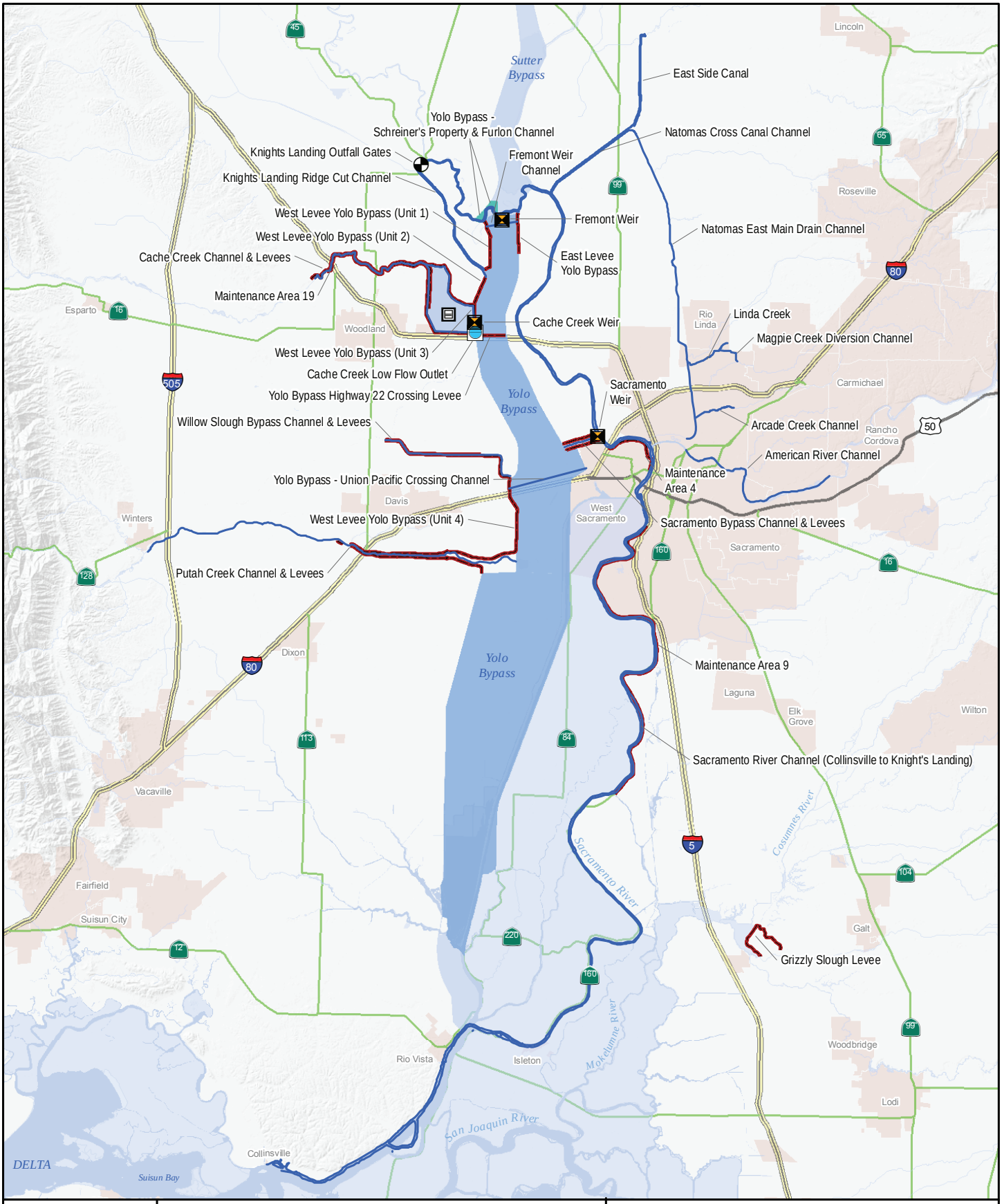


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Figure 3
DWR Sacramento Yard Maintenance Project Areas

Date: April 16, 2015

Prepared By: Eryn Pimentel

Project Objectives

The overall objective of the proposed Project is to continue the useful life of the SPFC facilities and provide for public safety and proper functioning of flood control facilities. Specifically, DWR conducts land and facilities management in ways that ensure the following:

- Maintain channel design flow capacity, levee integrity, and proper functioning of flood management structures.
- Maintain visibility and accessibility for inspections, maintenance, and flood fighting operations.
- Activities are consistent with other DWR plans and policies, including but not limited to the Central Valley Flood Protection Plan (CVFPP), DWR's Environmental Stewardship and Sustainability Policies, and the Governor's California Water Action Plan, DWR Climate Action Plan, etc.

Project Description

The following describes in detail the ongoing O&M activities carried out by the Maintenance Yards within the Project area. Because of funding and resource limitations DWR may not be able to complete all O&M activities annually or on a set rotational basis. DWR's O&M activities are limited by operational capacity, and therefore O&M activities are in some areas conducted on an as needed basis. In some cases O&M activities may be conducted at an interval of several years to decades, while in other areas O&M activities are conducted annually or on an every couple of years' rotation, when more frequent O&M activity is required.

In this project description the activities are organized first by facility type: levees, channels, and structures, and then by activity type. An additional section discusses data collection and survey and monitoring activities associated with ongoing maintenance across all facility types. Table 3 summarizes the proposed Project maintenance activities, including the timing and frequency of each activity.

TABLE 3
TIMING AND FREQUENCY OF MAINTENANCE ACTIVITIES

Activity Category	Activity		Timing[1]	Frequency[2]
Levee Maintenance				
Rodent Abatement and Damage Repair	Rodent Abatement	Baiting (pesticide)	April-October- Conducted during rodent's active season	Annual
		Fumigating (pesticide)		
		Depredating		
	Rodent damage repair	Grouting	April-December- Once a year; after herbaceous vegetation has been mowed and during giant garter snake active period	Annual
		Excavating and backfilling		
Levee Vegetation Management	Physical/ Mechanical Treatments	Cutting/limbing	Year round	Annual
		Mowing	March-October	
		Dragging	June-October	
		Disking	August-March	
		Grading	September-December	
	Applying herbicide (pesticide)		Year round	
	Controlled burning		June-October	
	Grazing		April-July	
Erosion Repair	Controlling and repairing erosion sites		Summer and fall- after veg management is completed and before rain, July-September.	As needed- based on inspections
Levee Crown and Access Road Maintenance	Grading and minor repairs		Fall- after first rain; Spring- before levees begin to dry	≥ 2 times/ year
	Levee crown gravel replenishing		July-November	As needed every several years
Encroachment removal	Removal of unauthorized construction, landscaping, or materials that may impact SPFC facilities		Year round	As Needed
Seepage and Stability Berm Construction	Seepage berm constructing		Dry Season, typically May 1 to October 1 (emergency projects may require work in wet season)	As needed
	Stability berm constructing		Dry Season, typically May 1 to October 1 (emergency projects may require work in wet season)	As needed
Fencing/levee protection	Install or repair gates and signs on levees		Year round	As needed

TABLE 3
TIMING AND FREQUENCY OF MAINTENANCE ACTIVITIES

Activity Category	Activity		Timing[1]	Frequency[2]
Channel Maintenance				
Sediment Removal	Sediment removal around structures		April - November	Varies- based on facility, rate of accumulation, and magnitude of sediment accumulation effects on conveyance and facility function
	Sediment removal from collecting canals		Generally May-October and extending into January based on canal conditions	Up to 20 miles annually
	Large-scale sediment removal (dry sediment removal)		May-October and extending into November when conditions allow	Based on specific facility considered, the rate of sediment accumulation at the site, and the magnitude of sediment accumulation effects on conveyance capacity and functioning of specific facilities
Debris/ obstruction removal	Removal of all trash and debris collected in the channel (including burning and/or chipping/scattering of organic debris). Debris consists of trash, beaver dams, flood-deposited woody and herbaceous vegetation, downed trees and branches, and any other man-made debris.		Year round	As needed- based on results of inspections
Channel Vegetation Management	Aquatic vegetation removal	Mechanical removal with excavator or dragline	May-October	Annually or every other year or several years based on size and density of the vegetation cover.
		Applying herbicide (pesticide)		
	Woody Vegetation Removal	Trimming/limbing/cutting	Wood vegetation removal-May-December	Woody vegetation removal occurs every several years
		Mowing		
		Strip disking		
		Masticating		
		Bulldozing		
		Applying herbicide (pesticide)	March-October	Applying herbicide (pesticide) - as needed to kill undesirable plants
	Burning		Burning piled vegetation-year round	Burning piled vegetation- Annually
	Grazing		April-October	Annually
	Vegetation Management in large channels		Herbaceous vegetation mowing- May-December;	Herbaceous vegetation-mowed annually;
			Woody Vegetation Treatment- May-August with equipment and year round using hand tools.	Woody Vegetation- every several years

TABLE 3
TIMING AND FREQUENCY OF MAINTENANCE ACTIVITIES

Activity Category	Activity	Timing[1]	Frequency[2]
Channel Scour Repairs	Repair dry portions of the channel by scraping, discing, filling, leveling, and regrading the ground surface	April-November	As needed
Flood Control Structure Maintenance and Repair			
Pumping Plant Maintenance and Repair	Debris and sediment/silt removal	Prior to high-water season (May-November)	Pumping plant- Annually
	Repairing wing walls, bulkheads, splash aprons, and the superstructure	Year round	As needed
Weir Maintenance and Repair	Removing/leveling of silt deposits, debris, and undesirable vegetation between the river and the structure	Debris removal: year round; Sediment removal: May-November	Annually
	Removing the obstructions within the spillway and concrete bulkhead to maintain function of the weir and control gates	Year round	
	Repair erosion around the structure that can be caused by increase of volume and velocity of water when gates of weir are opened	June October	
	Painting the metal structures of the weir	Year round	
Outfall Gates Maintenance and Repair	Removing debris near gates	Year round	Annually
	Removing/treating undesirable vegetation on the revetment on structure to maintain unobstructed passageway	Aquatic vegetation management- May-October	
	Inspecting concrete superstructure and patching cracks and spalls	Year round	
	Straitening or welding damaged metal portions of the outfall gates	Year round	
	Inspecting, testing, and repairing the electrical or hydraulic system	Year round	As needed
Pipe/ Culvert Repair, Replacement, and Abandonment	Pipe/Culvert Repair	April-November; year round for minor repair work.	As needed - as a result of inspections
	Pipe/Culvert Replacement	April-November	
	Pipe abandonment	April-November	

TABLE 3
TIMING AND FREQUENCY OF MAINTENANCE ACTIVITIES

Activity Category	Activity		Timing[1]	Frequency[2]
Bridge Maintenance, Repair, and Replacement	Bridge maintenance	Removal of woody debris within 50 ft of bridge	Year round	As needed
		Spraying, mowing, or burning vegetation near bridge abutments and foundation supports	Spraying: year round Mowing: March-October Burning: June-October	
		Controlling erosion near foundation supports, abutments, approaches, and railings.	June - October	
		Repairing and replacing bridge decking, wing walls, abutments, approaches, and railings	Year round	
		Repair in-channel pilings or concrete abutments and adjacent riprap	Year round	
	Bridge replacement	Demolition and excavation of new bridge. Then construction of new bridge.	Year round	As needed
Data Collection				
Data collection	Geotechnical borings (land based and in-water)		Year round	As needed
	Surveying (bathymetry and other topography)		Year round	As needed
	Biological Surveys		Year round	As needed
	Facility inspection		Year round	Once or twice yearly
	Ongoing facility monitoring		Year round	As needed

[1] The timing presented in this table is when O&M activities generally occur, however, these activities may occur outside of these time frames if work is required. Timing does not represent special-status species or habitat impact avoidance windows

[2] Because of funding and resource limitations DWR may not be able to complete all O&M activities annually or on a set rotational basis. DWR's O&M activities are limited by operational capacity, and therefore O&M activities are in some areas conducted on an as needed basis. In some cases O&M activities may be conducted at an interval of several years to decades, while in other areas O&M activities are conducted annually or on an every couple of years' rotation, when more frequent O&M activity is required.

Levee Maintenance

Levees are inspected by both the U.S. Army Corps of Engineers (USACE) and DWR, and inspection reports identify conditions that may pose a risk of flooding to property if levees fail. Levees are also maintained to provide visibility and access for those inspections, for maintenance, and for flood fighting activities. Rodent damage, vegetation, erosion, levee crown and access road degradation, and levee seepage are factors that contribute to structural deficiencies. Maintenance activities associated with correcting these are discussed below.

Rodent Abatement and Damage Repair

Rodent abatement and damage repair consists of controlling the populations of California ground squirrel (*Spermophilus beecheyi*), and, to a much lesser extent, common muskrat (*Ondatra zibethicus*) and American beaver (*Castor canadensis*) and then repairing the damage to levees caused by their burrowing. Botta's pocket gopher (*Thomomys bottae*) also burrows in levees, but the burrows of this small rodent are shallow and generally do not cause structural damage. Most rodent holes are located in the upper portion of the levee and reach a depth of less than 8 feet in the first year. If these holes are not addressed at an early stage, the rodents may increase the size of the holes substantially and develop individual holes into colony networks of tunnels connecting multiple holes. Beaver dens have been identified in levees and can reach up to 1,100 square feet in size. The rodent burrows, tunnels, and dens can weaken the levee and associated roads, potentially causing a collapse or failure during high-water events or maintenance activities. Rodents are controlled by the use of baits poisoned with rodenticides, fumigation, trapping, or shooting. Burrows, tunnels, and dens are filled by grouting or through excavation and backfill. Each of these activities is described in more detail below.

Rodent Abatement

FMO conducts rodent control activities under the guidance of licensed pest control advisors and follows the guidelines and requirements established by the California Department of Pesticide Regulation, and the local County Agricultural Departments.

Maintenance Activities

Baiting: Baiting is accomplished with either bait stations or by broadcasting bait. Bait stations are used exclusively for small, local ground squirrel colonies. Anticoagulant baits formulated as loose grain, paraffin bait blocks, or pellets are placed repeatedly in bait stations. Bait stations are anchored to the ground or some solid structure to reduce spillage and vandalism, with warning notices displaying the name of the toxicant, concentration being used, and the name and telephone number of the maintaining agency. To avoid any negative impacts on children or pets, bait stations are typically not used in urban areas, but may be used on occasion if rodent populations become too large. Broadcast baiting consists of distributing rodenticides, such as zinc phosphide, in high-density areas of ground squirrel populations. Under certain circumstances, anticoagulant baits may also be broadcast. FMO only uses baits approved by the California Department of Pesticide Regulation.

Fumigation: Fumigation tends to be less effective than baiting and is used only in certain cases (e.g., in areas frequented by the public and pets where the use of poisonous bait presents a hazard). Fumigants are placed in active burrows (i.e., the squirrels are not hibernating or aestivating), which are then sealed with earth (inactive burrows are also sealed with earth to avoid leakage). The soil should not be too dry or cracked during fumigation, and this treatment is most effective during the breeding season (February through May). Effectiveness is increased when monitored and re-treated (when needed) within 48 hours of the initial treatment. FMO only uses fumigants that are approved by the California Department of Pesticide Regulation.

Depredation: Depredation methods include trapping and shooting. Trapping is used for small infestations of ground squirrels, gophers, muskrats, and beavers where it is impractical or unsafe to use bait or fumigants. Both live and kill traps may be used. Traps are placed at the burrow entrance, runways, or other locations frequented by rodents. After a few days, traps can be set and baited with grain, nuts, or other foods that attract squirrels rodents. Kill traps should be anchored to prevent them from being carried off by predators. Rodents are euthanized, if necessary, and the carcasses are buried. FMO contracts with entities such as the U.S. Department of Agriculture Wildlife Services for depredation services. Several methods of depredation to control beaver populations have occurred in areas with damage to levees, including shooting and trapping. DWR does not conduct shooting; rather contracts for depredation services when necessary. Trapping and other depredation methods also require a permit from the CDFW.

Frequency

Rodent abatement is conducted annually where needed, based on results of levee inspections that are carried out by maintenance yard staff, DWR Division of Flood Management (DFM) levee inspectors, and USACE inspections.

Timing

Rodent abatement is conducted during the rodent's active season, (April through October), but can be done year round depending on weather conditions, rodent type, activity, and other site-specific conditions.

Damage Repair

Maintenance Activities

Grouting: In the summer to early fall after the herbaceous vegetation (mainly grasses) have been mowed, burned, or removed, an assessment by maintenance yard staff is used to identify the locations where rodent borrows need to be grouted. During grouting, burrows are filled with a grout mix consisting of cement, bentonite, and water. This mixture is pumped under low pressure from a trailer-mounted tank through a hose into the mouth of a burrow (Figure 4). Rags or burlap around the hose are used to plug the burrow opening, and grout is pumped into the burrow until back pressure indicates that the burrow is full. The hose is then removed and the burrow mouth sealed to prevent the grout from running out. Grouting operations are conducted by maintenance yard staff with the following equipment: a trailer constructed to mix and pump the grout mixture on site (Figure 4) towed by a water truck, and a haul truck, along with two pickups or flatbed trucks to transport the crew of four to five people and any additional hand tools and materials.

SOURCE: Central Valley Flood Management Planning Program, 2014

Figure 4
Photographs of Grout Pump with Mixing Hoppers (Upper) and Grouting Operation in Progress (Lower)

Excavation and Backfill: Large dens or tunnel networks may require excavation and backfill of the area to completely repair the damage to the levee. Typically, an excavator is used to open up the den from the surface and to remove soil around the perimeter to make sure all tunnels are found; the excavated area is then backfilled with soil and compacted with a compacting wheel or equivalent compaction device. Up to 450 cubic yards (CY) of earthen material may be required to fill large beaver dens but typical repairs use approximately 20 to 30 CY. Excavation and backfill activities may use the following equipment, or equivalent: excavator, scraper, dozer, backhoe, front-end loader, sheep-foot or tramping-foot roller, smooth drum and compactor, haul trucks, pickup and flatbed trucks, and water truck.

Frequency

Rodent damage repair is conducted annually to maintain levee integrity.

Timing

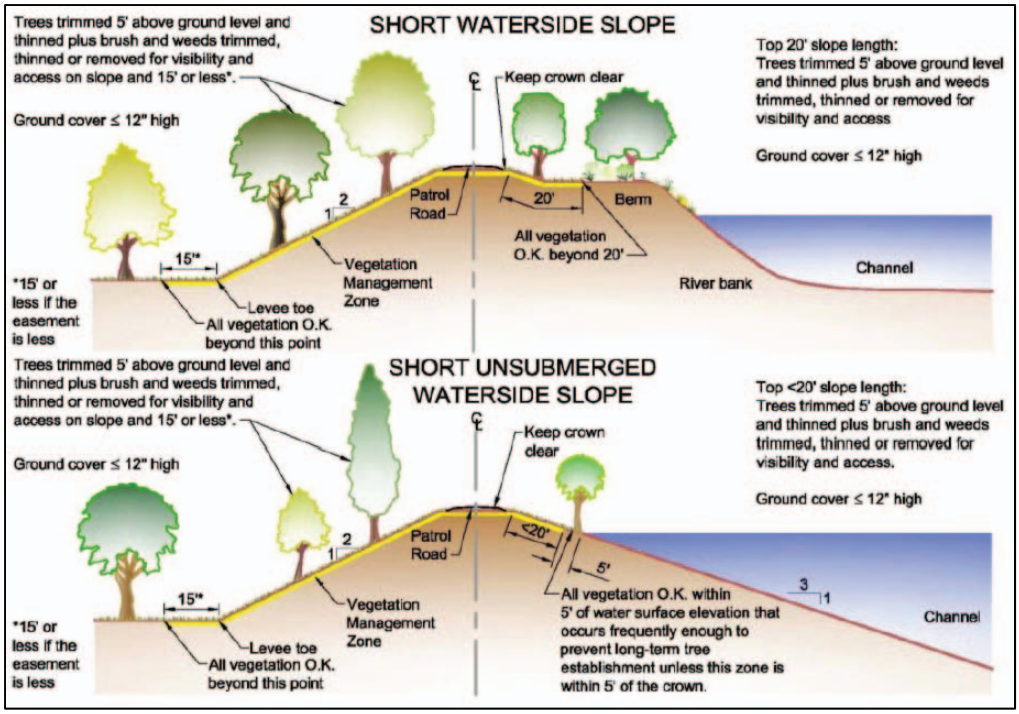
Grouting, excavation and backfilling to complete rodent damage repair is conducted once a year, or as needed. Work is generally completed after rodents have been controlled and herbaceous vegetation has been mowed and/or burned to allow for proper inspection of the levees. These activities are typically completed April through December, during the giant garter snake (*Thamnophis gigas*) active period. To ensure proper levee integrity, rodent damage repair may be required more frequently if damage is identified that may result in levee failure.

Levee Vegetation Management

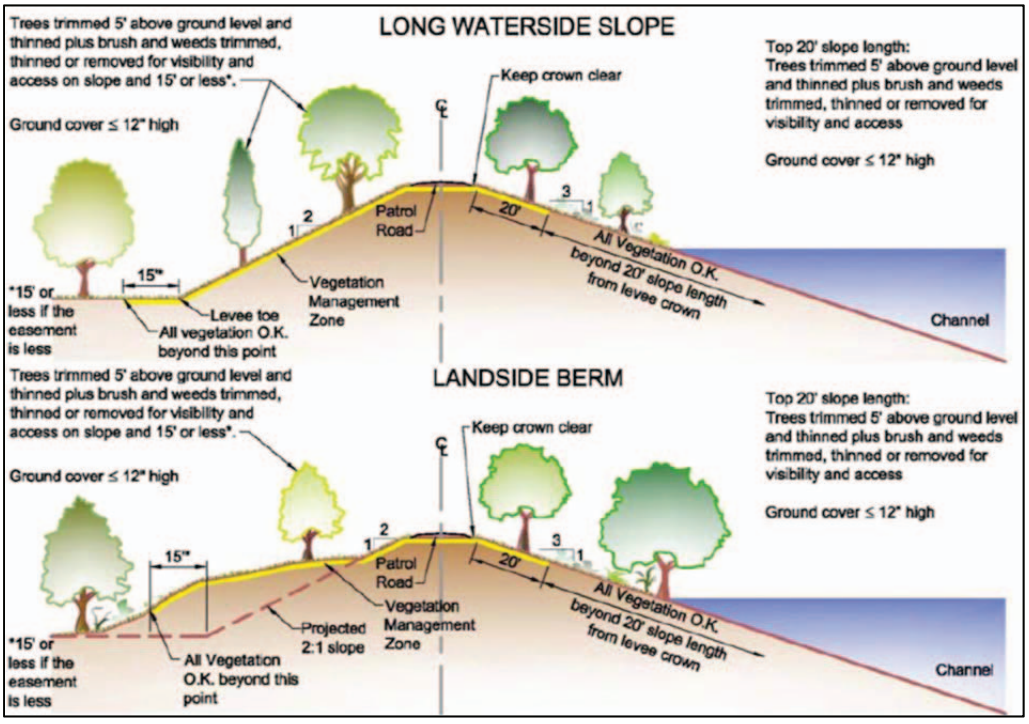
Vegetation on levees must be appropriately managed. Current and future work will focus on improving public safety by providing for integrity, visibility, and accessibility for inspections, maintenance, and flood fight operations; while at the same time, protecting important and critical environmental resources.

DWR's approach for managing levees with legacy vegetation is described by the vegetation management criteria in the CVFPP (DWR, 2012a), the CVFPP Conservation Framework (DWR, 2012b), and DWR's Urban Levee Design Criteria (DWR, 2012c). These criteria help to frame the adaptive management for appropriate clearing and thinning of vegetation for visibility (inspections) and accessibility (maintenance and flood fight activities) on these levees (Figure 5) and provide strategies for flexibility such as trimming vegetation up 12 feet near roads for safe access and patrol, and for retaining vegetation on the lower waterside slope if it poses no unacceptable threat. Trees may be deemed an unacceptable threat to levee integrity and will be evaluated using the assessment tool currently being developed by DWR and the California Levee Vegetation Research Program. This process is also discussed in the Conservation Strategy (DWR, 2015 in preparation).

Implementation of DWR's levee vegetation management will be adaptive and responsive to: (1) the results of ongoing and future research; (2) knowledge gained from levee performance during high water events; and (3) development of policy and guidance by future CVFPP and other related documents (e.g., Conservation Strategy).



Vegetation Management Zones on Levees with Short Waterside Slopes



Vegetation Management Zones on Levees with Long Waterside Slopes or a Landside Berm

SOURCE: Public Draft 2012 Central Valley Flood Protection Plan, Attachment 2: Conservation Framework. DWR, 2012b

Figure 5
Vegetation Management Zones

Invasive plants are widespread and abundant on levees and within channels throughout the SPFC area. Invasive species can increase the cost and difficulty of operating and maintaining the flood control system, and can degrade riverine and floodplain habitats by altering ecosystem process and displacing native plants. Dense stands of certain invasive species can alter channel morphology by retaining sediments and increasing the hydraulic roughness of the channel, which restricts flows and reduces flood conveyance, and can promote undercutting, collapse, and erosion of the stream bank or levees. Invasive plants can also reduce the integrity of native riparian plant communities by outcompeting native plants, reducing habitat quality and food supply for wildlife, and interfering with wildlife management. As part of vegetation management efforts conducted by maintenance yards staff, invasive species are managed to ensure that the integrity of the flood control system is maintained, and improve riverine and floodplain habitats.

The following sections describe the methods used by the Maintenance Yards for vegetation management. The appropriate methods in each circumstance are determined based on total management area, surrounding land uses, timing, type of vegetation requiring management (herbaceous, woody, invasive), and available resources.

Maintenance Activities

Physical/Mechanical Treatments: Physical/mechanical treatment methods include cutting, mowing, masticating, bulldozing, dragging, grading, and disking.

Trees and shrubs on levee slopes generally are trimmed up to 5 feet above the ground and are thinned to allow access to levee slopes and to facilitate visual inspection of the levee slopes. Access to levees for maintenance or flood fighting operations with large trucks and other equipment may require that trees are trimmed up to 12 feet high. Brush cutting and pulling are conducted with handheld manual and power tools. The removal of native vegetation is avoided to the extent practicable, and native riparian vegetation that can be reasonably avoided will be left undisturbed.

Ground cover (i.e., annual and perennial herbs and mat-forming vines) that is more than 12 inches high on the land-side slope and on the top 20 feet of the water side-slope of the levee is trimmed, thinned, mowed, burned, dragged, or otherwise removed. Mowing is conducted using mowers such as, wheeled tractor with boom-mounted or rear-attached mower, skid and slope mowers. Vegetation generally is mowed to 4 to 6 inches in height, and cut vegetation is left on site as mulch. Ground cover also may be disked, dragged, or graded, using a tractor attachment or bulldozer.

Woody vegetation on levees with stems greater than 4 inches in diameter at breast height (DBH) are trimmed but not removed (Figure 5), unless it is deemed that a tree presents an unacceptable threat to levee integrity. Stems with DBH less than 4 inches can either be trimmed, or the entire plant can be removed. Trimming involves cutting and removing limbs that obstruct access to the levee slopes or prevent visual inspection of the levee. Trimming and removal of woody vegetation are carried out using handheld tools such as loppers and tree saws, and power tools such as chainsaws. Cuttings and trees can be mulched and left on site, piled up and burned, or

removed from site. Mechanical mastication of thickets of woody and thick vegetation could be conducted as necessary.

Dragging usually follows burning (see description below) and is used to smooth the levee slope surfaces and further degrade and disperse remnant vegetative materials. A heavy chain or track is pulled (dragged) laterally along the levee slopes in horizontal bands from bottom to top with some overlap. The removal of old vegetative materials allow for new grass growth and helps identify rodent activity. Cut vegetation is chipped, burned, or hauled off-site to an appropriate facility.

Applying Herbicide: Herbicide application involves the selective application of contact, preemergent, and systemic herbicides (pesticides). Nonselective (broad-spectrum) herbicides are used to maintain bare-ground areas (e.g., levee toe roads, crown roadways, and access points). Selective herbicides (e.g., broadleaf selective herbicides) may be used instead of broad-spectrum herbicides to reduce damage to desired vegetation. Spot spraying is used to control specific species, minimize effects on desired vegetation, and control brush and vines that may interfere with access or visibility. All herbicides are applied according to label specifications, per guidance of a licensed pest control advisor, and follow the guidelines and requirements established by the California Department of Pesticide Regulation and the local County Agricultural Departments. Following label application instructions reduces drift and off-target effects.

Broadcast herbicide applications utilize a truck-mounted spray system with a hose and reel. Spot applications can be carried out with a hand-held or backpack pump sprayer.

Controlled Burning: Prescribed burning involves using controlled fire to remove both vegetation and organic matter (such as thatch) from the ground surface and to improve visibility along levee slopes for inspection and maintenance. Prescribed burning is conducted in coordination with the local fire district, local air quality management district, and in accordance with all laws and local ordinances, including those designed to ensure that burns are conducted only during safe weather conditions (e.g., burning generally is not conducted during windy conditions). Prescribed burns generally are conducted only in rural areas in summer (June through October) in coordination with the agencies listed above.

The amount and type of equipment used for prescribed burns may vary in relation to the size of the area to be burned and conditions on and near the burn site. A burn operation may involve the use of torches, trucks, hoses, pumps, maintenance yard crews to monitor the burn, and a water supply tank truck. Water tanks mounted on flatbed trucks, with appropriate hoses and pumps, are used to control the intensity and range of the burn. A pickup truck is used to haul torch fuel and other supplies.

Any flammable structures in or next to the burn area are chemically fire guarded or soaked with water before the start of burning and then are monitored throughout the burn operation. Where practicable, wet lines (firebreaks) are placed at the toes of levees to prevent the fire from spreading to adjoining areas. All fires, including smoldering debris, are entirely extinguished before the crew leaves the burn site.

Grazing: Sheep and goat grazing may be used to manage some vegetated areas on levees. Grazing can be used to reduce the load of vegetation, similar to mowing, or it can be used to remove vegetation more thoroughly.

Frequency

Levee vegetation management is conducted annually.

Timing

The timing for each physical/mechanical treatment varies by type, and generally occurs as follows:

- Cutting, limbing and removal of woody vegetation occurs year-round;
- Mowing occurs from March through October;
- Dragging occurs from June through October;
- Disking occurs from August through March;
- Grading occurs from September through December;
- Applying herbicide on levee slopes may occur year-round;
- Grazing occurs from April through July; and
- Burning occurs from June through October.

Erosion Repair

Erosion repair consists of stabilizing and in some cases reconstructing or reshaping the levee slope to prevent further erosion. Erosion repairs are often carried out along levees or levee toes roads where erosion or sloughing has occurred, around culverts and pipe penetrations, and alongside bridge and structure (weirs, outfall structures, pumping plants) abutments.

Maintenance Activities

Erosion repair activities typically require a small staging area (less than 0.5 acre) and access to the erosion control area by way of toe roads or levee crown roads. In some cases, new access roads or haul routes may be needed to access soil borrow sites. Dewatering is not typically required for erosion repair activities. Site preparation is the first step and includes removal or trimming of vegetation. Dragging and grading may be used to repair areas of minor surface erosion and surface irregularities, or to prepare sites for other erosion repair work. Dragging typically involves pulling a heavy straight blade-like implement by a tractor, such as an I-beam or used tractor track to smooth out the levee surface. The dragging implement is rigged with cable controls so that the operator can regulate its angle and reach. Dragging is typically carried out after vegetation management and rodent damage repair activities have been completed.

Once site preparation is complete, equipment including large and small bulldozers, haul trucks, dump trucks, water trucks, excavators, and cement mixers can then be staged for work. In some

cases a barge with a crane may be used for some of the work when water side access is needed or is the most feasible way to accomplish the repairs. When a barge is used, quarry stone can be placed using a drag line. The erosion site is typically graded to prepare the site for replacement of material. Stabilization materials may be installed in a key trench. Key trenches are also often installed at the toe of the slope to stabilize the slope material, although these are not used around bridge pilings/abutments, culverts, or pipes. Materials used for erosion repair include rock revetment, soil, and root wads. In some cases, soil is installed intermixed with other materials such as rock revetment to fill voids within the rock. A temporary stockpile of excavated material is made within the site or in adjacent disturbed areas and this material can be used in conjunction with other materials for stabilization as the trench is filled in.

The levee slope is reshaped to the original levee design. Live willow pole plantings can be inserted into the repaired slope near the active channel. Willow wattles, branch layering, and geotextile fabric may also be used, depending on the site requirements. The installation of live willow poles and willow wattles along the channel is considered beneficial for preventing future bank erosion and does not present an unacceptable threat to levee integrity, according to the Small Erosion Repair Program manual (DWR, 2013). Repaired areas are generally hydroseeded at the conclusion of repair work and stormwater and erosion measures are installed to prevent erosion of disturbed soil.

Frequency

Erosion repair is conducted as needed based on the results of annual inspections, conducted by maintenance yard staff, DFM levee inspectors, and the USACE inspections.

Timing

Erosion repair work is generally conducted after vegetation management is completed and before the start of the rainy season, typically in July through September. Erosion repair work varies in length and size based on the total area of repair work, access, and other site specific conditions. Erosion repair work is conducted over 1 or several days and up to 1 month, depending on the size of the site.

Levee Crown and Access Road Maintenance

Access, patrol, and toe road and levee crown maintenance consists of filling potholes, adding aggregate to smoothing the road surfaces, replacing gravel displaced by traffic, and checking and increasing compaction.

Maintenance Activities

Grading and Minor Repairs: Annual access and levee toe road and levee crown maintenance consists of filling potholes and depressions (e.g. scours), adding aggregate to smooth road surfaces, and checking and increasing compaction. Maintenance personnel fill potholes and depressions with soil or aggregate rock (12-inch minus rock), and smooth the drivable surface using small graders, support vehicles (e.g., pickup trucks), hand tools, and water trucks. Work includes compacting the drivable surface using compactors, support vehicles, and water trucks.

Access and toe road maintenance takes place entirely within the facility footprint of the existing roads. As discussed in the Superintendent's Guide (DWR, 2014), the levee crowns, roadways, ramps and state-maintained access roads are kept serviceable by grading and graveling. Unpaved road surfaces are maintained according to the design specifications based on the following guidelines:

- Utilize a grader with 12 foot blade, or appropriate;
- Smooth the road surface;
- Minimize ponded water;
- Recover gravel displaced by traffic;
- Scarify heavily trafficked or highly compacted surfaces prior to grading to prevent excessive wear of the blade and enhance the bonding of old and new surfacing materials;
- Ensure proper drainage by grading road surfaces to gradually slope from the centerline to shoulder;
- Implement measures for fugitive dust control to prevent damage to nearby crops or property; and
- Remove flammable debris and wild growth from the immediate area to protect facilities from fire. Vegetation removal methods are described above.

Levee Crown Gravel Replacement: Levee crown gravel replacement consist of scarifying and re-compacting the existing gravel roadway, followed by placing, spreading and compacting aggregate road base material along the levee crown roads. The work requires sub-grade preparation by scarifying and compacting the existing gravel roadway to provide a uniform level base. Material transfer trucks deliver the road base gravel to the crown road, followed by a motor grader spreading and levelling the gravel to a depth of up to 4 inches. Trucks delivering materials to the areas where levee crown gravel activities are to occur, use public roads and existing access roads/ramps to access the location where gravel replacement is to occur. A water truck and smooth drum roller compactor are used to provide optimum moisture content for compaction activity to lock the gravel into place after being placed and graded to design specifications. Up to 50 miles of levee crown may be repaired in a single project. The proposed activity will require the following construction equipment to be on the levee crown roads and access ramps at various times during the project: material transfer trucks, ranging from belly-dump to 10-ton dump trucks; blades; loaders; roller compactors; and, water trucks.

Frequency

Grading and minor road repairs occur at least twice a year. Levee crown gravel replacement occurs as needed at an interval of several years.

Timing

Levee and access roads are graded and repaired one to two times annually where needed: typically, once in the fall before flood season, and once in spring after flood season, (when needed). Levee crown replacement typically occurs between July and November.

Encroachment Removal

Unauthorized encroachments that may potentially present a major detrimental impact on the SPFC must be removed, abandoned, or suitably modified. Types of encroachments vary widely and may include vegetation, landscaping structures (e.g., staircases, fences, planter boxes), swimming pools, pipes, and ditches. Vegetation encroachments may be removed in a manner similar to that described for Vegetation Management on Levees, above. Landscaping structures may be removed with hand tools or by heavy equipment (e.g., excavator, backhoe) and hauled to a landfill. The levee would then be repaired in a manner similar to that described for Erosion Control, above. Swimming pools and drainage and irrigation ditches may be backfilled with soil in a manner similar to that described for filling beaver dens under Rodent Abatement and Damage Repair above.

Frequency

Encroachment removal is carried out on an as needed basis.

Timing

This activity is conducted year round.

Seepage and Stability Berm Construction

Seepage and stability berms may be constructed along the landside levee slopes to repair seepage in levees constructed of low-plasticity erodible soils (e.g., sand, silt), and correct slope instability associated with a decrease in shear strength or increase in shear stress, or both, respectively. Equipment used for these activities includes dump trucks, dozers, graders, loaders, compactors and water trucks. Staging occurs within facility footprints; typically on the levee or toe roads, or within the dry channel when needed. Vehicles and equipment are stored on the landside of the levee overnight and when they are not in use.

Seepage Berm

Seepage berms are wide embankments placed landward from the levee's landside toe to lengthen the underseepage path and thereby lower to acceptable levels the exit gradient of seepage through permeable layers under the levees. A drained seepage berm is a common type of seepage berm that consists of a rocky drainage layer covered by a soil layer, which together control the exit gradient of water seeping through the material under the levee. The water seeps under the levee, enters the rock layer and is controlled or contained in the rock layer by the overlying soil layer. A geotextile (filter fabric) is placed between the drainage rocks and the native soil below to prevent the water seeping into the drainage rock from carrying soil with it. The drainage system (chimney drain and blanket drain) includes a minimum of a 12-inch filter layer and a 12-inch drain rock layer (a reduced thickness filter layer may be justified based on engineering evaluations).

An undrained seepage berm may be constructed without any filter drain system. This type of seepage berm still reduces the seepage hazard by providing additional weight to counteract upward seepage forces and additional length to reduce uplift pressures at the toe of the berm.

Seepage berm materials are selected based on their compatibility with the blanket and levee materials. Seepage berm materials should be of equal or greater permeability than the existing blanket and levee, and should prevent movement of the underlying materials through the berm materials.

Stability Berm

Stability berms may be constructed along the landside levee slopes to correct slope instability associated with a decrease in shear strength or increase in shear stress, or both. Slope instability may occur in a levee's embankment and/or foundation due to pore water pressure, inadequate levee slope, or soil strength. A drained stability berm consists of a soil berm constructed on a drainage system (chimney and blanket drain), which reduces slope instability by adding resistance force against shear failure, increasing resistance to sliding by adding mass at the levee toe, and reducing pore water pressure through the drainage system. An undrained stability berm does not include a drainage system, but still reduces slope instability by adding resistance force against shear failure, increasing resistance to sliding by adding mass at the levee toe, and reducing pore water pressure by providing an extended path for water to spread.

Stability berm construction activities are similar to those described for the Seepage Berm Construction above, but with a narrower footprint (minimum 8 feet width).

Frequency

Seepage and stability berm construction occur as needed. Areas that require the construction of a seepage berm or stability berm are identified during regular inspections and monitoring by the Maintenance Yards.

Timing

Seepage and stability berm construction activities are typically confined to the dry season (May to October). Some emergency projects may require work during the wet season. Seepage and stability berms vary in size and their construction takes between 1 week and 1 month.

Fencing/Levee Protection

Maintenance Activities

Levee crown roads and toe roads tend to have restricted access so that unauthorized vehicles cannot access the roads for safety reasons. Metal gates secured with locks are installed on the roads at access points. These gates periodically require maintenance or replacement. In addition, road signs or other DWR signage may be installed, maintained, or replaced along levees.

Gate and sign installation involves excavating a small hole in the levee with a hydraulic auger or backhoe, framing the sign post and filling the hole with concrete or compacted soil. Equipment required for this work includes the hydraulic auger or backhoe mentioned above as well as hand tools, a truck, a small cement mixer, and a compactor. Maintenance work can be carried out using hand tools and may include repainting the gates.

Frequency

Gate and sign installation and maintenance occur as needed.

Timing

These activities may occur year round.

Channel Maintenance

The SRFCP includes a system of natural and constructed channels where FMO maintains conveyance capacity and structural integrity of the channels and associated structures (Tables 1 and 2). Flood conveyance capacity and in-channel structures are routinely inspected by DWR personnel to identify areas where maintenance is needed. Accumulated sediment and vegetation, or other debris along with improperly functioning structures can reduce the capacity of channels and inhibit flow, which in turn can lead to bank or levee erosion, diverted flow, or risk of levee overtopping. The following sections describe channel maintenance activities.

Sediment Removal

Sediment removal involves removing or displacing accumulated sediment from within channels and around structures that substantially obstructs water flow, reduces channel capacity, accelerates erosion, can damage concrete box culverts, metal culverts, or bridge structures, or may have the potential to do so. Sediment removal includes three types of activities: small-scale sediment removal around structures, sediment removal from collecting canals, and large sediment removal projects from behind weirs and in large channels. These activities are described below. Following sediment removal, the elevation of the ditch, canal, or channel surface will approximate that of the original design.

Sediment Removal around Structures

Maintenance Activities

Sediment removal around structures includes removing sediment from around bridges, culverts/ pipes and associated drainage ditches/canals, road crossings, and other relatively small structures. Sediment removal around bridges, road crossings and other small structures is typically conducted within 50 feet of these structures. For drainage ditches or canals associated with culverts or pipes sediment removal can be conducted up to 300 feet from the culvert/pipe inlet or outlet, and is typically conducted when there is little to no water present in the ditch or canal. However, there may be instances when sediment removal is needed when water is present. The amount of sediment that is typically removed from around the structures ranges from 100 to 1,000 CY. For the pumping stations, sediment is excavated to maintain a water depth of up to 20 feet deep in front of the intake to ensure proper functioning of the facility. For culverts, sediment is excavated at inflow and outflow points. Depending on the amount of sediment removed from a particular location, sediment may be hauled in trucks to spoil sites or placed on private property and agricultural lands, or access and toe roads, and disked into the ground or road surface once dry. A water truck may be used to minimize dust during sediment removal and grading or

disking, if needed. Rubber-tired scrapers, bulldozers, backhoes, loaders, graders, long armed excavators, bobcats, pickup trucks, and hand tools are used to remove sediment. Following sediment removal the culvert, pipe, bridge piling, or other facility should approximate the original design and water conveyance will not be obstructed or have reduced capacity.

Frequency

Frequency varies based on the specific facility considered, the rate of sediment accumulation at the site, and the magnitude of sediment accumulation effects on conveyance capacity and functioning of specific facilities.

Timing

Sediment removal around structure is typically conducted between April and November. Maintenance yard staff tries to conduct this work in dry channels or when the water levels are at their lowest outside the flood season for regulated streams (California Code of Regulations 23, Section 112).

Sediment Removal from Collecting Canals

Sediment removal from collecting canals involves removing or displacing accumulated sediment in wetted portions of a channel. Aquatic vegetation may also be removed as part of the sediment removal effort. Aquatic vegetation includes submerged and floating aquatic plants and emergent plants rooted below the water level. This vegetation is common in toe drains, seepage ditches, and collecting canals. Removing sediment to maintain a four foot water depth benefits vegetation management by minimizing growth of submerged aquatic weeds, and limiting emergent vegetation establishment to shallow canal margins. This in turn reduces sediment accrual by maintaining adequate flow.

Maintenance Activities

DWR staff will use a long reach excavator with a digging bucket that will travel along the agricultural operation access roads and remove sediment from the canal. Material and equipment will be staged on site as work is being completed, and access will be on the existing right-of-ways. The excavator will work on either side of the channel depending on access, and will avoid areas with dense riparian vegetation where feasible. Access will be either from the side of the canal that abuts the levee toe, or from the canal side with the patrol road. If necessary to provide access and maneuvering room for the excavator's boom arm, maintenance staff will trim or remove woody vegetation (as described under Channel Vegetation Management).

The excavator will scoop the sediment from the center of the channel, to avoid damaging vegetation growing along the banks of the channel and to avoid damaging the bank. Aquatic vegetation in the center of the channel will be removed mechanically by uprooting and piling plants using the bucket. Sediment will be removed to the depth of one bucket scoop, resulting in approximately one cubic yard of sediment deposited per 6 linear feet of canal. For the pumping stations, sediment will be excavated to maintain a water depth of up to 20 feet deep in front of the intake to ensure proper functioning of the facility. For the culverts, sediment will be excavated at

inflow and outflow points to appropriate depth. The desired depth is 4 feet below the Ordinary High Water Mark (OHWM).

Excavated sediment will be placed in the center of the access roads or at the toe of the levee so as to avoid the non-compacted shoulders of the road to the maximum extent practicable. In some cases, such as along the Sutter Bypass, sediment is placed at the landside base of the levee to avoid disturbance to canal banks. In all cases, sediment placement is limited by the range of the excavator arm (maximum reach 60 feet). Aquatic vegetation that is removed with sediment will also be piled together with the excavated sediment. If the material removed from the collecting canal is primarily aquatic vegetation, it will spread to dry and will not be left in piles near the canal as this attracts wildlife.

The excavated sediment will be left to dry. Drying time varies based time of year. Sediment removed and piled in the summer may take 1 to 3 months to dry, while sediment removed and piled in the fall may take up to 8 to10 months to dry. Generally owners of the access roads will be responsible for spreading out the sediment, followed by discing and leveling, but the Maintenance Yard staff also carries out this work in some instances. Maintenance Yard staff will encourage property owners to spread the sediment during the giant garter snake active season.

Frequency

DWR typically clears 12 to 20 miles of canals per year, out of the approximately 60 miles in the Project area. Sediment removal recurrence can vary from every 2 to 5 years, depending on the local rate of sediment accumulation in a particular canal.

The following conditions indicate high priorities for implementing sediment removal in collecting canals:

- Canals feeding sumps at the Sutter Bypass Pumping Plants remain full even when the water elevation immediately around the pumps decreases quickly;
- Upstream areas overtop and produce localized flooding while in the downstream collecting canals water elevations appear to be sufficiently low;
- Farmers' irrigation pumps are buried in sediment; and
- Water levels in canals directly upstream and downstream of pumps remain higher than in the downstream canal portion, which prevents water from getting to downstream pumps.

Timing

Sediment removal from collecting canals will be carried out generally between May and October. However, it may also take place in the fall and winter, as late as February, depending on weather conditions. Sediment removal is easiest and most effective in the fall following the rice harvest and when water levels are lowest in the canals.

Sediment removal from 12 to 20 miles of collecting canals each year will require approximately 50 work days for three crews.

Large-scale Sediment Removal (Dry Sediment Removal)

Maintenance Activities

Sediment removal in channels and behind weirs generally occurs in dry portions of the channel (as opposed to sediment removal around structures and from collection canals, described above), except where required in the low-flow channel as described below. The width and depth of sediment excavation varies depending on existing topography, in-channel environmental features (e.g., riparian vegetation), and the gradient needed for drainage and restoration to original design capacity/configuration. Typical sediment removal depths range from 0 to 6 feet. In most cases, the path of the existing low flow channel is retained while the width of the low flow channel can be increased. The amount of sediment removal can vary depending on the facility (e.g., channel, weir). Sutter Yard staff has indicated that it removes approximately 1,000 - 2,000 CY of sediment from behind the Colusa Weir every 2to 4 years. Another example includes a previous sediment removal project at the Sacramento Bypass Weir where approximately 45,000 CY were removed. Each Maintenance Yard is able to conduct up to 50,000 CY of sediment removal projects each year (100,000 CY total for FMO).

Prior to sediment removal activities, the sediment removal area is cleared of vegetation. Existing riparian vegetation, particularly large trees and stands of riparian vegetation with high wildlife habitat values, are retained in channels wherever possible. Rubber-tired scrapers, bulldozers, loaders, graders, dump trucks, tracked excavators, backhoes, bobcats, and pickup trucks are used to remove sediment. Removed sediment may be hauled to an appropriate spoils location, deposited on the private or agricultural land (with proper land owner agreements), deposited on the landside of an adjacent levee for minor levee embankment or stability berm construction, to build up toe or seepage berms, or fill in ditches or depressions, as described in Levee Maintenance, above.

A temporary equipment staging area is generally needed for each large-scale sediment removal site. Staging areas and access routes may be established within the channel, on the channel banks or levee crown roads, or just outside the channel in previously disturbed or developed areas. Staging areas may be graded and certain primary haul roads may be improved. Earthen ramps or localized access paths may be constructed to allow access to designated spoil sites, and vegetation may be removed from the vicinity of the ramps to allow access. Vegetation removed would either be chipped or piled and burned on-site or hauled to an appropriate off-site disposal facility. Piled vegetation is burned in place when permitted by local Air Quality Management District.

Following sediment removal, the elevation of the channel surface will approximate that of the original design. For constructed channels this is typically with a trapezoidal cross section and 2:1 side slopes.

Haul roads will be located within the bed of the channel, when possible, or else established roads will be used. In most cases existing public and private roads are used for access and hauling material off-site; however in some cases new access roads or haul routes may need to be established for access to spoil sites. New ramps may be constructed to move sediment out of the

channel and to the spoil site. All disturbed sites will be restored by distributing an herbaceous seed mix (e.g., hydroseeding) and implementing other erosion control measures as needed.

Areas where sediment removal has occurred are maintained annually to prevent sediment from accumulating by removing fallen trees, debris, and beaver dams, controlling or repairing erosion damage on channel banks, and removing vegetation that may trap sediments.

Frequency

Frequency varies based on the specific facility considered, the rate of sediment accumulation at the site, and the magnitude of sediment accumulation effects on conveyance capacity and functioning of specific facilities.

Timing

Large-scale sediment removal will occur when the channel sections are thoroughly dry between May and October, and extending into November when conditions allow. This work requires 1 to 6 weeks to complete, depending on the size of the sediment removal area.

Debris/Obstruction Removal

Debris in flood control channels has the potential to obstruct flow, reduce channel capacity, accelerate erosion, and damage structures or facilities. Debris consists of trash, beaver dams, flood-deposited woody and herbaceous vegetation, downed trees and branches, and any other debris (e.g., vehicles, tires, refrigerators). Debris is removed using hand tools, tractors, truck-mounted cranes, bulldozers, and backhoes. Organic material may be chipped, or burned on-site or hauled to a certified disposal site in pickup or dump trucks. Non-organic materials such as trash are hauled off-site to certified disposal sites. Debris removal work occurs year-round and generally takes 1 day to complete, although up to 1 week may be needed to clear debris after a high-water event.

When large items such as vehicles are removed from the channel, the work may require a water level reduction. In some cases, lowering of water levels can be achieved by diverting water to a nearby low flow channel or diverting flows. Water is reduced to a level that will allow the work to be completed but will still provide fish passage and will not potentially strand fish. If water levels cannot be feasibly lowered, divers may be used to remove the submerged debris.

Frequency

Debris and obstruction removal are conducted as needed based on the results of inspections conducted by Maintenance Yard staff. Some areas such as log booms at pumping plants are cleared annually or more than once a year. Some active beaver dams may require multiple removal events each year. Many channel sections where woody debris collects during the flood season are cleared after high water events.

Timing

Debris may be removed from channels anytime during the year. However, as noted above, woody debris in channels is usually removed at the end of the flood season.

Channel Vegetation Management

The intent of channel vegetation management is to reduce floodway roughness, increase or maintain floodway capacity, reduce potential debris accumulation, and promote native plant establishment and growth in restoration, mitigation, and wildlife areas. Treatments may occur over a wide range of areas, from less than an acre to areas up to 700 acres. Activities such as limbing may occur in relatively small areas or up to several acres, and vegetation management in large channels such as, the Butte Creek, O'Conner lakes, Sutter Bypass, Fremont Weir, and Natomas East Main Drain, may be up to 700 acres (see Vegetation Management in Large Channels, below) and may occur in wet or dry channels.

Vegetation management is guided by the environmental stewardship values of the CVFPP and Conservation Framework while also meeting channel capacity objectives and ensuring that flood control facilities function properly. Restoration and mitigation sites may be associated with specific implemented projects within the flood control system such as levee or erosion repair projects or large sediment removal projects. Some wildlife areas and mitigation sites are owned by CDFW and the Department of Parks and Recreation, respectively ,are located within channels that are maintained for flood control such as the Colusa State Recreation Area, Abbott Lake, and M&T Ranch are also maintained by DWR. The Maintenance Yards carry out vegetation management in these areas using the methods described in the sections below.

For vegetation management in large channels environmental and engineering staff from the FMO work with staff from the Maintenance Yards to determine the treatment area and methods, and also to designate areas of habitat near channels that should remain untreated.

Aquatic Vegetation Removal

Aquatic vegetation includes submerged and floating aquatic plants and emergent plants rooted below the water level. This vegetation is common in toe drains, seepage ditches, and collection canals. Typically, the aquatic vegetation specifically targeted for removal includes water hyacinth (*Eichhornia crassipes*), water primrose (*Ludwigia peploides, L. hexapetala*), parrotfeather (*Myriophyllum aquaticum*), giant Asian dodder (*Cuscuta japonica* var. *formosana*), coontail (*Ceratophyllum demersum*), and water lettuce (*Pistia stratiotes*).

Water primrose tends to be densest in the spring and summer. While sediment removal can be performed with aquatic vegetation in the canal, and is effective at removing aquatic vegetation at the same time, dense vegetation in the canal may obscure biological monitoring. Herbicide application may be used prior to sediment removal.

Maintenance Activities

Aquatic vegetation is typically removed mechanically by uprooting and piling plants using a dragline, or an excavator with a clamshell bucket. Removed vegetation is either hauled off site and disposed of, or piled on site and burned. Piled vegetation can be burned in place when permitted by the local air quality management district. When aquatic vegetation is removed in support of sediment removal from collecting canals the vegetation is piled with the removed material and left to dry, then spread once the materials are dry.

Translocating herbicides are also used in certain circumstances where mechanical methods are not feasible or effective, though herbicides have the distinct disadvantage of not removing the material from the channel. Herbicide treatments are applied using a tractor and trailer-mounted storage tank with a high-pressure pump or a truck-mounted spray system with a hose and reel for large, contiguous areas while spot applications are made using a hand-held or backpack pump sprayer. All herbicides are applied according to label specifications, guidance of a licensed pest control advisor, and following the guidelines and requirements established by the Department of Pesticide Regulation, and the local County Agricultural Departments. Following label application instructions reduces drift and off-target effects.

Frequency

Vegetation in channels is removed annually. In some areas aquatic vegetation is cleared every year while in others aquatic vegetation is cleared every other year or every several years. The return interval is based on the size and density of the vegetation cover in the channel, which contributes to the effectiveness of each treatment.

Timing

Aquatic vegetation in channels including mechanical and chemical removal (herbicide application) methods is typically conducted May through October.

Woody Vegetation Removal and Management

Maintenance Activities

In the dry portions of channels, shrubs, trees, and woody vines are trimmed (limbed up), cut, and may be managed by hand tools, mowing, strip disking, and mastication. Trees may be trimmed by hand crews using chainsaw and other equipment for cutting vegetation. Downed trees and trees that pose an unacceptable risk to levee integrity also may be removed. Horizontal trees may be deemed an unacceptable risk to levee integrity and will be evaluated using the assessment tool currently being developed by DWR and the California Levee Vegetation Research Program and discussed in the Conservation Strategy (DWR, 2015 in preparation). Tree trimming or removal is usually conducted in fall or winter. However, trees may be cut, trimmed, or removed at any time if they are in clear danger of falling in or across a channel and substantially reducing channel capacity, accelerating erosion, or otherwise causing an emergency. Woody vegetation may be chipped and spread on-site. Typically, California native trees greater than 4 inches DBH are not removed, except in emergency situations. Where feasible and applicable, some vegetation providing beneficial wildlife habitat is left in the channel, in consultation with CDFW or US Fish

and Wildlife Service (USFWS) or DWR's environmental staff. Non-native woody vegetation specifically targeted for removal from channels includes giant reed (*Arundo donax*), Chinese tallow (*Triadica sebifera*), Spanish broom (*Spartium junceum*), Himalayan blackberry (*Rubus armeniacus*), tree of heaven (*Ailanthus altissima*), black locust (*Robinia pseudoacacia*), tree tobacco (*Nicotiana glauca*), castor bean (*Ricinus communis*), pampas grass (*Cortaderia selloana*), eucalyptus (*Eucalyptus* spp.), red sesbania (*Sesbania punicea*), and tamarisk (*Tamarix* sp.).

Application of herbicide to woody vegetation in channels is typically carried out on non-native woody vegetation that has established in the channel or at the toe of the levee. The methods and equipment are similar to those described in the Levee Vegetation Management section. All herbicides are applied according to label specifications, guidance of licensed pest control advisor, and following the guidelines and requirements established by the Department of Pesticide Regulation, and the local County Agricultural Departments

Frequency

Woody vegetation in channels is typically trimmed and removed every several years. Herbicide application is carried out as needed according to the label instructions.

Timing

Woody vegetation removal by mechanical methods is conducted May through December, though removal using hand tools may be carried out year-round. Applying herbicide in channels is carried out May through October.

Vegetation Management in Large Channels

Large flood control channels within the Project area provide enhanced flood protection by maintaining the capacity of the channel. These areas also support vegetation that provides wildlife habitat. In these areas, vegetation management is typically carried out in swaths which are contiguous areas within the channel where vegetation is mowed, trimmed, or removed to maintain flood conveyance capacity. Existing channel vegetation between the swaths is left in place to provide wildlife habitat. Some examples of large flood control channels were vegetation is managed in swaths are: O'Connor Lakes, Butte Creek, Natomas East Main Drain, and the Gilsizer Slough Cross-over Channel with the Sutter Bypass.

Maintenance Activities

In large flood control channels the understory (shrubs and herbaceous vegetation) is typically targeted for vegetation removal. Equipment used for vegetation management includes mowers, masticators, tractors with implements, and excavators with attachments. Vegetation is either mowed or removed using a masticator, depending on site specific conditions. For areas where vegetation management has not previously been conducted or has not been done in a number of years, swaths ranging from approximately 20 to 200 feet wide are cut, leaving anywhere from approximately 50 to 400 feet between swaths, depending on the needs to maintain flood flow conveyance. Dense growth of shrubs, mainly Himalayan blackberry (*Rubus armeniacus)*, wild

grape (*Vitis californica)*, and poison oak (*Toxicodendron diversilobum*) is common in the understory of riparian trees and this vegetation is usually the management target because this dense shrub layer can trap debris and sediment and slow stormwater flow in the channel. Riparian trees greater than 4 inches DBH are trimmed to a height of six feet and trees with DBH less than 4 inches are removed within the swaths. In some cases, trees larger than 4 inches DBH may need to be removed to accommodate equipment (mowers, 60 foot boom excavators equipped with mastication units, chippers, etc.) to enter and move around in the channel to conduct maintenance activities. In addition, in some areas a 15 foot buffer between the swaths and the wetted portion of the channel is maintained to preserve wildlife habitat. In some cases downed trees and woody debris are removed from the areas between swaths in order to help convey high water flows.

Equipment used for vegetation management in large channels includes masticators, mowers, chainsaws, and hand tools. Typically the swaths are treated once for trimming and removal of woody vegetation then followed up in subsequent years with mowing of herbaceous plants or disking of the swaths. Mowing in subsequent years prevents the reestablishment of woody vegetation within the swaths, thereby maintaining flood conveyance capacity in the large channels.

Frequency

Woody vegetation in channels is typically trimmed and removed every several years. Herbaceous vegetation within the large flood control channels may be mowed annually.

Timing

Woody vegetation removal by mechanical methods is conducted May through August, though removal using hand tools may be carried out year-round. Herbaceous plant mowing in the large flood control channels may be conducted May through December, with May through August being the most likely treatment period. Burning of piled channel vegetation may occur year round.

Burning

Channel vegetation, both aquatic and woody is typically removed from the channel and piled on for burning. Aquatic vegetation is removed as described above under Aquatic Vegetation Removal, and woody vegetation is removed as described above under Woody Vegetation Removal and Management. Piles are formed by hand or using equipment such as excavators for aquatic vegetation. Vegetation is allowed to dry before the piles are burned.

Frequency

Burning of piled aquatic and woody channel vegetation occurs annually.

Timing

Piles are burned year round.

Grazing

Grazing in dry portions of channels occurs throughout the Project area in areas where this vegetation management approach makes the most sense based on local conditions. Sheep and goats are used to reduce the overall height of herbaceous and woody vegetation within the targeted management area.

Frequency

Grazing in dry portions of the channel occurs annually.

Timing

Grazing could occur April-October.

Channel Scour Repairs

Channel scours are uneven ground surfaces caused by the erosive force of water suspending sediment and carrying it away. Channel scours can be created across large areas or as more localized depressions (e.g., around bridge foundations, around weir structures). Channel scours are repaired in the dry portions of channels (not the low-flow channel) by scraping, disking, filling, leveling, and regrading the ground surface. When using fill to repair scoured areas, 6 to 24 inch minus rock is used, depending on the size of scouring. These actions are similar to those described in Sediment Removal and Minor Grading above.

Frequency

Areas of channel scour are repaired as needed based on the surveys and monitoring conducted by the Maintenance Yards.

Timing

Channel scour repairs typically occur from April through November.

Flood Control Structure Maintenance and Repair

Structure maintenance activities include the maintenance, repair, and replacement of pumps, water control structures (e.g., outfall gates and weirs), pipes and culverts, bridges, and maintenance yard facilities. These activities are conducted year-round, and each requires 1 day to several weeks to conduct. Work takes place in facility footprints and does not require additional work areas or new access routes or staging areas. Work is performed primarily with hand tools but also requires pickup and flatbed trucks, truck-mounted cranes, backhoes, and generators. Structure maintenance activities are often preceded by supporting maintenance activities described in the following sections above: Sediment Removal; Debris/Obstruction Removal; and Vegetation Management. Removal of sediment or debris and removal or trimming of vegetation prior to structure maintenance is often necessary to improve access for equipment and materials and to ensure proper functioning of the facilities.

Pumping Plant Maintenance and Repair

Maintenance Activities

Pumping plants frequently require active maintenance and occasionally require repair in order to function properly. Channel vegetation clearing, channel maintenance, and sediment removal from collecting canals are critical for ensuring successfully operating pumps because when the pumps are turned on, vegetation, loose sediment, and any other loose debris can be drawn toward the pumps. The channel maintenance section above describes the methods used to clear vegetation and debris that may impact pump operations. Pumping plants are designed to accommodate a wide range of capacities and to draw excess water from drainage systems and discharge it into the main channel. Pumping plants include steel trash racks that are installed in front of the intake sump to protect the pumps and prevent damaging materials from entering the intake sump. At some stations, a log boom supplements the function of trash racks. Log booms are placed in the channel upstream of the facility to collect floating material. A maintenance guide and inspection checklist, located inside each control structure, guides maintenance staff to carry out typical maintenance activities. As described in the Superintendent's Guide (DWR, 2014), typical maintenance activities of the pumping plant include:

- Removing all trash, including built-up sand gravel, and/or silt, from the area of the log boom, the trash rack, and the gravity discharge pipe or channel before the high-water season begins;
- Removing all debris captured by intercepting structures must be removed, either by hand tools or mechanical means, when the pumps are active before the accumulated materials clog the pump system; and
- Repairing wing walls, bulkheads, splash aprons, and the superstructure that are made of reinforced concrete that is subject to cracking and spalling and may lead to exposing the reinforcement bars.

Staging, materials stockpile, and equipment access for these activities are carried out within the existing footprint of the pumping plant facility and along developed access roads.

Frequency

Maintenance and repair activities are generally conducted annually at each pumping plant. Structural repair work (e.g., repairing wing walls, bulkheads, splash aprons) is conducted as needed.

Timing

Several activities are included with pumping plant maintenance and repair. Debris removal, sediment removal, and vegetation removal are conducted prior to the high-water season (typically May through November). Repairing the pumping plant structure, and conducting repairs and maintenance within the pumping plant may occur year round.

Weir Maintenance and Repair

Maintenance Activities

There are several weirs that DWR is responsible for maintaining (Figures 2 and 3). As described in the Superintendent's Guide (DWR, 2014), "control weirs permit excess water to escape into a bypass system when high river stages occur and are designed to release additional flows through a series of control gates to reduce the stress on levee systems when needed. Proper operation of control weirs is considered vital to the safety of residential, industrial, and agricultural property near and downstream from the facility." Typically, maintenance staff adheres to operational guidelines that are dictated by USACE and document maintenance and operations. According to the Superintendent's Guide (DWR, 2014), typical maintenance activities include:

- Removing or leveling of silt deposits, debris, and undesirable vegetation between the river and the structure (see Channel Maintenance for descriptions of Vegetation Management and Sediment Removal);
- Removing the obstructions within the spillway and concrete bulkhead to maintain function of the weir and control gates (see Channel Maintenance for a description of Debris / Obstruction Removal);
- Repairing erosion around the structure that can be caused by increase of volume and velocity of water when gates of weir are opened. Erosion repair methods are described in the erosion repair section above (see Section Levee Maintenance for a description of Erosion Repair); and
- Painting the metal structures of the weir. This requires building a cofferdam to block flows around the weir, and removing the structure to treat and paint the metal off-site.

Staging, materials stockpile, and equipment access for these activities are carried out within developed or disturbed areas in the vicinity of the weir including roads and level areas that are used regularly for maintenance of the facility.

Frequency

Maintenance and repair activities are generally conducted annually at each weir. Each weir may not require all maintenance and repair activities every year, but it is likely that one or several of these activities will occur in a given year at each weir.

Timing

Several activities such as sediment and debris removal, erosion repair, and structure painting are included in weir maintenance and repair. Debris removal may be conducted year-round. Sediment removal is conducted May through November. Erosion repair is typically conducted June through October.

Outfall Gates Maintenance and Repair

Maintenance Activities

DWR is responsible for maintaining several outfall gates located in the Project area (Figures 2 and 3). As described in the Superintendents' Guide (DWR, 2014), "outfall structures are multipurpose features that are usually situated in a drainage canal or channel near its confluence with a main river. A series of mechanized discharge pipes or slide gates are incorporated into a reinforced concrete barrier that, when closed, prevents flood water in the river from backing up into the drain system. The gates can also be operated to maintain desirable levels in the drainage system to meet irrigation needs or to release excess flood water into a bypass system. Trash gates and/or log booms are positioned on the upstream side of the control gates to prevent debris from fouling their operation." The primary maintenance activities of the outfall gates include:

- Removing debris that collects near the gates (at some facilities, a debris boom is installed for this purpose) (see Channel Maintenance for a description of Debris/Obstruction Removal);
- Removing/treating undesirable vegetation on the revetment on both sides of the structure such that an unobstructed passageway is maintained (see Channel Maintenance for a description of Channel Vegetation Management);
- Inspecting the concrete superstructure and patching any cracks and spalls;
- Straightening or welding damaged metal portions of the outfall gates (e.g., flap gate, grizzly bars, etc.); and
- Inspecting, testing and repairing (as necessary) the electrical or hydraulic system.

Staging, materials stockpile, and equipment access for these activities are carried out within developed or disturbed areas in the vicinity of the outfall gates including roads and level areas that are used regularly for maintenance of the facility.

Frequency

Maintenance and repair activities are generally conducted annually at each outfall gate. Each outfall gate may not require debris removal, vegetation removal, and structure repair every year, but it is likely that one or several of these activities will occur in a given year at each outfall gate.

Timing

Many associated activities such as debris removal and vegetation management are conducted as part of outfall gates maintenance. Debris removal may be conducted year round alongside other maintenance and repair of outfall gates. The timing of management for aquatic vegetation is May through October.

Pipe/Culvert Repair, Replacement and Abandonment

USACE provides periodic inspections to verify proper maintenance and component operation of the flood control system. Included in the USACE inspection program is a requirement that all

culverts/discharge pipes be verified by the levee maintaining agency and the owner of the structure using television camera videotaping or visual inspection methods within the past 5 years and that a report for every pipe is available for review by the USACE inspector. DWR's current method is to visually inspect the readily visible crossings where flapgates, closure devices, headwall, and exposed pipes are present in addition to the adjacent levee conditions. An annual inspection report is submitted to the FMO Chief each fall, along with an update to the California Data Exchange Center (CDEC) database, detailing the deficiencies and prioritizing any required repairs. Currently, DWR does not utilize camera equipment unless a substantial problem is suspected. Pipe/culvert repair, replacement, and abandonment is necessary to ensure that levee integrity is maintained. Additional goals for culvert and pipe repair and replacement may include reducing annual maintenance requirements and improving fish and wildlife passage.

For pipe/culvert repair, replacement, or abandonment, staging and stockpiling areas are generally located in disturbed or developed areas, often within the footprint of an existing or future facility. These activities may occur anywhere in the Project area, including on levees or in channels. Construction footprints associated with culvert and pipe repair or replacement, including staging and stockpiling areas, may be as large as 1 acre.

Pipe/Culvert Repair

Damaged or dysfunctional culverts and pipes must be repaired or replaced to maintain conveyance and avoid potential safety hazards associated with flooding and scouring. Existing pipes and culverts are excavated and repaired in place. In some cases, over-excavation is used in order to facilitate repairs on the pipe or to repair voids. Excavated soil may be used on site, hauled off-site and stockpiled at an existing stockpile location, or disposed of at an appropriate facility. Once the excavation is complete, the subsoil is inspected by an engineer for compliance with Code of Federal Regulations (CCR) Title 23 levee material. If the material is unsuitable it is replaced with CCR Title 23 compliant levee material. Minor repairs such as flapgate repairs may not require any excavation and can be carried out using hand tools.

Erosion repairs (e.g., revetment installation) also may be made around the culvert inlet/outlet including the replacement of wingwalls or headwalls, and erosion control measures will be in place during construction. If necessary, water will be diverted around the work area with temporary dams and submersible pumps. Vegetation also may be cleared from the work area to provide access for equipment. Following the maintenance work, disturbed areas will be restored to pre-activity conditions through native plantings or seeding. Equipment used may include hand tools, bulldozers, excavators, vibratory compactors, cranes, trucks, and backhoes.

Frequency

Minor repairs are made annually as needed in response to the USACE and maintenance yard inspections. There is no regular return interval or typical number of pipes or culverts repaired each year.

Timing

Work may take up to 1 month to complete and typically occurs in April and the beginning of flood season, usually around November 15. However, minor repairs that do not require excavation such as repairing flapgates may be carried out any time of the year.

Pipe/Culvert Replacement

The methods and equipment for pipe/culvert replacement are similar to those described above for pipe/culvert repair. The existing pipe or culvert is excavated and soil is stockpiled on-site or hauled off-site to an existing stockpile location or disposal facility. Excavated material is used for backfilling the excavated area once the installation is complete, to the extent feasible. Over excavation is frequently needed for pipe/culvert replacement to accommodate pipes or culverts with larger capacity than the existing materials, or to provide equipment and personnel access to the work area. A combination of hand tools, bulldozers, excavators, trucks, and backhoes are used to excavate the existing pipe or culvert and this equipment, in addition to cranes, may be used to install the replacement pipe or culvert and fill in the excavation. Vibratory compactors are often used to compact the material once it has been replaced.

Frequency

Pipe/culvert replacements are made annually as needed in response to the USACE and maintenance yard inspections.

Timing

Work may take up to 1 month to complete and typically occurs between April and November.

Pipe Abandonment

Pipes that are beyond repair may be abandoned. This process typically involves filling the pipe with grouting material (see Levee Maintenance for description of grouting material) and leaving it in place.

At times, in place pipe abandonment within a levee is preferred due to site constraints such as roads or railways on top of levees. Pipes that are abandoned in place must be completely filled with concrete per Title 23 Section 124. To safely and properly fill a pipe with concrete, the pipe must first be inspected via video camera or visual inspection if practical. The pipe is then cleaned to remove rust and silt within the pipe to ensure complete concrete coverage and adhesion. The low end of the pipe (typically on the water side of the levee) is capped using an appropriate method for the situation. In cases where the end of the pipe is under water, a diver may be needed to set the plug. Many intake pipes have grates on the end that need to be removed prior to capping. Once the plug is installed, the high end of the pipe is fitted with a flange with valves for injecting concrete and releasing air. To reduce the possibility of a failed plug leading to a discharge of concrete, the backfill occurs in two lifts. The first lift is the minimum amount of concrete needed to fill the end of the pipe against the plug. The second lift occurs at least 3 days later and fills the remainder of the pipe. After the concrete is given 7 days to cure, the inflatable plug may be removed for re-use if desired.

Frequency

Pipe abandonment is carried out as needed based on the results of regular inspections. There is no regular return interval or typical number of pipes abandoned each year.

Timing

Pipe abandonment work is typically conducted between April and November.

Bridge Maintenance Repair and Replacement

Bridge Maintenance

Maintenance Activities

Bridges located throughout the plan area require periodic maintenance to ensure their operability and limit damage to other structures. Failure of a bridge can occur as a result of corrosion or collapse, which can lead to internal erosion of a levee or road, and loss of access to property and flood control structures (e.g., levees, water control structures) for potential flood fight operation and required maintenance.

Typical bridge maintenance includes removing woody debris from the waterway within 50 feet of the bridge; spraying, mowing, or burning vegetation near bridge abutments and foundation supports; controlling erosion (i.e., through revetment placement and minor earthwork) near the foundation supports, abutments, and wing walls; and repairing and replacing bridge decking, wing walls, abutments, approaches, and railings. Bridges may include in-channel pilings or concrete abutments, footings, and adjacent riprap that may need to be repaired when cracks or spalls occur. Equipment used to maintain and repair bridges can include dump trucks, excavator, cement truck or mixer, hand tools, welders, pumps, and forklift. Construction waste is disposed of at an appropriate disposal facility.

One common maintenance need is the repair of areas of erosion along the bridge abutments that results in separation of the bridge and the bank. To repair the separation, concrete abutments and aprons are installed or replaced along one or several sides of the bridge. To prepare the bridge abutments, soil is first excavated in trenches alongside the bridge and the trenches are filled with rebar cages. The trenches are typically 1 to 2 feet wide, are 8 feet deep, and vary in length depending on the length of the bank. Trenches are filled with concrete and bolted to the bridge to prevent separation. Concrete aprons are installed alongside the abutments and typically measure 8 feet wide and 6 inches deep. The length of the apron varies depending on the length of the bank. This type of bridge repair generally requires 2 to 4 weeks of work. A dump truck, excavator, and cement truck as well as hand tools are needed to complete the work.

Staging, materials stockpile, and equipment access for bridge repair and maintenance activities are carried out within developed or disturbed areas in the vicinity of the bridge including roads and level areas.

Frequency

Bridge maintenance is carried out as needed; there is no regular return interval for each bridge.

Timing

Bridge maintenance work is conducted year-round.

Bridge Replacement

Maintenance Activities

Small bridges over drainage canals that provide access to farm roads periodically need replacement due to natural degradation. These bridges are primarily located in the Sutter Bypass area, including EL-1A, CC-2, CC-4, EI-2, EI-5, WI-1, WI-2, EL-2, EL-3, EL-6, and WL-1. These bridges are narrow, accommodating one vehicle at a time, and are constructed of wood with metal railings. These structures are typically constructed with concrete abutments and aprons, and metal pilings within the channel for support.

The existing bridge must first be demolished and the materials hauled off-site to an appropriate disposal facility. Demolition is carried out using excavators, dump trucks, hand tools, and a forklift. A small staging area of less than 0.5 acre located within the existing road or on an adjacent disturbed area is used for staging materials for construction of the replacement bridge. A dump truck, excavator, and cement truck are needed to excavate the trenches and install the concrete abutments and aprons and the metal pilings within the channel.

Frequency

Bridges are replaced as needed, and an estimate of five bridges will need to be replaced over the next 10 years

Timing

Bridge replacement work is conducted year round.

Data Collection

Data collection activities such as geotechnical, water quality, and biological surveying, levee and other facility inspections, and ongoing monitoring by the maintenance yards support the maintenance work described in the previous sections by providing information about facility conditions and identifying areas where maintenance is needed. Surveys, inspections, and monitoring specific to certain activities, such as those associated with pipes and culverts are described in those sections above. This section discusses the methods and equipment for data collection activities that support maintenance activities more generally.

Data Collection Activities

Specialized survey work such as geotechnical exploration, bathymetry, water quality, and biological monitoring are typically carried out in advance, and in support of, facility or structure

maintenance activities and sediment removal. Geotechnical borings, for example, are often needed at existing structures where maintenance work is planned to provide information about soils so that structure designs (e.g. in-water pilings) can incorporate site-specific conditions.

Geotechnical borings are one of the more equipment and labor-intensive data collection activities. In-water geotechnical boring can be done from a barge or ship in locations where the channel can support large vessels. In-water borings are typically advanced, using the mud rotary method and can be drilled and sampled to a maximum depth of approximately 80to 100 feet below the bottom of the channel. Bentonite clay is typically added to the boring to allow removal of drill cuttings and to stabilize the boring. Soil samples are collected from within the conductor casing. The drill hole below the conductor casing can be approximately 3.5to 5.5inches in diameter. Drilling fluids are kept in a closed system and all drill equipment is disconnected within the drill system or on the barge deck. Grouting of the drilled hole is accomplished from the bottom upward to a depth of approximately 10 feet below the bottom of the river based on a calculated grout take volume to prevent grout migration into the river water. At the completion of the grouting, the conductor casing is then be pulled out of the channel bottom to complete the in-water boring operation.

On land geotechnical borings utilize the cone petrometer test (CPT) and/or the hollow-stem auger (HSA) approach. CPT uses a cone petrometer to continuously measure the resistance to penetration, providing information about the nature and structure of the soil strata and estimating the physical and mechanical properties of the soil. The boring depth is typically twice the depth of the channel plus the height of the levee where the equipment is located. HSA recovers soil cores to identify zones of soft soils. CPT usually requires a truck-mounted, 20-ton push-capacity cone apparatus and HSA requires a truck or track mounted hollow stem rotary drill rig. Both are usually powered by a diesel engine, also located on the rig. A drill rig tender vehicle and tool truck generally accompany the test rigs for CPT and HSA. Boring sites are located along the levee embankment on the channel side. Each boring location requires several hours or up to 2 days to complete. The number of boring sites varies by the size, location, and individual needs of the maintenance activity that is being supported by geotechnical investigations.

Bathymetry surveys, or topographic surveys of channels below the water line, are typically conducted using standard surveying equipment such as a totals station connected to multiple survey points along channel cross-sections. Multiple cross-section transects are established along the channel, and the surveyor collects elevation data at survey points starting outside the levee, extending across the channel to the outside of the opposite levee. Multiple points are recorded along the levee, at the top of bank, the bottom of the channel, and any other breaks in grade that occur along the transect. The work is carried out by two or more individuals with one person at the survey station and another wading across the channel on foot with the survey pole. A vehicle is needed to transport the personnel and survey equipment to the site, the bulk of the survey is done on foot. No staging areas are required and vegetation is not generally removed for this type of survey work.

Biological surveys are typically conducted using a truck or boat to arrive at the survey site. Then the biologists may continue to examine the survey area on foot, recording observational or

quantitative data as they go along. Heavy equipment is not used for biological surveys and vegetation is not removed.

Annual or biannual facility inspections are carried out by maintenance yard staff and other DWR staff as well as USACE staff in some circumstances, such as levee inspections. These inspections may require minor vegetation removal in order to improve visibility of facility structures. Staff members arrive at the inspection site by truck or boat, and no specialized equipment is needed to conduct the inspection.

Ongoing monitoring by maintenance yard staff is conducted regularly to inspect flood control facilities and ensure their proper functioning. Monitoring efforts are concentrated in the fall, winter, and spring when flood control facilities are operating at capacity; data from monitoring informs the maintenance activities that are often carried out during late spring through early fall. Monitoring during and after flood events is critical for identifying areas of immediate as well as long-term maintenance needs. Monitoring is generally conducted using trucks travelling along levee or toe roads, and also by boat as needed.

Frequency

Specialized survey work such as geotechnical, water quality, and biological monitoring are generally associated with a specific planned activity such as sediment removal, bridge maintenance, repair, or replacement, or maintenance of other structures, and occur on an as needed basis. Levee and other facility inspections typically occur on an annual or biannual basis around the same time every year. Ongoing monitoring activities by the maintenance yard staff take place as needed throughout the year with routine monitoring often occurring during and after flood events so that maintenance needs such as debris removal can be addressed immediately.

Timing

Data collection activities occur year-round.

Potential Environmental Effects

The EIR will evaluate potential project-specific and cumulative environmental effects associated with the proposed Project. The proposed Project may have potentially significant impacts on the following environmental factors, but not limited to:

- Air quality
- Biological resources
- Cultural resources
- Hydrology and water quality
- Noise

References

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