Draft Environmental Assessment/Initial Study for Levee Repair of 25 Erosion Sites Volume 1

Sacramento River Bank Protection Project

Prepared for:

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Sacramento, CA 95814

and

The Central Valley Flood Protection Board
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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO ATTENTION OF

Environmental Resources Branch

DRAFT FINDING OF NO SIGNIFICANT IMPACT
Sacramento River Bank Protection Project
Twenty-five Erosion Sites, 2009-2010

I have reviewed and evaluated the information in this Environmental Assessment/Initial Study (EA/IS); final Programmatic Environmental Impact Report/Supplemental Environmental Impact Statement IV for the Sacramento River Bank Protection Project (SRBPP); and views of other agencies, organizations, and individuals concerning the proposed levee work at 25 erosion sites in Sacramento, Yolo, Yuba, Colusa, Sutter, and Tehama counties in northern California. The proposed work is authorized under the authority of the SRBPP, Phase II.

The proposed action consists of implementing bank protection measures along 15,646 linear feet of levees along the Sacramento River and tributaries during 2009 and 2010. Bank protection measures at 22 of the erosion sites would include (1) reinforcing the bank toe with riprap; (2) placing a mixture of riprap and soil on upper banks and tops of the lower bank riprap to create riparian benches above the mean summer water elevation; and (3) planting the benches and upper banks with vegetation to provide bank stabilization and riparian habitat. In-stream woody material would also be placed along the sites to provide bank protection and aquatic habitat. Work at the remaining three erosion sites would consist of constructing setback levees on the land side of their existing levees.

The possible consequences of the work described in the EA/IS have been studied with consideration given to land use; aesthetics; recreation; cultural resources; biological resources; hydrology and water quality; geomorphology; air quality; traffic and circulation; noise; hazardous, toxic, and radioactive waste; socioeconomics; and environmental justice concerns. The effects, significance, and mitigation requirements have been fully coordinated with other Federal and State resource agencies. The proposed levee work would have short-term adverse effects on riparian habitat and aquatic habitat values. Environmentally sensitive design and mitigation measures have been integrated into the project to fully compensate for these effects.

The proposed levee work would have no significant adverse effects on the environment, and the mitigation measures agreed to in the EA/IS are sufficient to substantially reduce potentially significant effects. The Corps will implement all terms and conditions in each Biological Opinion issued by the U.S. Fish and Wildlife Service and National Marine Fisheries Service. Based on the results of the environmental evaluation and completion of interagency coordination, I have determined that the EA/IS and Finding of No Significant Impact provide adequate documentation and that no further environmental document is required.

_____
Date

_____
Thomas C. Chapman, P.E.
Colonel, U.S. Army
District Engineer

NOTICE OF PUBLIC REVIEW
AND INTENT TO ADOPT A
MITIGATED NEGATIVE DECLARATION

The Central Valley Flood Protection Board (CVFPB) has coordinated with the U.S. Army Corps of Engineers (Corps) to prepare a joint Environmental Assessment/Initial Study (EA/IS) for the Sacramento River Bank Protection Project (SRBPP), Phase II Levee Repair of 25 Erosion Sites. The CVFPB is the non-federal sponsor and the lead agency under the California Environmental Quality Act (CEQA). The Corps is the federal sponsor and the lead agency under the National Environmental Policy Act (NEPA). The EA/IS is tiered from the 1987 Environmental Impact Report/Supplemental Environmental Impact Statement IV (EIR/SEIS IV) for the SRBPP.

The EA/IS describes the proposed project and the potential impacts on the environment. The CVFPB has concluded that potentially significant impacts resulting from implementation of the proposed project would be avoided, or reduced to a less-than-significant level, by the adoption and implementation of the mitigation measures specified in the EA/IS. Therefore, the CVFPB intends to adopt a Mitigated Negative Declaration (MND) pursuant to the requirements of CEQA (Section 210000 et seq., Public Resources Code) and the CEQA Guidelines (Section 15000 et seq., Title 14, California Code of Regulations).

Project Location: The proposed project is located along the Sacramento River and its tributaries in Sacramento, Yolo, Colusa, Sutter, and Tehama counties. Fifteen of the 25 erosion sites are along the Sacramento River at river mile (RM) 8.0 left bank (L), 10.8L, 26.0L, 35.4L, 41.9 right bank (R), 71.3R, 73.5L, 78.8L, 87.0L, 93.7, 114.5R, 130.0L, 136.7L, 136.9R, and 157.7R; four sites are along the Feather River at RMs 1.0L, 3.7L, 5.5L, and 7.0L; two sites are along the lower American River at RMs 10.0L and 10.6L; two sites are located along Cache Creek at levee mile (LM) 2.8L and 3.4L; one site is along Deer Creek at LM 0.9 North; and one site is along the Sutter Bypass at LM 0.4 East. More specific information for the 25 erosion sites is included in the EA/IS.

Description of the Proposed Project: The proposed project is authorized under the authority of Phase II of the SRBPP, which has approximately 15,646 linear feet of levee repair remaining of the 405,000 linear feet originally authorized. The proposed project consists of implementing bank protection measures at up to 15,646 linear feet of SRBPP levees along the Sacramento River and its tributaries during 2009 and 2010.

Based on field assessments of the SRBPP levees conducted in 2007, the CVFPB and the Corps have identified 25 priority sites that are at risk of erosional failure during flooding and/or normal flow conditions. These sites must be repaired before their condition becomes so critical as to require emergency repair. The lengths of the erosion sites range from 250 feet to 2,300 feet; the cumulative length of the 25 erosion sites is approximately 23,897 feet.

Only 15,646 linear feet of levee repair can be completed under the existing SRBPP Phase II authorization. Because of the inherent and unpredictable difficulties in obtaining all access,

easements, and other required authorizations to complete SRBPP levee repairs, the EA/IS addresses the environmental effects associated with bank protection for all 25 erosion sites (i.e., 23,897 linear feet). This provides the CVFPB and the Corps with the needed flexibility to ensure that 15,646 linear feet of repairs are completed during 2009 and 2010 (i.e., all required authorizations for some of the 25 erosion sites may not be obtainable during 2009 and 2010). The erosion sites that are not repaired in 2009 and 2010 (i.e., repairs in excess of the 15,646 linear feet authorized under the existing Phase II authorization) will be readdressed in future CEQA and NEPA documentation under subsequent SRBPP authorization.

Public Review Period: The draft EA/IS is being circulated for public review and comment for a period of 30 days beginning April 9, 2009. Comments on the draft EA/IS are welcomed and appreciated. Comments received on the draft EA/IS will be incorporated in the final EA/IS, as appropriate. Comments on the draft EA/IS need to be submitted and received at the following address no later than 4:00 p.m. on May 8, 2009:

California Department of Water Resources (DWR)
Attn: Mr. Kip Young, Staff Environmental Scientist
2825 Watt Ave, Suite 100
Sacramento, CA 95821
(916) 574-1437
kyoung@water.ca.gov

Document Availability: The draft EA/IS is available for review at:

- Department of Water Resources, Division of Flood Management, Levee Repairs Branch , 2825 Watt Ave, Suite 100, Sacramento, California 95821
- Central Valley Flood Protection Board website at: http://www.cvfpb.ca.gov/reports
- U.S. Army Corps of Engineers, Sacramento District's website at: http://www.spk.usace.army.mil/projects/civil/sac_river_bank_protection/index.html

Copies of the draft EA/IS have also been submitted to the following public libraries with a request that the document be available for public review.

- Chico Branch Library, 1108 Sherman Avenue, Chico, CA 95926
- Gridley Branch Library, 299 Spruce Street, Gridley, CA 95948
- Colusa County Free Library, 738 Market Street, Colusa, CA 95932
- Grimes Branch Library, 240 Main Street, Grimes, CA 95950
- Hamilton City Branch Library, 330 Broadway, Hamilton City, CA 95951
- Sutter County Library, 750 Forbes Avenue, Yuba City, CA 95991
- Sacramento Central Library, 828 I Street, Sacramento, CA 95814

- Belle Cooledge Library, 5600 South Land Park Drive, Sacramento, CA 95822
- Rancho Cordova Library, 9845 Folsom Blvd, Sacramento, CA 95827
- Walnut Grove Library, 14177 Market Street, Walnut Grove, CA 95690
- North Natomas Library, 2500 New Market Drive, Sacramento, CA 95835
- Rio Vista Library, 44 S. 2nd St., Rio Vista, CA 94571
- Courtland Library, 170 Primasing Ave, Courtland, CA 95615
- Tehama County Library, 645 Madison Street, Red Bluff, CA 96080
- Corning Branch Library, 740 Third Street, Corning, CA 96021
- Los Molinos Branch Library, 7881 Highway 99E, Los Molinos, CA 96055
- Yolo County Library, 226 Buckeye Street, Woodland, CA 95695
- Clarksburg Branch Library, 52915 Netherlands Road, Clarksburg, CA 95612
- Knights Landing Branch Library, 42351 Third Street, Knights Landing, CA 95645
- Arthur F. Turner Branch Library, 1212 Merkley Avenue, West Sacramento, CA 95691

Notice of Public Meeting: A CVFPB public meeting for the proposed project has been scheduled for May 15, 2009. Information regarding the location, and time of the public meeting can be obtained on the CVFPB website at http://www.cvfpb.ca.gov, or by contacting Mr. Kip Young by phone at (916) 574-1437 or by e-mail at kyoung@water.ca.gov.

PROPOSED MITIGATED NEGATIVE DECLARATION

SACRAMENTO RIVER BANK PROTECTION PROJECT, PHASE II LEVEE REPAIR OF 25 EROSION SITES

LEAD AGENCY
Central Valley Flood Protection Board
3310 El Camino Avenue
Room LL40
Sacramento, CA 95821

Availability of Document: The draft Environmental Assessment/Initial Study (EA/IS) for this proposed Mitigated Negative Declaration (MND) is available for review at:

1. Department of Water Resources, Division of Flood Management, Levee Repairs Branch, 2825 Watt Ave, Suite 100, Sacramento, California 95821

2. Central Valley Flood Protection Board website at: http://www.cvfpb.ca.gov/reports

3. U.S. Army Corps of Engineers, Sacramento District's website at: http://www.spk.usace.army.mil/projects/civil/sac_river_bank_protection/index .html

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- Arthur F. Turner Branch Library, 1212 Merkley Avenue, West Sacramento, CA 95691

Questions and/or comments regarding the proposed Mitigated Negative Declaration and the draft EA/IS should be submitted no later than 4:00 p.m. on May 8, 2009, to:

California Department of Water Resources
Attn: Mr. Kip Young, Staff Environmental Scientist
2825 Watt Ave, Suite 100
Sacramento, CA 95821
(916) 574-1437
kyoung@water.ca.gov

Project Description: The Central Valley Flood Protection Board (CVFPB) has coordinated with the U.S. Army Corps of Engineers (Corps) to design bank protection measures for 25 priority erosion sites within the Sacramento River Bank Protection Project (SRBPP) planning area. Priority erosion sites are areas along the SRBPP levees that are at risk of erosional failure during flooding and/or normal flow conditions. The proposed project consists of implementing bank protection measures at up to 15,646 linear feet of levees along the Sacramento River and tributaries during 2009 and 2010. Bank protection measures would be completed at a portion of 25 erosion sites identified in the Draft EA/IS.

Table 1. 25 SRBPP Erosion Sites Proposed for Repair during 2009 and 2010

Site	County	Agency	Proposed Year Construction	Length of Repair (feet)
SAC 8.0L	Sacramento	Corps	2010	1,550
SAC 10.8L	Sacramento	Corps	2010	550
SAC 26.0L	Sacramento	Corps	2010	2,005
SAC 35.4L	Sacramento	DWR/CVFPB	2009	1,070

Site	County	Agency	Proposed Year Construction	Length of Repair (feet)
SAC 41.9R	Yolo	Corps	2009	1,515
SAC 71.3R	Yolo	Corps	2009	515
SAC 73.5L	Sacramento	Corps	2009	1,050
SAC 78.8L	Sutter	Corps	2009	250
SAC 87.0L	Sutter	Corps	2009	750
SAC 93.7	Sutter	Corps	2009	1,050
SAC 114.5R	Colusa	Corps	2010	1,500
SAC 130.0L	Sutter	Corps	2010	470
SAC 136.7R	Colusa	Corps	2009	300
SAC 136.9R	Colusa	Corps	2009	900
SAC 157.7R	Colusa	Corps	2010	1,005
FR 1.0L	Sutter	Corps	2010	990
FR 3.7L	Sutter	Corps	2010	2,300
FR 5.5L	Sutter	Corps	2009	832
FR 7.0L	Sutter	DWR/CVFPB	2009	520
LAR 10.0L	Sacramento	DWR/CVFPB	2009	740
LAR 10.6L	Sacramento	DWR/CVFPB	2009	670
CC 2.8L	Yolo	DWR/CVFPB	2010	1,300
CC 3.4L	Yolo	DWR/CVFPB	2010	900
DC 0.9N	Tehama	Corps	2010	800
SBP 0.4E	Sutter	Corps	2010	365
Total				**23, 897**

The CVFPB is the non-federal sponsor and the lead agency under the California Environmental Quality Act (CEQA). The Corps is the federal sponsor and the lead agency under the National Environmental Policy Act (NEPA). The draft EA/IS is tiered from the 1987 Environmental Impact Report/Supplemental Environmental Impact Statement IV (EIR/SEIS IV) for the SRBPP. The proposed project is authorized under the authority of Phase II of the SRBPP, which has approximately 15,646 linear feet of levee repair remaining of the 405,000 linear feet originally authorized. The erosion sites that are not repaired in 2009 and 2010 (i.e., repairs in excess of the 15,646 linear feet authorized under the existing Phase II authorization) will be readdressed in future CEQA and NEPA documentation under subsequent SRBPP authorization.

The proposed project includes a suite of four different designs to address the needed repairs at each of the 25 erosion sites. Selection of the appropriate design for each site required: 1) consideration of the likely causes of erosion; 2) consideration of site-specific vegetation conditions, wildlife resources, existing structures, land ownership, and access; and 3) consideration of input provided by resource agencies, including National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game.

Three of the proposed designs (Design 1, Design 2, and Design 3) involve repair of the existing levee by placing rock revetment (i.e., quarry stone) on the levee slope to provide bank protection and prevent continuing erosion. These designs also incorporate the construction of

vegetated benches, installation of instream woody material (IWM), maximum retention of existing trees, and revegetation of the benches and levee slope. These elements are customized for each erosion site to respond to the specific environmental conditions present (e.g., extent of erosion, existing habitat to be preserved). The fourth design (Design 4) is a setback levee and is proposed for sites where repair of the existing levee is not practicable.

Findings: The draft EA/IS has been prepared to determine if the proposed project could have a significant effect on the environment. Although the proposed project has a potential to result in a significant effect on the environment, the incorporation of the mitigation measures identified in the draft EA/IS would reduce the potential for significant effects to a less-than-significant level. The mitigation measures identified in the draft EA/IS and a mitigation monitoring and reporting plan (MMRP) will be adopted to ensure compliance with the required mitigation measures. Conservation elements that have been incorporated into the proposed project to offset environment effects (i.e., installation of IWM, revegetation with native riparian plant species) will also be included in the MMRP. A summary of the potential impacts of the proposed project, the significance of the potential impacts, and the required mitigation measures is presented in the attached table.

Determination: In accordance with Section 21082.1 of CEQA, the CVFPB has independently reviewed and analyzed the draft EA/IS and proposed MND for the proposed project. The draft EA/IS and proposed MND reflect the independent judgment of the CVFPB. The CVFPB has determined that adoption of a MND is appropriate and that the preparation of an Environmental Impact Report (EIR) will not be required. The CVFPB will adopt an MMRP to ensure compliance with the required mitigation measures and integrated conservation elements of the proposed project.

_____ _____

Jay Punia Date
Executive Officer
Central Valley Flood Protection Board

Approved as to Legal Form and Sufficiency

_____ _____

Nancy Finch Date
Staff Counsel

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
Land Use			
Impact LAND1 Construction under the proposed action would result in the conversion of a small amount of farmland for the construction of setback levees.	LS[A]	None required.	N/A
Aesthetics			
Impact AES1 Construction equipment on the levee repair sites would temporarily degrade the aesthetics of the repair sites.	LS	None required.	N/A
Impact AES2 Implementation of the proposed project would result in long-term changes in visual resources.	LS	None required.	N/A
Recreation			
Impact REC1 Construction at the levee repair sites would result in a temporary loss of recreational opportunities.	PS[B]	***Mitigation Measure REC1*** a. Signage and/or buoys shall be provided at each of the erosion sites to warn of the potential hazards during construction. Construction personnel shall warn the public (e.g., boaters, recreationists) to stay away if they approach within 100 feet of construction equipment (e.g., barges, cranes).	LS

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		b. Where construction zones encompass recognized recreational trails, alternate routes and detours shall be imposed. Signage shall be placed around the construction areas to identify the closed areas and alternate routes.	
Impact REC2 Changes in the landscape due to levee repair could result in long-term loss of recreational opportunities.	LS	None required.	N/A
Impact REC3 Features of the project design could represent public safety hazards to recreationists.	PS	***Mitigation Measure REC2*** a. The design of the restored levees shall ensure local approach visibility for recreational boaters through the use of natural indicators, such as highly visible emergent portions of IWM and vegetation on the low-elevation areas, to act as visual warning of the presence of shallowly submerged hardscape. IWM shall be oriented in a downstream direction to reduce potential straining effects on river users and the subsequent danger of entrapment.	LS
Cultural Resources			
Impact CR1 Implementation of levee repairs could affect historic era pilings.	LS	None required.	N/A
Impact CR2 Implementation of levee repairs could affect historic era levee segments.	LS	None required.	N/A

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
Impact CR3 Implementation of levee repairs at SAC 41.9R would affect the remains of the Clarksburg ferry.	PS	***Mitigation Measure CR1*** a. Prior to initiation of construction activities at SAC 41.9R, the Clarksburg Ferry shall be formally evaluated for eligibility for listing in the National Register of Historic Places (NRHP) and the California Register of Historical Resources (CRHR). The determination of eligibility shall be made in consultation with the State Historic Preservation Officer (SHPO). If the Clarksburg Ferry is determined to not be eligible for listing, no further measures are required. If the Clarksburg Ferry is determined to be eligible for listing in the NRHP or the CRHR, the proposed designs for bank protection at SAC 41.9R shall be modified, as practicable, to avoid effects to the Clarksburg Ferry. If effects can be completely avoided, no further measures are required. If effects cannot be avoided, the following measures shall be implemented. b. Prior to any construction activities at SAC 41.9R, data recovery for the Clarksburg Ferry shall be completed. The data recovery shall include: 1) limited excavation to expose construction details; 2) recordation of all construction details, including the plan view, exposed cross-section details, and specific vessel components (e.g., rudder, guard); 3) photographic documentation including video and still images; 4) collection and/or conservation of select artifacts (e.g., rudder, fasteners, wood samples) if appropriate and authorized; and 5) archival research that captures the informational value of the resource and its role in the maritime history of the Sacramento River and the local community (e.g., Nunes Brothers boat builders). These data recovery measures are recommended treatment measures for inclusion in a Historic Properties Treatment Plan (HPTP) to address project-related effects to the Clarksburg Ferry. Final treatment measures to address project-related effects will be specified in the HPTP as stipulated in a Memorandum of Agreement between the Corps and SHPO.	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		c. Prior to any construction activities at SAC 41.9R, section 106 consultation with the State Historic Preservation Officer (SHPO) shall be completed.	
Impact CR4 Implementation of levee repairs at SAC 73.5L could affect potentially significant prehistoric subsurface deposits.	PS	***Mitigation Measure CR2*** a. All prehistoric subsurface deposits at SAC 73.5L shall be preserved in place, unless other arrangements are requested by the appropriate tribal government. To accomplish preservation in place, the following steps shall be taken: ▪ Vegetation to be removed from the site shall be removed manually using hand tools (e.g., chainsaws, mowers, gas-powered hedgers). No grubbing or excavation of any kind (e.g., excavation for tree root removal) shall be allowed. No large mechanical equipment (e.g., tractors, crawlers, bulldozers) shall be used for vegetation removal. ▪ Coir fabric or similar sterile natural fabric shall be placed over the entire area containing the subsurface deposits (approximately 165 feet long). At least 2 feet of soil shall be placed on the fabric before placing the rock revetment. ▪ A qualified professional archaeologist shall be retained to conduct on-site monitoring during vegetation removal and construction activities at SAC 73.5L. At the discretion of the monitoring archaeologist, any construction activities shall be slowed or halted at any time if a suspected archaeological object or archaeological site is encountered. b. If a possible significant cultural resource is encountered, all construction activity in the vicinity of the discovery shall be stopped. The monitoring archaeologist shall work with the construction contractor and the Corps/CVFPB to determine appropriate conservation measures. Construction activities in the vicinity shall not resume until appropriate conservation measures have been implemented. Appropriate conservation measures may	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		include, but are not limited to, evaluating the find for significance, formal recording and data recovery, erecting exclusionary fencing, and consultation with SHPO and appropriate tribal governments	
Impact CR5 Implementation of levee repairs could affect unidentified traditional use resources.	PS	***Mitigation Measure CR3*** a. In the event ongoing interagency consultation reveals potentially significant tribal values (pursuant to NHPA) ascribed to or affected by work at any of the 25 erosion sites, then, prior to any construction (e.g., ground disturbance, viewshed disturbance), the Corps/CVFPB shall formally record the affected resource to the extent permitted by the affected tribal government and to a degree that would allow for evaluation and treatment. The affected resource shall be evaluated pursuant to the NRHP and the CRHR by a professional archaeologist retained by the Corps/CVFPB. The archaeological recording and eligibility determination shall be conducted in coordination with the Office of Historic Preservation (and the Advisory Council on Historic Preservation, if any consulting party requests). If the affected resource is determined to not be eligible for listing on either the NRHP or the CRHR, then no further mitigation is required. If the affected resource is determined to be eligible (or potentially eligible) for the listing on either the NRHP or the CRHR (in consultation with the Office of Historic Preservation), then mitigation measure CR-3b shall be implemented. b. If the affected resource is determined to be eligible (or potentially eligible) for listing on either the NRHP or the CRHR, impacts shall be avoided to the extent practicable. Measures required to achieve avoidance shall be determined in consultation with the Corps/CVFPB, the Office of Historic Preservation, and the affected tribal government(s); and shall be written in a memorandum of agreement. Avoidance measures may include, but are not limited to, installing	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		exclusionary fencing during project development; providing permanent protection from disturbance through a deed restriction, conservation easement, or other legal instrument. If disturbance to the affected resource is completely avoided, no further mitigation is required. If consultation fails to achieve methods of avoidance or practical mitigations, the wording of the memorandum of agreement may allow the project to affect the resource. If a memorandum of agreement is issued that would allow disturbance to the affected resource, then no further mitigation is required.	
Impact CR6 Implementation of levee repairs could affect unknown buried, submerged, or obscured cultural resources.	PS	***Mitigation Measure CR4*** a. In the event archaeological resources (e.g., buildings, structures, or objects older than 45 or 50 years of age) other than those determined to lack eligibility for either the NRHP or the CRHR, are discovered as a result of construction activities, all work in the immediate vicinity of the discovery shall be stopped immediately and the Corps/CVFPB shall be notified. An archaeologist meeting the Secretary of Interior's Professional Qualifications Standards in prehistoric or historical archaeology, as appropriate, shall be retained to evaluate the find and recommend appropriate conservation measures. Conservation measures shall be implemented prior to reinitiation of activities in the immediate vicinity of the discovery. b. If human remains are discovered during construction activities, all activities in the vicinity of the find shall be suspended and the appropriate County Coroner's Office shall be notified. If the coroner determines that the remains may be those of a Native American, the coroner shall contact the Native American Heritage Commission (NAHC). Treatment of the remains shall be conducted in accordance with the direction of the County Coroner or the NAHC, as appropriate.	LS

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
Biological Resources			
Impact BIO1 Implementation of the proposed action could affect orchard and pasture vegetation communities.	LS	None required.	N/A
Impact BIO2 Implementation of levee repairs could affect native tree resources.	PS	***Mitigation Measure BIO1*** a. All native trees within the construction easement that are greater than 4 inches dbh shall be retained to the greatest extent practicable. Tree removal shall be limited to situations where access, required equipment maneuverability, worker/public safety, and levee integrity are not reasonably possible without removal of trees. Any tree removal that is not specifically identified as authorized in the construction plans shall require individual authorization by the Corps and/or CVFPB. This specification shall be identified in the construction contract. b. All trees that are to be retained and that occur within the footprint of the repairs shall be trimmed of any branches that would interfere with installation of protective materials (e.g., burlap or plywood boxes) or be covered with revetment. All trimming of trees shall be completed by an International Society of Arboriculture (ISA) certified arborist or other qualified personnel that are knowledgeable about tree biology and appropriate trimming procedures. c. All trees that are to be retained and that occur within the footprint of the repairs shall be protected by constructing plywood boxes around the trunks or wrapping the trunks with protective materials (e.g., burlap) prior to placement of revetment. Tree protection measures shall be clearly illustrated in the	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		construction plans. Where construction of plywood boxes around tree trunks is appropriate (e.g., on upper slopes with limited height of revetment), the box shall be constructed as far as practicable away from the trunk. d. Construction staging and operation of vehicles/heavy equipment within the dripline of native trees shall be avoided to the greatest extent practicable.	
Impact BIO3 Implementation of the levee repairs could affect riparian vegetation communities.	LS	None required. Proposed action includes revegetation with native riparian species.	N/A
Impact BIO4 Implementation of the proposed action could affect ruderal vegetation communities.	LS	None required.	N/A
Impact BIO5 Implementation of the proposed action could affect emergent wetland vegetation communities.	PS	***Implement Mitigation Measures WQ1 and WQ2***	LS
Impact BIO6 Implementation of the proposed action could affect special-status plants.	PS	***Mitigation Measure BIO2*** a. Direct disturbance to populations of Mason's lilaeopsis, Suisun Marsh aster, and Delta mudwort at erosion sites SAC 8.0L and SAC 10.8L shall be avoided. The locations of the populations of these species shall be clearly identified on construction plans, and these locations shall be clearly identified as avoidance areas. b. Prior to initiation of construction activities, exclusionary fencing (i.e., 4-foot	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		tall plastic orange mesh) and signage shall be erected around the populations of special-status plant species within the construction easement. Fencing shall be placed as far as practicable away from the plant populations. No fencing shall be placed within inundated areas of the Sacramento River. Fencing shall be erected under the supervision of a qualified biologist. No construction disturbance shall be allowed within the fenced areas. Signage prohibiting entrance shall be placed at a minimum of every 50 feet along the exclusionary fencing. The signs shall be clearly readable from a distance of 20 feet. All fencing and signage shall be maintained for the duration of all construction activities. c. Prior to initiation of construction activities, worker environmental awareness training shall be conducted by a qualified biologist. The training shall inform workers of the sensitivity of the avoidance areas and their responsibilities to ensure that the populations of special-status plant species are not disturbed. d. Prior to initiation of construction activities at erosion site SBP 0.4E, a qualified biologist shall conduct surveys for wooly rose-mallow within 100 feet upstream and downstream of the construction easement footprint. Surveys shall be conducted during the identifiable period for this species. If wooly rose-mallow is not present within the survey area, no additional measures are required. If wooly rose-mallow is present within the survey area, the following measures shall be implemented: ▪ Direct impacts to populations shall be avoided to the greatest extent practicable. This may include, but is not limited to, installation of exclusionary fencing, signage, and implementation of worker environmental awareness training. ▪ If direct impacts cannot be avoided, the plants (including their root balls/rhizomes) shall be transplanted to an appropriate location under the	

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		supervision of a qualified biologist. The qualified biologist shall coordinate with the DFG regarding transplantation techniques and locations prior to implementation of transplantation efforts. ▪ If transplantation of plants is required, a monitoring program (with performance requirements) shall be implemented to evaluate the success of the transplantation effort. The monitoring program shall be developed by a qualified biologist in coordination with the DFG. The monitoring program shall be implemented for a minimum of 3 years. If transplantation efforts are determined to be unsuccessful during the monitoring period, remedial actions shall be identified and implemented in coordination with the DFG. Remedial actions may include, but are not limited to, providing replacement plantings and continued monitoring with plants obtained from a local native plant nursery, participating in the improvement of habitat conditions at off-site locations known to support the species, and implementing or providing financial support to conservation efforts in the watershed that would benefit regionally occurring special-status plant species. ***Also, implement Mitigation Measures WQ1 and WQ2 below.***	
Impact BIO7 Construction activities could have direct impacts on fish.	PS	***Mitigation Measure BIO3*** a. In-water work activities shall be limited to August 1 through November 30. b. During construction operations, stockpiling of construction materials, portable equipment, vehicles, and supplies shall be restricted to the designated construction staging areas. A qualified biologist shall provide worker environmental awareness training to contractors and construction crews regarding all special-status fish species known to occur near the erosion sites. c. A representative (on-site monitor) shall be appointed by the Corps to be the	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		point of contact for any worker that observes a dead, injured, or entrapped special-status fish. Dead or injured fish shall be photographed and the photographs provided to the Corps, NMFS, and the USFWS. If a live specimen is captured in good condition, and a positive identification cannot be made in the field because of size or lack of other distinguishing characteristics, the fish shall be immediately returned to the river downstream of the project area.	
Impact BIO8 Construction activates could affect fish through short-term increases in turbidity and suspended sediment.	PS	***Implement Mitigation Measure WQ1***	LS
Impact BIO9 Construction activates could affect fish through the accidental release of toxic substances into the water.	PS	***Implement Mitigation Measure WQ2***	LS
Impact BIO10 Implementation of levee repairs could affect fish through loss of riparian vegetation.	LS	None required. Proposed action includes revegetation with native riparian species.	N/A
Impact BIO11 Construction activities could affect fish by removing instream woody materials.	LS	None required. Proposed action includes installation of instream woody material.	N/A

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Impact BIO12 Implementation of levee repairs would result in a loss of steelhead spawning habitat at sites LAR 10.0L and LAR 10.6L.	PS	***Mitigation Measure BIO 4*** a. A compensatory replacement program shall be implemented for the estimated loss of 25,939 square feet (0.60 acre) of potentially suitable steelhead spawning habitat at erosion sites LAR 10.0L and LAR 10.6L. The compensatory replacement program shall result in addition of spawning-size gravel in an amount suitable to account for replacement of the spawning habitat lost by the project. The augmentation of spawning-size gravel shall account for both the actual area lost to each revetment structure footprint and the loss of the steelhead spawning that would potentially occur in the season(s) that the revetments are built. A 2:1 replacement ratio shall be required to compensate adequately for the potential spatial and temporal loss of potential spawning habitat. Applying the 2:1 ratio, the estimated required spawning habitat mitigation area is 51,878 square feet (1.19 acres). b. The location and volume for mitigation gravel shall be selected in close coordination with qualified fishery biologists who are familiar with the location and habits of steelhead in the Lower American River. Furthermore, selection of the mitigation site(s) shall be selected in coordination with a qualified geomorphologist familiar with gravel augmentation and its attendant caveats. c. The mitigation gravel shall have a thickness that is greater than the typical redd thickness, or height, constructed by Lower American River steelhead to insure adequate habitat for spawning and incubation of eggs and alevin. The initial gravel volume shall also be thick enough to provide an adequate supply of spawnable gravel subsequent to possible redistribution of the emplaced mitigation gravel that may occur after sediment transporting flows. The mitigation gravel shall be placed in a location adjacent to the project sites that is accessible to spawning steelhead and where key habitat parameters (e.g.,	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		water velocity, depth, and temperature) are suitable for steelhead spawning. d. Prior to implementation of the compensatory replacement program, the location of augmentation sites, volume of gravels required, and method and timing for gravel placement shall be approved by NMFS. e. Through coordination with NMFS, CVFPB, and the Corps, an ongoing monitoring program shall be developed to document the success of gravel augmentation in the project reach. Specifically, field surveys shall document steelhead use of the added gravels, track the movement and dispersal (i.e., loss) of the added gravels over time, and identify losses or additions of suitable spawning areas elsewhere in the project reach due to changes in hydraulic conditions as a result of the project. Information obtained from ongoing redd surveys conducted by the USBR in the project reach may be used to complement the monitoring activities.	
Impact BIO13 Implementation of levee repairs would result in temporary and long-term impacts to aquatic habitat for special-status fish species.	PS	***Mitigation Measure BIO5*** a. Prior to implementation of the proposed action, formal consultation under section 7 of the ESA shall be completed with NMFS and the USFWS. All terms and condition of the Biological Opinions shall be implemented. b. On-site mitigation shall include the creation of three riparian bench types, including a riparian bench with a 10:1 bank slope (13 Corps-built sites), and undulating riparian bench with 2-foot transverse berms and 10:1 bank slope (4 DWR-built sites), and a sloping riparian bench with a 6:1 bank slope (3 Corps-built sites on the Feather River). The riparian benches shall be seasonally inundated during winter and spring high flows. In Reach 1a, where no riparian benches will be constructed, bank slope repairs shall be planted with riparian vegetation. c. IWM and fascines shall be installed at all of the erosion sites (except the three	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		setback levee sites) to retain and enhance the structural habitat and hydraulic complexity of the nearshore zones relative to existing conditions. The key objective is to provide essential SRA habitat and velocity refuge opportunities for rearing juveniles. Woody materials shall be installed at the 22 sites in accordance with the installation designs shown in the revegetation plans (Appendix F). All installed IWM shall consist of hardwood tree species (e.g., English walnut and almond) that span approximately 15 to 20 feet in length and retain an extensive branch and root structure. IWM shall be securely anchored under rock revetment at the front edge of the riparian bench or bank toe (e.g., SAC 8.0L and 10.8L) for both high water winter and spring habitat and for low water summer and fall aquatic habitat. The required specifications for installation of IWM and planting of riparian trees shall be clearly identified in final construction drawings and construction contracts. d. To compensate for salmonid habitat losses identified by the SAM, the Corps and CVFPB shall purchase or develop aquatic habitat with equivalent values (within the SAM) to provide 1,390 linear feet and 271,363 square feet (6.2 acres) of habitat for juvenile Chinook salmon in fall within Regions 1a, 1b, 2, and 3 by WY 2015 (Year 6 for 2009-built sites and Year 5 for 2010-built sites). These values shall be used to compensate for effects on juveniles as well as other salmonid life stages, even though model results indicate that juveniles would potentially experience the greatest habitat losses. A suitable mitigation site shall be situated within 50 miles of the project sites and approved by NMFS. The expected project-related impacts to other juvenile special-status fish species (i.e., green sturgeon, Sacramento splittail, river lamprey, and hardhead) would be similarly mitigated to less-than significant levels with the creation of aquatic habitat by this salmonid-targeted mitigation measure.	

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Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		e. To compensate for delta smelt habitat losses identified by the SAM, the Corps and CVFPB shall purchase or develop aquatic habitat with equivalent values (within the SAM) to provide 1,014 linear feet and 181,455 square feet (4.2 acres) of habitat for the affected delta smelt life stages (spawning, incubation, and rearing) in summer within Regions 1a and 1b. Compensation in these amounts shall be applied no later than 2011 to ensure habitat recovery within the 2-year recovery period recommended by the SAM (USACE 2004). Off-site mitigation credits shall be withdrawn from the Cache Slough/Yolo Bypass Mitigation Area. Prior to 2007, the Cache Slough mitigation site offered 12,000 feet and 138 acres (6,011,280 square feet) of potential habitat compensation. Considering both the current SAM-modeled deficits (1,014 linear feet and 4.2 acres) and previous compensation of 2,531 linear feet and 21.9 acres from 29 previously constructed Corps sites (USACE 2008a) and 816 linear feet and 3.8 acres from 13 planned Corps sites in 2008–2009 (USACE 2008b) withdrawn from this mitigation site, this would leave a balance of 7,639 feet and 108.1 acres (4,708,836 square feet for future delta smelt compensation needs.	
Impact BIO14 Construction activities at erosion sites SAC 41.9R, FR 1.0L, FR 3.7L, FR 5.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC3.4L, SAC 73.5L, SAC 130.L, and SAC 157.7R could have impacts on the valley elderberry longhorn beetle.	PS	***Mitigation Measure BIO6*** a. The locations of elderberry shrubs to be preserved and elderberry shrubs to be transplanted shall be clearly identified on construction plans. b. Prior to any vegetation clearing, plywood boxes (or other protective measures approved by the USFWS) shall be constructed around all elderberry shrubs proposed to be preserved within the footprint of the levee repairs. The plywood boxes shall be constructed as far as feasible outside the dripline of the elderberry shrubs. A biological monitor shall be present during construction of the plywood boxes to ensure that all elderberry shrubs intended to be preserved	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		are identified and adequately protected prior to vegetation clearing. c. Prior to any construction activities, exclusionary fencing (e.g., 4-foot tall plastic orange mesh) shall be erected around all elderberry shrubs located outside of the footprint of the repairs, but within the construction easement. Fencing shall be placed as far as practicable outside of the dripline of the elderberry shrubs. Fencing shall be erected under the supervision of a qualified biologist. No construction disturbance within the fenced areas shall be allowed. Signage shall be placed a minimum of every 50 feet along the exclusionary fencing with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the FESA of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs shall be clearly readable from a distance of 20 feet. All fencing and signage shall be maintained for the duration of all construction activities. d. Prior to the initiation of construction activities on all sites containing elderberry shrubs to be preserved, worker environmental awareness training shall be conducted by a qualified biologist. The training shall instruct crews about the status of the valley elderberry longhorn beetle, its relationship with its host plant, the need to avoid damaging elderberry shrubs, and the possible penalties for not complying with these requirements. e. Following completion of the levee repairs at all sites containing elderberry shrubs, a post-construction evaluation shall be conducted by a qualified biologist to determine whether any elderberry shrubs intended to be preserved were damaged by construction activities. If damage is identified, the USFWS shall be immediately consulted to determine appropriate compensatory measures. Measures to compensate for unanticipated impacts to elderberry shrubs shall (at a minimum) conform to the 1999 USFWS *Conservation*	

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		Guidelines for the Elderberry Longhorn Beetle. f. All elderberry shrubs proposed to be removed from the footprint of the levee repairs shall be transplanted to an off-site location approved by the USFWS. Timing, transplant techniques, and ratios for plantings of additional elderberry shrubs and associated native plant species shall be approved by the USFWS. A qualified biologist shall monitor the transplanting of all elderberry shrubs to ensure that all requirements of the USFWS are fulfilled.	
Impact BIO15 Construction activities at erosion site SBP 0.4E could have impacts on the giant garter snake.	PS	***Mitigation Measure BIO7*** a. Unless otherwise approved by the USFWS, construction activities at erosion site SBP 0.4E shall be initiated only during the giant garter snake active period (May 1 to October 1), when individuals are active on the surface and able to move away from disturbance. b. Prior to initiation of construction activities at site SBP 0.4E, workers shall participate in USFWS-approved worker environmental awareness training provided by a qualified biologist. The training shall instruct workers on how to identify the snake and its habitats, what to do if a snake is encountered during construction activities, and how to contact the designated biological monitor. c. Within 24 hours prior to commencement of construction activities, the site shall be inspected by a qualified biologist approved by the USFWS. The biologist shall provide the USFWS with a field report documenting the monitoring effort that occurred within 24 hours of commencement of construction activities. The biologist shall be available during construction. If a giant garter snake is encountered, the monitoring biologist and the USFWS shall be immediately notified and all construction activities with the potential to disturb the snake shall be immediately stopped. The snake shall be	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		monitored and allowed to leave the area on its own. The biologist shall remain in the area for the remainder of the workday to ensure that the snake is not harmed. If a snake does not leave on its own within one working day, further consultation with the USFWS shall be conducted. d. Movement of heavy equipment to and from the construction site shall be restricted to established roadways and designated construction areas. Stockpiling of construction materials shall be restricted to designated staging areas. e. Giant garter snake habitat that can be avoided shall be clearly identified on construction plans, and these locations shall be clearly identified as avoidance areas. Exclusionary fencing and signage shall be erected to delineate avoidance areas. No construction disturbance shall be allowed with the avoided areas. f. Erosion control measures (BMPs) that minimize soil or sediment from entering the river shall be implemented. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations. g. Litter, debris, unused materials, equipment, and supplies from areas below the ordinary high water line shall be removed daily. Such materials or waste shall be deposited at an appropriate disposal or storage site. h. No plastic, monofilament, jute, or similar erosion control matting that could entangle snakes shall be placed in the construction area when working within 200 feet of giant garter snake habitat. Possible substitutions include coconut coir matting, tactified hydroseeding compounds, or other material approved by the USFWS. i. Upon completion of construction activities, any temporary fill and/or construction debris shall be removed from the site. If the material is located	

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		near undisturbed giant garter snake habitat and shall be removed between October 1 and April 30, it shall be inspected by a qualified biologist to ensure that snakes are not using it as a hibernaculum.	
Impact BIO16 Construction activities could have impacts on western pond turtles.	PS	***Mitigation Measure BIO8*** a. Pre-construction surveys for western pond turtles shall be conducted by a qualified biologist the morning of initiation of construction activities. Any turtles observed shall be allowed to move out of the construction area before construction activities are initiated. b. Prior to initiation of construction activities at all erosion sites, workers shall participate in a worker environmental awareness training provided by a qualified biologist. The training shall instruct workers regarding how to identify the turtle, the habitats used by the turtle, the potential for turtle egg clutches (i.e., nest sites) to be discovered during vegetation clearing, what to do if a turtle or suspected egg clutch is encountered during construction activities, and how to contact the monitoring biologist. The monitoring biologist shall be contacted immediately in the event that a turtle or eggs are encountered. c. Any dead or injured turtles shall be immediately reported to the DFG. The treatment of any injured or dead turtles shall be coordinated with the DFG.	LS
Impact BIO17 Construction activities at sites SAC 136.9R and CC 3.4L could have impacts on bank swallows.	PS	***Mitigation Measure BIO9*** a. To the extent practicable, construction activities at erosion sites SAC 136.9R and CC 3.4L during the bank swallow nesting season shall be avoided. The bank swallow nesting season is early April to mid-July. b. If construction activities at sites SAC 136.9R and CC 3.4L are to occur during the bank swallow nesting season, a qualified biologist shall conduct a pre-	LS

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		construction survey within the construction easement to determine the presence/absence of nesting bank swallows. At least one survey shall be conducted no more than one week prior to the onset of any construction activity. If no active nests are located, no further mitigation is necessary. c. If active bank swallow nests (nests containing eggs or young) are present within the construction easement, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the DFG. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate. d. A qualified biologist shall monitor any active nests that are located within the construction easement. The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and nest failure is possible, the DFG shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with the DFG and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to the DFG within 2 weeks of termination of monitoring activities.	
Impact BIO18 Construction activities at erosion sites SAC 41.9R, SAC 71.3R, SAC 130.0L, SAC 136.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR	PS	***Mitigation Measure BIO10*** a. To the extent practicable, construction activities at the erosion sites during the nesting season for white-tailed kites and other raptor species shall be avoided. The nesting season for raptor species is March through August.	LS

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7.0L, SBP 0.4E, SAC 73.5L, SAC 78.8L, SAC 114.5L, SAC 136.9R, and SAC 157.7R could have impacts on white-tailed kites.		b. If construction activities are to occur during the nesting season, a qualified biologist shall conduct pre-construction surveys of the construction easement and accessible areas within a 500-foot radius prior to initiation of construction activities. At least one survey shall be conducted no more than one week prior to the initiation of construction activities. If no active nests are located, no further measures to avoid impacts to active raptor nests are warranted. c. If an active raptor nest is identified within 500 feet of the construction easement, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the DFG. Determination of the required width of the buffer zone shall consider the distance of the nest site from construction activities, the line of sight from the nest site to construction activities, the existing level of disturbance, and other factors established with the DFG on a case-by-case basis. d. A qualified biologist shall monitor any active nests that are located within 500 feet of construction activities (assuming DFG approves a buffer width of greater than or equal to 500 feet). The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and nest failure is possible, the DFG shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with the DFG and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to the DFG within 2 weeks of termination of monitoring activities.	

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Impact BIO19 Construction activities could have impacts on the Swainson's hawk.	PS	***Mitigation Measure BIO11*** a. At all erosion sites (other than SAC 8.0L, SAC 10.8L, and DC 0.9N), construction activities during the Swainson's hawk nesting season shall be avoided to the extent practicable. The Swainson's hawk nesting season is March 1 to August 15. b. If construction activities are to occur during the Swainson's hawk nesting season, a qualified biologist shall conduct a pre-construction survey of accessible areas within a 0.5-mile radius of the construction easement, The required survey radius may be reduced (on a case-by-case basis) if approved in advance by the DFG, but in no case shall be less than 500 feet. At least one survey shall be conducted no more than one week prior to the initiation of construction activities. If no active nests are located, no further measures to avoid impacts to active Swainson's hawk nests are necessary. c. If an active Swainson's hawk nest is identified within the required survey radius, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the DFG. Determination of the required width of the buffer zone shall consider the distance of the nest site from construction activities, the line of sight from the nest site to construction activities, the existing level of disturbance, and other factors established with the DFG on a case-by-case basis. d. A qualified biologist shall monitor any active nests that are located within 500 feet of construction activities (assuming DFG approves a buffer width of greater than or equal to 500 feet). The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		nest failure is possible, the DFG shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with the DFG and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to the DFG within 2 weeks of termination of monitoring activities.	
		e. If direct impacts to an active Swainson's hawk nest site cannot be avoided, or the required no-disturbance buffer determined in coordination with DFG cannot be maintained, a CESA 2081 incidental take permit shall be obtained prior to initiation of construction activities. All conditions of the 2081 permit shall be implemented. Permit conditions may include, but are not limited to, implementing restoration/replacement of woody riparian habitat, acquisition/preservation of existing habitat, and purchase of credits from an authorized mitigation bank or payment of in-lieu fees.	
		f. Suitable foraging habitat for Swainson's hawk occurs at site SAC 87.0L. This habitat shall be avoided to the extent practicable. Any suitable foraging habitat that is temporarily disturbed due to construction activities (e.g., staging or ground disturbance) shall be restored to pre-construction conditions or better after completion of construction activities. If construction activities result in a permanent loss of suitable foraging habitat, compensation for loss of foraging habitat shall be provided in accordance with the *Staff report regarding mitigation for impacts to Swainson's hawks (Buteo swainsoni) in the Central Valley of California* (California Department of Fish and Game 1994b) or by other measures as approved by the DFG.	

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Impact BIO20 Construction activities could have impacts on the yellow warbler and yellow-breasted chat.	PS	***Mitigation Measure BIO12*** a. To the extent practicable, construction activities at erosion site DC 0.9N during the nesting season for the yellow warbler and yellow-breasted chat shall be avoided. The nesting season for these species is from early April to mid-July. If construction activities avoid the nesting season, no further mitigation is required. b. If construction activities are to occur during the nesting season, pre-construction surveys of all suitable habitats within 250 feet of proposed construction activities shall be conducted by a qualified biologist. A minimum of one survey shall be conducted no more than one week prior to the onset of any construction activity. If no active nests are located, no further mitigation is necessary. c. If active nests (nests containing eggs or young) are present within the survey area, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the DFG. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate	LS
Impact BIO21 Construction activities could have impacts on the western red bat.	LS	None required.	N/A

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Impact BIO22 Construction activities could have impacts on non–special status fish species.	PS	***Implement Mitigation Measure WQ1, WQ2, and BIO3***	LS
Impact BIO23 Construction activities could have impacts on nesting raptors and migratory birds.	PS	***Mitigation Measure BIO 13*** a. Vegetation removal during the peak nesting season for migratory birds shall be avoided. The peak nesting season is April 1 to July 15. b. If vegetation removal is to occur during the peak nesting season, a qualified biologist shall conduct a pre-construction survey within the construction easement to determine the presence/absence of nesting birds. At least one survey event shall be conducted no more than one week prior to the onset of any construction activity. If no active nests are located, no further mitigation is necessary. c. If active nests (nests containing eggs or young) are identified within the survey area, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the USFWS. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate. ***Also, implement Mitigation Measure BIO10***	LS
Impact BIO24 Construction activities could have impacts on marine mammals.	PS	a. All aquatic habitat within the construction area shall be inspected for the presence of marine mammals within 2 hours and 30 minutes prior to the initiation of construction and during construction activities. b. If a marine mammal is encountered, all construction activities shall cease and	LS

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		NMFS and the monitoring biologist shall be contacted for further instructions. Construction activities shall not be initiated or resumed until the marine mammal has completely left the area at its own volition. c. If any dead or injured marine mammals are discovered, all construction activities shall cease and NMFS and the monitoring biologist shall be immediately contacted. Construction activities shall not resume until authorized by NMFS. The treatment of any injured or dead marine mammals shall be coordinated with NMFS.	
Impact BIO25 Construction activities could have impacts on non–special status wildlife species.	LS	None required.	N/A
Hydrology and Water Quality			
Impact WQ1 Construction activities could cause a temporary increase in turbidity.	PS	***Mitigation Measure WQ1*** a. The contractor shall prepare a Storm Water Pollution Prevention Plan (SWPPP) and implement the SWPPP during and after construction to minimize turbidity-generating activities. The SWPPP shall include an erosion control plan, a water quality monitoring plan, a hazardous materials management plan, and BMPs for construction activities, including the use of a floating turbidity curtain, as appropriate. The BMPs shall be maintained until terrestrial areas disturbed during construction have been adequately revegetated and stabilized. b. Water quality monitoring, as detailed in the SWPPP, shall contain specific directives for establishing sampling locations and for acceptable levels of turbidity and settleable solids. Sampling shall be conducted at an upstream	LS

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		location in the vicinity of each construction site once daily to establish background levels. Water samples for determining down-current turbidity and settleable solids levels shall be collected 5 feet from the shoreline and 300 feet down-current of any floating turbidity curtain. c. Benchmark levels for turbidity under the Central Valley RWQCB Basin Plan shall not exceed 1 NTU above ambient conditions (where natural turbidity levels range from 0–5 NTU); 20% (where natural turbidity levels range from 5–50 NTU); 10 NTU (where natural turbidity levels range from 50–100 NTU); or 10% (where natural turbidity levels are >100 NTU). In determining compliance with these turbidity limits averaging periods may be applied, provided that beneficial uses remain fully protected. d. Settleable solids shall be determined by the American Public Health Association (1998) Method 2540F. During working hours, the construction activity shall not cause the settleable solids down-current from each construction site to exceed 0.1 ml/L after one hour settling. e. Prior to placement of any material within the ordinary high water mark of the waterbody, a Section 401 Water Quality Certification shall be obtained from the RWQCB. All conditions of the Water Quality Certification shall be met. f. Project construction contractors shall obtain and comply with the conditions of a State General Construction Activity Stormwater Permit adopted by the California State Water Resources Control Board.	
Impact WQ2 Construction activities could release hazardous materials into the waterway.	PS	***Mitigation Measure WQ2*** a. The contractor shall develop and implement a hazardous materials management plan prior to initiation of construction. The plan shall include BMPs that would reduce the potential for spills of toxic chemicals and other hazardous materials during construction. The plan shall include a specific	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		protocol for the proper handling and disposal of materials and contingency procedures to follow in the event of a hazardous materials spill. The plan shall also describe the specific protocol for the proper handling and disposal of potentially hazardous materials that could be encountered during construction. Any spills of hazardous materials to the river shall be cleaned up immediately and immediately reported to the Central Valley RWQCB, NMFS, and USFWS.	
Geomorphology			
Impact GEO1 Implementation of levee repairs would arrest bank erosion and change sediment recruitment.	LS	None required.	N/A
Impact GEO2 Implementation of levee repairs could reduce instream woody material (IWM) recruitment rates.	LS	None required.	N/A
Impact GEO3 Implementation of levee repairs would change local hydraulics and shear stress.	LS	None required.	N/A
Impact GEO4 Construction activities would accelerate erosion and sedimentation.	PS	***Implement Mitigation Measure WQ1***	LS

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
Air Quality			
Impact AQ1 Implementation of levee repairs will temporarily increase emissions.	PS	***Mitigation Measure AQ1*** a. Standard construction practices at the erosion sites would ensure that exhaust emissions from all off-road diesel-powered equipment used on the sites do not exceed 40 percent opacity for more than 3 minutes in any 1 hour. Any equipment found to exceed 40 percent opacity (or Ringelmann 2.0) shall be repaired immediately, and the Corps or CVFPB and the appropriate local air quality agency shall be notified within 48 hours of identification of non-compliant equipment. A visual survey of all in-operation equipment shall be made at least weekly and a monthly summary of the visual survey results shall be submitted throughout the duration of construction activities, except that the monthly summary will not be required for any 30-day period in which there is no construction activity. The monthly summary shall include the quantity and type of vehicles surveyed, as well as the dates of each survey. The SMAQMD and/or other officials shall be authorized to conduct periodic site inspections to determine compliance. None of the mitigation measures presented in this section would supersede SMAQMD, YSAQMD, FRAQMD, TCAPCD, CCAPCD, or state rules or regulations. b. Additional BMPs shall be implemented for ozone and PM_{10} to help protect ambient air quality conditions. To reduce ozone and PM_{10} levels, the contractor shall perform routine tuning and maintenance of construction equipment to ensure that the equipment is in proper running order. The contractor shall also monitor dust conditions along access roads and within the construction area to ensure that the generation of fugitive dust is minimized below the 50 $\mu g/m^3$ 24-hour threshold. Water sprays shall be periodically applied to disturbed areas and soil stockpiles for dust control, at least three	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		times per day during hot weather. Minimum freeboard for all haul vehicles shall be 2 feet or greater. Soil-disturbing activities shall be suspended during periods with winds over 25 miles per hour. c. For NO_x, significant air quality effects have been identified, and the Corps or CVFPB shall implement the mitigation measures at the end of this section to reduce emissions in years when SMAQMD, YSAQMD, or FRAQMD thresholds are exceeded (Tables 3.9-4 and 3.9-5). d. The project applicant or representative shall provide a plan for approval by SMAQMD (Sites SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 73.5L, and LAR 10.0L, and LAR 10.6L), YSAQMD (Sites SAC 35.4L, SAC 41.9R, SAC 71.3R, CC 2.8L, and CC 3.4L,), FRAQMD (Sites SAC 78.8L, SAC 87.0L, SAC 93.7L, SAC 130.0L, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, and SBP 0.4E), CCAPCD (Sites SAC 114.5R, SAC 136.7R, SAC 136.9R, and SAC 157.7R), TCAPCD (Site DC 0.9N), and the Corps or CVFPB demonstrating that the construction activities shall not exceed 85 pounds per day of NO_x (Sites SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 73.5L, LAR 10.0L, and LAR 10.6L), 82 lbs/day of NO_x (Sites SAC 35.4L, SAC 41.9R, SAC 71.3R, CC 2.8L, and CC 3.4L), and 25 lbs/day of NO_x (Sites SAC 78.8L, SAC 87.0L, SAC 93.7L, SAC 130.0L, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, DC 0.9N, and SBP 0.4E). The plan shall demonstrate that heavy-duty (>50 horsepower) off-road vehicles to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project-wide fleet-average 20 percent NO_x reduction and 45 percent particulate reduction compared to the most recent CARB fleet average at time of construction. To reduce NO_x emissions for this project, the applicant may employ one or more of the following measures: ▪ Require injection timing retard of 2 degrees on all diesel vehicles, where	

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		applicable. ▪ Install high-pressure injectors on all vehicles, where feasible. ▪ Encourage the use of reformulated diesel fuel. ▪ Electrify equipment, where feasible. ▪ Maintain equipment in tune with manufacturer's specifications. ▪ Install catalytic converters on gasoline-powered equipment. ▪ Substitute gasoline-powered for diesel-powered equipment where feasible. ▪ Use compressed natural gas or on-site propane mobile equipment instead of diesel-powered equipment, where feasible. e. The contractor shall submit to the lead agency and all relevant air quality management districts a comprehensive inventory of all off-road construction equipment equal to or greater than 50 horsepower that will be used an aggregate of 40 or more hours during any portion of the construction project. The inventory shall include the horsepower rating, engine production year, and projected hours of use or fuel throughput for each piece of equipment. The inventory shall be updated and submitted monthly throughout the duration of construction activities, except that an inventory shall not be required for any 30-day period in which no construction activity occurs. At least 48 hours prior to the use of subject heavy-duty off-road equipment, the contractor shall provide the relevant air quality management districts with the anticipated construction timeline, including start date and the name and phone number of the project manager and on-site foreman. f. An off-site mitigation fee shall be paid to the appropriate local air quality management districts. The off-site mitigation fee shall be based on the incremental significant emissions at a rate of $16,000/ton (or other negotiated amount) of NOx. The mitigation fees shall be paid to the districts prior to	

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		construction initiation. The districts will utilize the payments to fund various emission reduction projects in their respective air quality basins. Payments that are due were estimated using the latest version of the SMAQMD Mitigation Fee Calculator (revised July 2008, SMAQMD 2008b), which assumes 20 percent reduction in NOx due to the proposed mitigation plan. Calculations used in the Mitigation Fee Calculator were also applied to district-specific thresholds to obtain potential fees due to the other air quality or air pollution control districts involved. YSAQMD, TCAPCD, and CCAPCD do not require mitigation fees. The required payment is calculated to be $171,398 to SMAQMD for exceedance of 10.2 tons during the construction of the proposed action, assuming simultaneous construction at SAC 73.5L, LAR 10.0L, and LAR 10.6L during 2009 and construction at SAC 8.0L, SAC 10.8L, SAC 26.0L during 2010; $302,095 to FRAQMD for exceedance of 18.0 tons during the construction of the proposed action, assuming simultaneous construction at SAC 78.8L, SAC 87.0L, SAC 93.7L, FR 5.5L, FR 7.0L, and SBP 0.4E during 2009 and simultaneous construction at SAC 130.0L, FR 1.0L, and FR 3.7L during 2010. At this point, it is difficult to verify the fee estimates above because the specific number of days that each piece of equipment would be used and the specific length of the construction period is not yet known. Final emissions estimates and fees shall be determined by the contractor in consultation with the appropriate agency.	
Impact AQ2 Implementation of levee repairs would generate green house gas emissions.	LS	None required.	N/A

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
Impact AQ3 Implementation of levee repairs could expose sensitive receptors to pollutants and objectionable odors.	LS	None required.	N/A
Traffic			
Impact TR1 Construction activities during levee repairs could have a temporary impact on traffic and circulation.	PS	***Mitigation Measure TR1*** a. The construction contractor shall prepare and implement a traffic control plan (or plans) that addresses conditions at each site. The plan(s) shall be approved by the responsible counties, cities (in cases where city streets would be used), and Caltrans, as applicable, prior to the initiation of construction activities. The plan(s) shall include measures to (1) reduce, to the extent practicable, the number of vehicles (construction-related and other) on the roadways adjacent to the sites; (2) reduce, to the extent practicable, the interaction between construction equipment and other vehicles; and (3) promote public safety through actions aimed at driver and road safety. b. Prior to implementation of construction activities, the contractor shall verify that all roads, bridges, culverts, and other infrastructure along the access routes can support expected vehicle loads. c. The plan(s) shall identify all intended haul routes, locations of signage, locations of flaggers, approved permits, documentation of coordination with local and state agencies, and locations of potential delays to vehicle and pedestrian traffic. Construction vehicles shall follow established truck routes to the greatest extent practicable.	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		Mitigation Measure TR2 a. The contractor shall maintain travel traffic on all roads adjacent to the site and on all affected public roads during the construction period. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by state and local authorities having jurisdiction. b. The traveling public shall be protected from construction and work damage to person and property. The contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. c. Traffic controls on major roads and collectors shall include flag-persons wearing safety vests and using “stop/slow” paddles to direct drivers. d. Through access for emergency vehicles shall be provided at all times. e. Access to public transit shall be maintained, and movement of public transit vehicles shall not be impeded as a result of construction activities. f. Access to driveways and private roads shall be maintained. ***Mitigation Measure TR3*** a. Construction parking shall be restricted to the designated staging areas. b. During peak periods, construction-generated traffic shall avoid roadway segments or intersections that are at, or approaching, a LOS that exceeds local standards. c. The speed of all construction vehicles shall be limited to a maximum of 10 mph on the levee access roads. The contractor shall provide a minimum of	

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		four construction speed limit signs large enough to be visible by the passing traffic. The speed limit signs shall be in English units and posted on the levee and on each of the access roads. Signs shall be posted for both incoming and outgoing traffic. d. Construction warning signs shall be posted in accordance with the local standards or those set forth in the Manual on Uniform Traffic Control Devices (FHA 2007) in advance of the construction area and at any intersection that provides access to the construction area. e. A sign, at least one square yard in size, shall be posted at all active construction sites that gives the name and telephone number or email address to contact with complaints regarding construction traffic. f. Measures shall be implemented as needed to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. The construction contractor shall minimize the amount of mud transported onto paved public roads by vehicles or runoff. g. Rock, dirt, and/or other fill materials shall be prevented from being accidently dropped from trucks traveling on highways to and from the erosion sites. h. Any damage to roads caused by construction operations shall be repaired to pre-project conditions.	
Noise			
NOI1 Implementation of levee repairs would result in construction generated noise.	PS	***Mitigation Measure NOI1*** a. Construction activities (including equipment warm-up) shall be limited to 7:00 a.m. to 7:00 p.m. (Monday through Saturday) and 9:00 a.m. to 6:00 p.m. (Sunday). Work hours shall not deviate from this schedule unless otherwise	LS

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		approved by the Corps. b. Haul truck routes shall avoid residential areas to the extent practicable. c. Where possible, noise-generating activities shall be combined to occur in the same time period. The total noise level produced shall not be significantly greater than the level produced if the operations were performed separately. d. To the extent practicable, the contractor shall use newer construction equipment or retrofit older equipment to make the associated noise as unobtrusive as possible (i.e., installing mufflers).	
Hazardous, Toxic, and Radioactive Waste			
Impact HAZ1 Construction activities will occur on site that have or potentially have Recognized Environmental Conditions (RECs).	LS	None required.	N/A
Impact HAZ2 Undocumented hazardous materials could be discovered during construction.	PS	***Mitigation Measure HAZ1*** a. If previously undocumented HTRW materials or contamination (e.g., stained soils) are exposed or otherwise identified during construction activities, all work in the vicinity of the discovery shall be stopped and the Corps and/or CVFPB, as appropriate, shall be notified immediately. The potential contamination shall be evaluated by a qualified professional and work in the vicinity shall not resume until appropriate remediation measures (if determined to be necessary) have been implemented. Appropriate remediation measures may include, but are not limited to, testing and evaluating the suspected areas, removal or treatment of contaminated soils, or capping the contaminated areas with imported material.	LS

SUMMARY OF IMPACTS AND MITIGATION MEASURES
Sacramento River Bank Protection Project, Phase II Levee Repair of 25 Erosion Sites

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
Impact HAZ3 Hazardous materials (petroleum products) used during construction could be released into the environment.	PS	***Mitigation Measure HAZ2*** a. Prior to initiation of construction activities, the construction contractor shall submit for approval to the Corps and/or CVFPB, as appropriate, a contamination prevention plan. The plan shall include, but is not limited to: 1) a list of all potentially hazardous petroleum products and toxic materials to be used during construction; 2) provisions to prevent accidental or intentional introduction of such materials into any waterway, the air, or the ground; 3) methods for preventing polluted runoff from plant, equipment parking, and maintenance areas from entering directly into local water bodies; 4) procedures, instructions, and reports for contaminant cleanup; 5) and the name of the individual who will report any spills, who will be responsible for implementing and supervising containment and cleanup, and who will follow up with complete documentation. b. All construction personnel shall be trained in the proper use and handling of fuels, lubricants, and other potentially hazardous materials. c. Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants, and oil shall be managed and stored in accordance with all federal, state, regional, and local laws and regulations. There shall be no storage of fuel on the project site. Fuel must be brought to the project site each day that work is performed. d. The Corps and/or CVFPB, as appropriate, shall be notified immediately of any spill of petroleum products, organic or earthen materials, or any other potentially hazardous materials. e. Solid wastes (excluding clearing debris) shall be placed in containers that are emptied on a regular schedule. Handling, storage, and disposal shall be	LS

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure(s)	Level of Significance After Mitigation
		conducted so as to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. All solid waste shall be transported from the construction site and disposed of in compliance with federal, state, and local requirements for solid waste disposal. f. Construction materials, such as revetment, IWM, and fill soil used during construction activities shall be free of HTRW materials. To alleviate the possibility that HTRW are released to the environment through these materials, the construction contractor shall have strict specifications for these materials and the supplier providing these materials shall provide certificates indicating these materials are free of HTRW materials. g. Any construction equipment that normally includes a spark arrester shall be equipped with an arrester in good working order. This includes, but is not limited to, vehicles, heavy equipment, and chainsaws. No smoking shall be allowed in refueling areas. The construction contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP/IIPP, the AHA, federal and/or state OSHA regulations, and other related fire and safety regulations. The most stringent standard shall prevail.	

[A] Less-than-significant

[B] Potentially significant

Draft Environmental Assessment/Initial Study for Levee Repair of 25 Erosion Sites Volume 1

Sacramento River Bank Protection Project

April 2009

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Acronyms and Abbreviations

.shp	Shapefile
˚F	degrees Fahrenheit
µg/m3	micrograms per cubic meter
APE	Area of Potential Effects
AQMD	Air Quality Management District
BA	biological assessment
BMP	Best Management Practice
BO	biological opinion
CalEPA	California Environmental Protection Agency
CalFire	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CCAPCD	Colusa County Air Pollution Control District
CCR	California Code of Regulations
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHRIS	California Historical Resources Information System
CMP	Sacramento Coordinated Water Quality Monitoring Program
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
Corps	U.S. Army Corps of Engineers
CRHR	California Register of Historical Resources
CTR	California Toxics Rule
CVFPB	Central Valley Flood Protection Board
CWA	Clean Water Act
D_{50}	median bed material size
dB	decibel
dBA	A-weighted decibel
dbh	diameter at breast height
DD	doubling of distance
DFG	California Department of Fish and Game
DPC	Delta Protection Commission

DPS	distinct population segment
DTSC	Department of Toxic Substances Control, California Environmental Protection Agency
DWR	California Department of Water Resources
EA/IS	environmental assessment/initial study
EDR	Environmental Data Resources, Inc.
EFH	essential fish habitat
EFHA	essential fish habitat assessment
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	federal Endangered Species Act
ESU	evolutionarily significant unit
FMP	Fisheries Management Plan
FONSI	Finding of No Significant Impact
FR	Federal Register
FRAQMD	Feather River Air Quality Management District
GCC	Global Climate Change
GHG	Greenhouse Gas
GIS	geographical information system
GPS	global positioning system
H:V	horizontal to vertical ratio
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HEC-RAS	Hydrologic Engineering Centers–River Analysis System
HTRW	Hazardous, Toxic, or Radioactive Waste
I-5	Interstate 5
IWM	instream woody material
kg	kilograms
km	kilometer
LAR	lower American River
lbs/day	pounds per day
Ldn	day-night noise level
Leq	equivalent noise level
LOS	level of service
m3/sec	cubic meters per second
MBTA	Migratory Bird Treaty Act

MCL	maximum contaminant level
mg/L	milligrams per liter
mm	millimeter
MMP	Maintenance and Monitoring Plan
MMPA	Marine Mammal Protection Act
MMRP	Mitigation Monitoring and Reporting Program
MND	mitigated negative declaration
mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSWL	mean summer water level
MTBE	methyl tert-butyl ether
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NCIC	North Central Information Center, Sacramento
NEIC	Northeast Information Center, Chico
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOD	Notice of Determination
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPPA	Native Plant Protection Act
NRHP	National Register of Historic Places
NSR	North State Resources, Inc.
NTU	nephelometric turbidity units
NWIC	Northwest Information Center, Sonoma
O_3	ozone
OPR	Office of Planning and Research
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbons
Panamerican	Panamerican Consultants, Inc.
PM_{10}	particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	fine particulate matter (particulate matter less than 2.5 microns in aerodynamic diameter)
ppm	parts per million
ppt	parts per thousand
PSM	process safety management
RCRA	Resource Conservation and Recovery Act
REC	recognized environmental conditions
RM	river mile
ROG	reactive organic gas
RQ	reportable quantities

RWQCB	Regional Water Quality Control Board
SAM	standard assessment methodology
SEL	single event noise level
SHPO	State Historic Preservation Office
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMS/RMA2	Surface Water Monitoring System Software
SR	State Route
SRA	shaded riverine aquatic habitat
SRBPP	Sacramento River Bank Protection Project
SRWP	Sacramento River Watershed Program
SWCA	SWCA Environmental Consultants
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCAPCD	Tehama County Air Pollution Control District
TMDL	Total Maximum Daily Load
tons/yr	tons per year
TQ	threshold quantities
TSS	total suspended solids
USBR	U.S. Bureau of Reclamation
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTM	Universal Transverse Mercator
UVA	ultraviolet absorbance
VELB	valley elderberry longhorn beetle
WQO	water quality objectives
WY	water year
YSAQMD	Yolo-Solano Air Quality Management District

CHAPTER 1

Purpose and Need for Action

1. PURPOSE AND NEED FOR ACTION

1.1. Proposed Action

The U.S. Army Corps of Engineers, Sacramento District (Corps), and California Department of Water Resources (DWR) staff, representing the non-federal sponsor, the Central Valley Flood Protection Board (CVFPB), conduct annual field reconnaissance reviews of the Sacramento River Flood Control Project to identify, document, and monitor erosion sites. An erosion site is defined as a site that is at risk of erosional failure during flooding and/or normal flow conditions.

As a result of the 2007 review, the Corps and DWR identified 25 priority sites along the Sacramento River, Feather River, American River, Cache Creek, Deer Creek, and Sutter Bypass where bank protection measures are needed to prevent ongoing streambank erosion. The lengths of the sites range from 250 feet to 2,300 feet; the cumulative length of the 25 sites is 23,897 feet.

The proposed action evaluated in this Environmental Assessment/Initial Study (EA/IS) consists of implementing bank protection measures at up to 15,646 linear feet at some of the 25 erosion sites during 2009 and 2010. This work would be completed under the authority of the Sacramento River Bank Protection Project (SRBPP), Phase II, which has approximately 15,646 linear feet remaining of the 405,000 linear feet originally authorized.

This EA/IS addresses the environmental effects associated with bank protection for all 25 erosion sites to ensure that the Corps and the CVFPB have the flexibility needed to complete the 15,646 linear feet of repairs during 2009 and 2010. This flexibility is needed because if, for example, it is not possible to obtain access or easements for some of the sites during this timeframe, work can be performed at the sites for which access or easements have been obtained. Sites that are not repaired in 2009 and 2010 will be readdressed in future environmental documentation under subsequent SRBPP authorization.

The bank protection measures proposed at the erosion sites vary. The specific measures proposed for each site were designed based on the likely causes of erosion, site conditions that could affect construction, and other site-specific considerations, including land ownership, access, and existing environmental resources (e.g., vegetation, wildlife). Work would be completed under the authority of the Sacramento River Bank Protection Project (SRBPP), Phase II.

This EA/IS is tiered from the 1987 Environmental Impact Report/Supplemental Environmental Impact Statement IV (EIR/SEIS IV) for the Sacramento River Bank Protection Project (U.S. Army Corps of Engineers 1987). The EIR/SEIS IV, hereby incorporated by reference, is a programmatic assessment of impacts of the entire SRBPP that evaluates and discloses general and common impacts resulting from SRBPP levee repairs projects, including cumulative effects of the SRBPP. Resources not analyzed in this EA/IS were addressed programmatically in the EIS/SEIS IV. The EIR/SEIS IV disclosed that the SRBPP has and may continue to have long-term adverse effects on biological and visual resources along the

Sacramento River system, including tributaries. It also described the benefits of modifying traditional revetment in ways that promote the regeneration of native habitats, to be pursued where feasible.

1.2. Purpose and Need Statement

The Sacramento River Flood Control Project (SRFCP) protects low-lying areas of the Sacramento Valley and the Sacramento–San Joaquin Delta from damaging floods. These areas contain large urban populations and industrial-commercial developments as well as extensive agriculture operations. A large amount of infrastructure, including highways, railroads, airports, water systems, and gas wells, is also present. Failure of a project levee would threaten these populations and developments.

The purpose of the proposed action is to implement bank protection measures at the 25 sites to control the identified erosion problems and to integrate the bank protection design with the protection and on-site mitigation of resource values. The presence of riparian woodlands, shaded aquatic habitat, and habitat for special-status plant and animal species, especially in reaches where they have been diminished to the point of scarcity, are examples of existing resource values.

The need for the proposed action is to maintain the integrity of the Sacramento River Flood Control Project. Each of the 25 erosion sites is at risk of an erosional failure during flooding and/or normal flow conditions. These sites must be repaired before their condition becomes so critical as to require emergency repair, or they experience a levee break, resulting in losses of life and property.

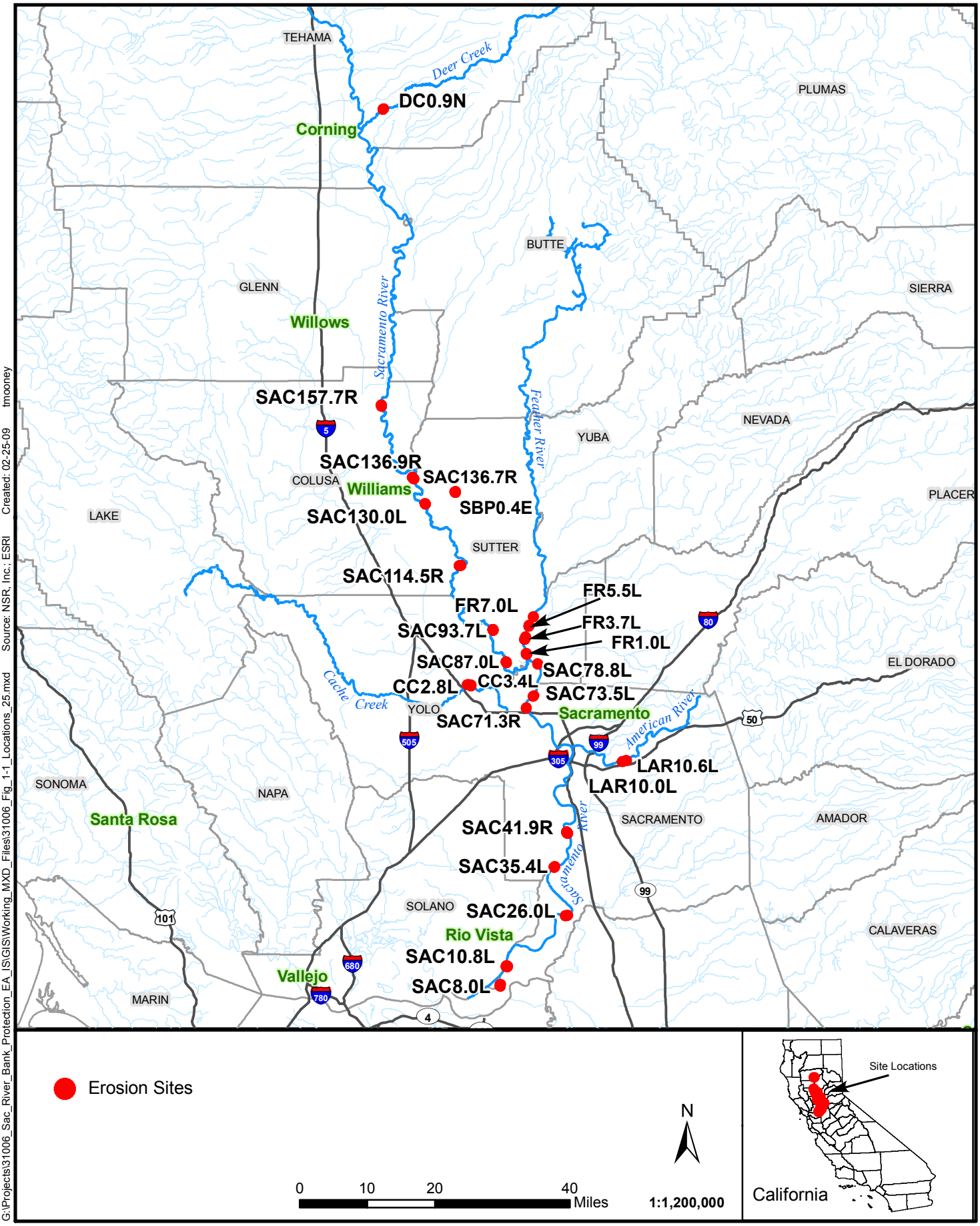
1.3. Project Location

The 25 erosion sites addressed in this document span five counties: Sacramento, Yolo, Sutter, Colusa, and Tehama. The naming convention for the erosion sites is based on location and can be used to locate the sites. Erosion site nomenclature begins with the name of the water body, followed by the approximate distance in river miles (RM) from the mouth of the river (sites along Cache Creek, Deer Creek, and Sutter Bypass are designated by levee mile [LM]), and either “R” or “L” for right or left bank (as facing downstream) or directional orientation (north, south, east, and west). For example, erosion site Sacramento 8.0L is located approximately 8.0 miles upstream from the mouth of the Sacramento River on the left bank as one faces downstream.

The locations of the 25 erosion sites addressed in this Environmental Assessment/Initial Study (EA/IS) are shown in Table 1-1. A location map of the 25 sites is presented as Figure 1-1.

Table 1-1 Erosion Site Locations

Erosion Site	Water Body	RM/LM	Bank	Length of Repair (feet)	County
1	Sacramento River (SAC)	8.0	L	1,550	Sacramento
2	Sacramento River (SAC)	10.8	L	550	Sacramento
3	Sacramento River (SAC)	26.0	L	2,005	Sacramento
4	Sacramento River (SAC)	35.4	L	1,070	Sacramento
5	Sacramento River (SAC)	41.9	R	1,515	Yolo
6	Sacramento River (SAC)	71.3	R	515	Yolo
7	Sacramento River (SAC)	87.0	L	750	Sutter
8	Sacramento River (SAC)	130.0	L	470	Sutter
9	Sacramento River (SAC)	136.7	R	300	Colusa
10	Feather River (FR)	1.0	L	990	Sutter
11	Feather River (FR)	3.7	L	2,300	Sutter
12	Feather River (FR)	5.5	L	832	Sutter
13	Feather River (FR)	7.0	L	520	Sutter
14	Lower American River (LAR)	10.0	L	740	Sacramento
15	Lower American River (LAR)	10.6	L	670	Sacramento
16	Cache Creek (CC)	2.8	L	1,300	Yolo
17	Cache Creek (CC)	3.4	L	900	Yolo
18	Deer Creek (DC)	0.9	N	800	Tehama
19	Sutter Bypass (SBP)	0.4	E	365	Sutter
20	Sacramento River (SAC)	73.5	L	1,050	Sacramento
21	Sacramento River (SAC)	78.8	L	250	Sutter
22	Sacramento River (SAC)	93.7	L	1,050	Sutter
23	Sacramento River (SAC)	114.5	R	1,500	Colusa
24	Sacramento River (SAC)	136.9	R	900	Colusa
25	Sacramento River (SAC)	157.7	R	1,005	Colusa



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North State Resources, Inc.

Sacramento River Bank Protection Project

Figure 1-1
Location Map

1.4. Background

The SRBPP is a continuing construction project authorized by the Flood Control Act of 1960 to provide protection for the existing levees and flood control facilities of the Sacramento River Flood Control Project. The Sacramento River Flood Control Project consists of approximately 1,300 miles of levees and overflow weirs, pumping plants, and bypass channels that protect communities and agricultural lands in the Sacramento Valley and Sacramento–San Joaquin Delta.

The SRBPP is a local cooperation project, with a state-federal cost-share arrangement. The Corps is the federal participant, and the CVFPB is the state agency designated for non-federal responsibilities and cost-sharing. Therefore, project activities under the SRBPP require compliance with both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

Under natural conditions, the floodplain of the Sacramento River varied in width from about 2 to 30 miles, extended about 250 miles from the mouth of the river to the vicinity of Red Bluff, and covered over 1 million acres (U.S. Army Corps of Engineers 1972). Beginning in the 1840s, low, discontinuous levees were built by individual landowners. Since that time, a variety of levee improvement projects have been implemented to regulate and repair the system.

Wave wash, human disturbance, and flood flows can erode and stress the levees, weakening them and sometimes causing them to fail. To maintain the integrity of the flood control system, locations with the potential for failure are identified and remedied under the SRBPP. The SRBPP planning area extends from the lower Sacramento River near Collinsville at RM 0 to Chico Landing at RM 194 and includes the lower reaches of the American River (RM 0-23), Feather River (RM 0-61), Yuba River (RM 0-11), and Bear River (RM 0-17), as well as portions of Three Mile, Steamboat, Sutter, Miner, Georgiana, Elk, and Cache sloughs.

1.5. Project Authority

The proposed action is a component of the SRBPP, which was authorized by Congress under the Flood Control Act of 1960 (Public Law 86-645), in accordance with the recommendations of the Chief of Engineers (as recorded in Senate Document Number 103, 86th Congress, Second Session, entitled “Sacramento River Flood Control Project, Sacramento” and dated May 26, 1960). Authorization for environmental features associated with the proposed action was provided through the Water Resources Development Act of 1990.

1.6. Purpose of the EA/IS

The primary purpose of this EA/IS is to determine whether the proposed action would have a significant impact on the environment and therefore require the preparation of an Environmental Impact Report/Environmental Impact Statement (EIR/EIS). This document describes existing environmental resources, evaluates the significance of the effects of the proposed action on those resources, and identifies mitigation measures for any effects found to be significant. If significant impacts are found to be less than significant after adoption of the

mitigation measures, it is anticipated that the Corps and the CVFPB will adopt a finding of no significant impact (FONSI) and a mitigated negative declaration (MND), respectively.

This EA/IS will also serve as a Biological Assessment (BA) to be provided to the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) for section 7 consultation under the federal Endangered Species Act (ESA) concerning the effects of the proposed action on listed and sensitive species, critical habitat, and essential fish habitat. A programmatic BA has been prepared for the SRBPP, and section 7 consultations were initiated with NMFS and USFWS in October 2007. This EA/IS will be submitted to NMFS and USFWS with requests to append project activities for the 25 erosion sites to the programmatic consultations.

1.7. Similarities and Differences between NEPA and CEQA

This document is designed to comply with both NEPA and CEQA. NEPA and CEQA require that governmental agencies evaluate the environmental impacts of their proposed actions before making formal commitments to carry them out and that the public be involved in the evaluations. NEPA is a federal law that applies to federal agencies, whereas CEQA is a California law that applies to state and local agencies. For this project, NEPA requires preparation of an EA and CEQA requires preparation of an IS. By preparing a single document that complies with both statutes, the involved agencies have been able to avoid unnecessary duplication of effort.

Although there are similarities between NEPA and CEQA, the two acts are not identical. For example, NEPA is a procedural law requiring federal agencies to evaluate a range of reasonable alternatives, disclose potential impacts, and identify feasible mitigation. CEQA, in contrast, is partly "substantive" in that it requires an agency to adopt "feasible" mitigation measures for any "significant effect on the environment." Because of the obligation under CEQA to mitigate "significant effects on the environment" when feasible, the characterization of impacts as being either "significant" or "less than significant" is very important under CEQA. For this reason, this EA/IS has been written in a manner that identifies, for CEQA purposes, "significance thresholds" for anticipated impacts.

CEQA requires that this EA/IS propose mitigation measures for each significant impact of the proposed action subject to the approval of an agency governed by California law, even when the mitigation measure cannot be adopted by the "lead agency" (i.e., CVFPB), but can only be imposed by another responsible agency. There are no NEPA statutes or regulations that explicitly require that all significant project impacts be avoided or mitigated to a less-than-significant level, or that any adopted mitigation measures developed as part of an EA be "monitored" to ensure that they are carried out. California Public Resources Code section 21081.6(a), subdivision (a), however, requires lead agencies under CEQA to "adopt a reporting and mitigation monitoring program … in order to mitigate or avoid significant effects on the environment." Throughout this EA/IS, mitigation measures are clearly identified and presented in language that will facilitate establishment of a monitoring and reporting program. Any mitigation measures adopted by the CVFPB as conditions of project approval will be included in a Mitigation Monitoring and Reporting Program (MMRP) to verify compliance.

CEQA and NEPA sometimes use different terms for similar concepts. For example, CEQA uses the term "proposed project" while NEPA uses the term "proposed action." For readability, this document uses "proposed action"; for the purposes of this document, the two terms are synonymous.

1.8. Required Decisions

The EA/IS is being circulated to responsible public resource agencies, permitting agencies, trustee agencies, the State Clearinghouse, and interested stakeholders. Written and oral comments that are received in response to the EA/IS will be addressed in a final document. After the public review period, the Corps' Sacramento District Engineer must determine if the proposed action qualifies for a FONSI under NEPA or if a supplemental EIS must be prepared. The CVFPB must determine if the proposed project qualifies for an MND under CEQA or if a supplemental EIR must be prepared.

Based on the analysis set forth in this document, the Corps and the CVFPB presently believe that a FONSI/MND will be appropriate and that a supplemental EIS/EIR will not be required. That determination is subject to change, however, after receipt and consideration of comments provided during the public comment period. In other words, the appropriateness of a FONSI/MND cannot be definitively determined absent a review of information generated through public review. The NEPA process will be complete with the Corps' adoption of a FONSI, unless, through public review or the receipt of other information not presently available, the Corps decides that preparation of a supplemental EIS is required. The CEQA process will be complete with the CVFPB's adoption of a MND and filing of a Notice of Determination (NOD), unless the CVFPB determines that a supplemental EIR is required.

CHAPTER 2

Alternatives

2. ALTERNATIVES

2.1. No-Action Alternative

Under the no-action alternative, no action would be taken to halt erosion to protect the levees at the 25 erosion sites. Forces of erosion would persist, including wave wash, flood flows, and human disturbances. Continued erosion of the levee system would increase the risk of levee failure and possible flooding of surrounding areas.

Should levee failure result from the no-action alternative, emergency measures would likely be of a nature that limits the ability of the Corps to properly implement Best Management Practices (BMPs), site-specific mitigation, and other measures that would minimize impacts to aquatic and terrestrial communities. Additionally, a larger disturbance area would be required to restore the levees, resulting in greater environmental impacts as well as a greater cost.

2.2. Alternative 1: Proposed Action

The proposed action includes a suite of four different designs to address the needed repairs at each of the 25 erosion sites. Selection of the appropriate design for each site required: 1) consideration of the likely causes of erosion; 2) consideration of site-specific vegetation conditions, wildlife resources, existing structures, land ownership, and access; and 3) consideration of input provided by resource agencies, including NMFS, USFWS, and the California Department of Fish and Game (DFG).

Three of the proposed designs (Design 1, Design 2, and Design 3) involve repair of the existing levee by placing rock revetment (i.e., quarry stone) on the levee slope to provide bank protection and prevent continuing erosion. These designs also incorporate the construction of vegetated benches, installation of instream woody material (IWM), maximum retention of existing trees, and revegetation of the benches and levee slope. These elements are customized for each erosion site to respond to the specific environmental conditions present (e.g., extent of erosion, existing habitat to be preserved). The fourth design (Design 4) is a setback levee and is proposed for sites where repair of the existing levee is not practicable.

Table 2-1 summarizes the proposed design and design features for each of the 25 erosion sites. The four proposed designs are discussed in additional following the table.

Table 2-1 Proposed Design and Design Elements for the 25 Erosion Sites

Erosion Site	Proposed Design	Rock Revetment	IWM	Notes
SAC 8.0L	Design 1 – bank fill rock slope with IWM above and below MSWL.	Along upper bank only. No revetment at levee toe.	Installed above and below the MSWL, at 60% of bankline cover.	No bench to be constructed. Existing wetland bench to be preserved.
SAC 10.8L	Design 1 – bank fill rock slope with IWM above and below MSWL.	Along upper bank only. No revetment at levee toe.	Installed above and below the MSWL, at 60% of bankline cover.	No bench to be constructed. Existing wetland bench to be preserved.
SAC 26.0L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 60% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
SAC 35.4L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 40% of bankline cover.	Riparian bench with 10:1 slope to be constructed
SAC 41.9R	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
SAC 71.3R	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
SAC 87.0L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian bench with 10:1 slope to be constructed.

Table 2-1 Proposed Design and Design Elements for the 25 Erosion Sites

Erosion Site	Proposed Design	Rock Revetment	IWM	Notes
SAC 130.0L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
SAC 136.7R	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
FR 1.0L	Design 3 – sloping riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian and wetland bench with 6:1 slope to be constructed.
FR 3.7L	Design 3 – sloping riparian bench with IWM above and below MSWL.	From lower slope to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian and wetland bench with 6:1 slope to be constructed.
FR 5.5L	Design 3 – sloping riparian bench with IWM above and below MSWL.	From lower slope to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	Riparian and wetland bench with 6:1 slope to be constructed.
FR 7.0L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 40% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
LAR 10.0L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 40% of bankline cover.	Riparian bench with 10:1 slope to be constructed.

Table 2-1 Proposed Design and Design Elements for the 25 Erosion Sites

Erosion Site	Proposed Design	Rock Revetment	IWM	Notes
LAR 10.6L	Design 2 – low riparian bench with IWM above and below MSWL.	From lower slope to upper bank.	Installed above and below the MSWL, at 40% of bankline cover.	Riparian bench with 10:1 slope to be constructed.
CC 2.8L	Design 4 – setback levee.	No revetment will be placed on existing levee.	No IWM to be installed.	Setback levee with 3:1 slope on waterside and 2:1 slope on landside. 12-foot-wide levee road.
CC 3.4L	Design 4 – setback levee.	No revetment will be placed on existing levee.	No IWM to be installed.	Setback levee with 3:1 slope on waterside and 2:1 slope on landside. 12-foot-wide levee road.
DC 0.9N	Design 4 – setback levee.	No revetment will be placed on existing levee. Materials from levee road will be removed to construct setback levee.	No IWM to be installed.	Setback levee with 3:1 slope. 12-foot-wide levee road. Area of existing levee road will be revegetated with native plants.
SBP 0.4E	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to lower bank. No revetment along upper bank.	Installed above and below the MSWL, at 10% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.
SAC 73.5L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.

Table 2-1 Proposed Design and Design Elements for the 25 Erosion Sites

Erosion Site	Proposed Design	Rock Revetment	IWM	Notes
SAC 78.8L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.
SAC 93.7L	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.
SAC 114.5R	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.
SAC 136.9R	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.
SAC 157.7R	Design 2 – low riparian bench with IWM above and below MSWL.	From levee toe to upper bank.	Installed above and below the MSWL, at 50% of bankline cover.	15-foot riparian bench with 10:1 slope to be constructed.

**MSWL = mean summer water level.*

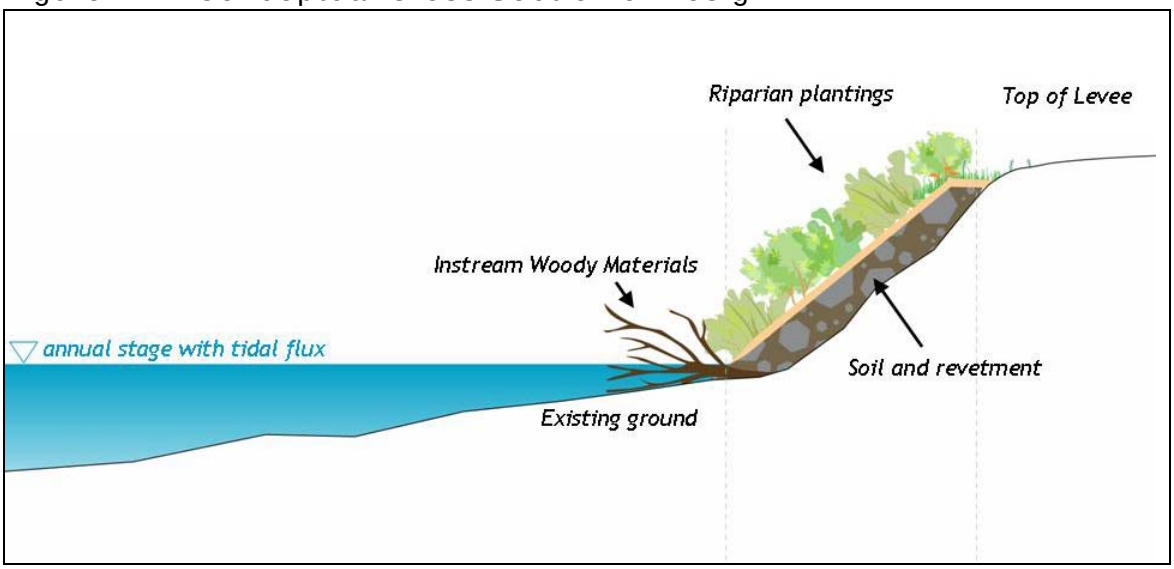
2.2.1. Design 1 – Bank Fill Rock Slope with IWM Above and Below MSWL

Design 1 includes repair of the upper bank and installation of IWM at the mean summer water level (MSWL). This design offers the bank protection required to address the existing erosion, while protecting existing habitat and replacing habitat value lost through construction.

To the extent practicable, all native trees greater than 4 inches in diameter at breast height (dbh) would be preserved during construction. Soil-filled quarry rock would be placed on the levee slope above the MSWL, and the levee slope would be revegetated with native container plants and pole cuttings. IWM would be anchored into the levee slope above and below the MSWL, providing year-round, instream aquatic habitat and structure.

Two erosion sites would be repaired using Design 1 model: SAC 8.0L and SAC 10.8L. Figure 2-1 is a conceptual illustration of the Design 1 model.

Figure 2-1 Conceptual Cross-Section of Design 1



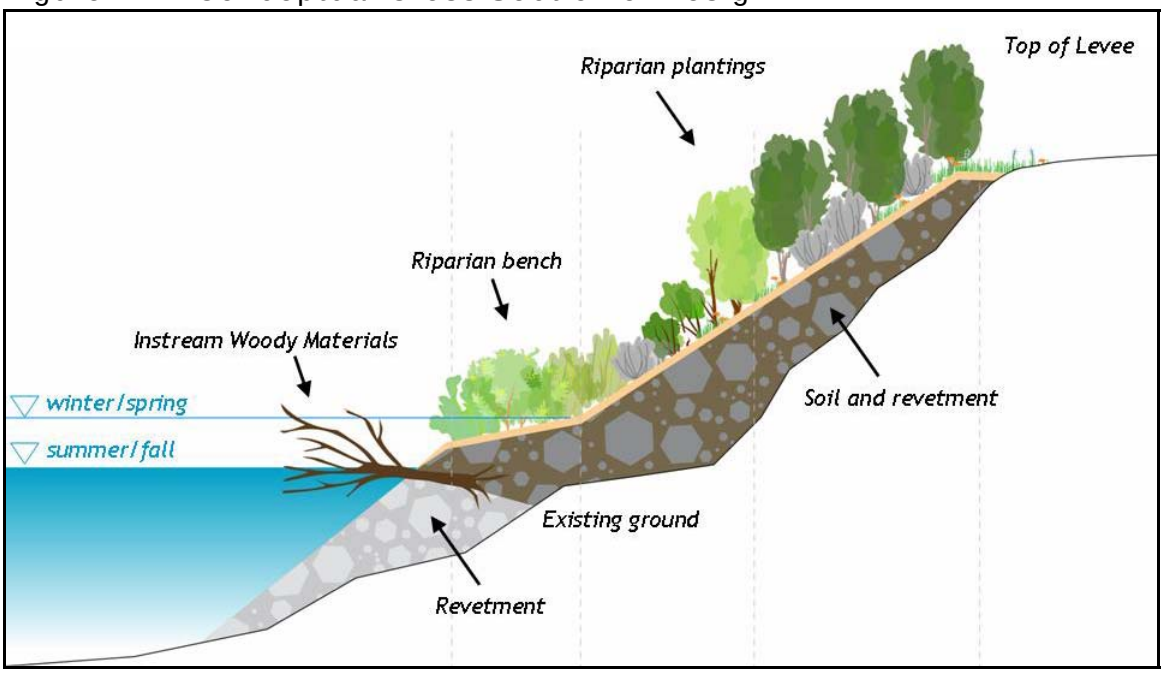
2.2.2. Design 2 – Low Riparian Bench with IWM Above and Below MSWL

Design 2 includes the incorporation of a low riparian bench and installation of IWM into the proposed repair. This design offers the bank protection required to address the existing erosion, while protecting existing habitat and replacing habitat value lost through construction.

To the extent practicable, all native trees greater than 4 inches dbh would be preserved during construction. Clean quarry rock would be placed below the MSWL, soil-filled quarry rock would be placed on the levee slope above the MSWL, a riparian bench subject to inundation during the winter/spring flows would be constructed above the MSWL, and the riparian bench and levee slope would be revegetated with native container plants and pole cuttings. IWM would be anchored into the riparian bench above and below the MSWL, providing year-round, instream aquatic habitat and structure.

Seventeen erosion sites would be repaired using the Design 2 model: SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 87.0L, SAC 130.0L, SAC 136.7R, FR 7.0L, LAR 10.0L, LAR 10.6L, SBP 0.4E, SAC 73.5L, SAC 78.8L, SAC 93.7L, SAC 114.5R, SAC 136.9R, and SAC 157.7R. Modifications to the Design 2 model were incorporated into the specific designs for each of these 17 erosion sites to address site-specific conditions. Figure 2-2 provides a conceptual illustration of the Design 2 model.

Figure 2-2 Conceptual Cross-Section of Design 2



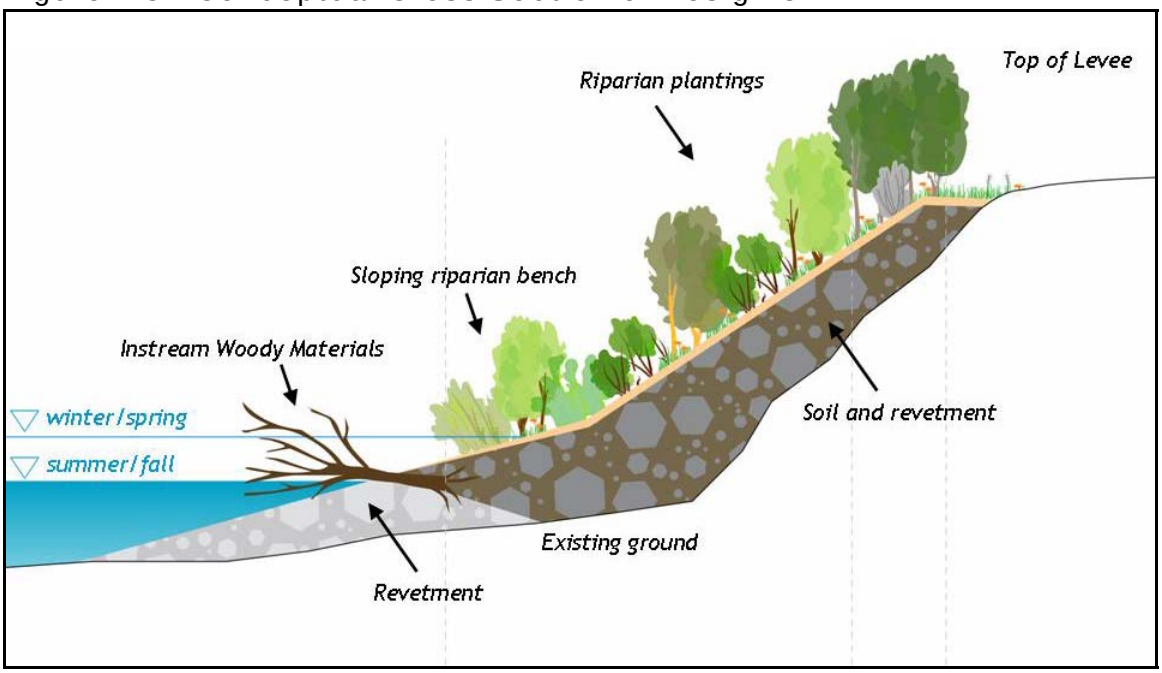
2.2.3. Design 3 – Sloping Riparian Bench with IWM Above and Below MSWL

Design 3 includes the incorporation of a sloping riparian bench and installation of IWM into the proposed repair. This design offers the bank protection required to address the existing erosion, while protecting existing habitat and replacing habitat value lost through construction.

To the extent practicable, all native trees greater than 4 inches dbh would be preserved during construction. Clean quarry rock would be placed below the MSWL, soil-filled quarry rock would be placed on the levee slope above the MSWL, a sloping riparian bench would be constructed above the MSWL within the lower portions subject to inundation during the winter/spring flows, and the riparian bench and levee slope would be revegetated with native container plants and pole cuttings. The lowest portions of the riparian bench would be covered with gravel to minimize the voids in the quarry stone that could serve as habitat for non-native predatory fish. IWM would be anchored into the riparian bench above and below the MSWL, providing year-round, instream aquatic habitat and structure.

Three erosion sites would be repaired using the Design 3 model: FR 1.0L, FR 3.7L, and FR 5.5L. Modifications to the Design 3 model were incorporated into the specific designs for each of these three erosion sites to address site-specific conditions (e.g., sensitive species concerns, existing bench to be preserved). Figure 2-3 provides a conceptual illustration of the Design 3 model.

Figure 2-3 Conceptual Cross-Section of Design 3

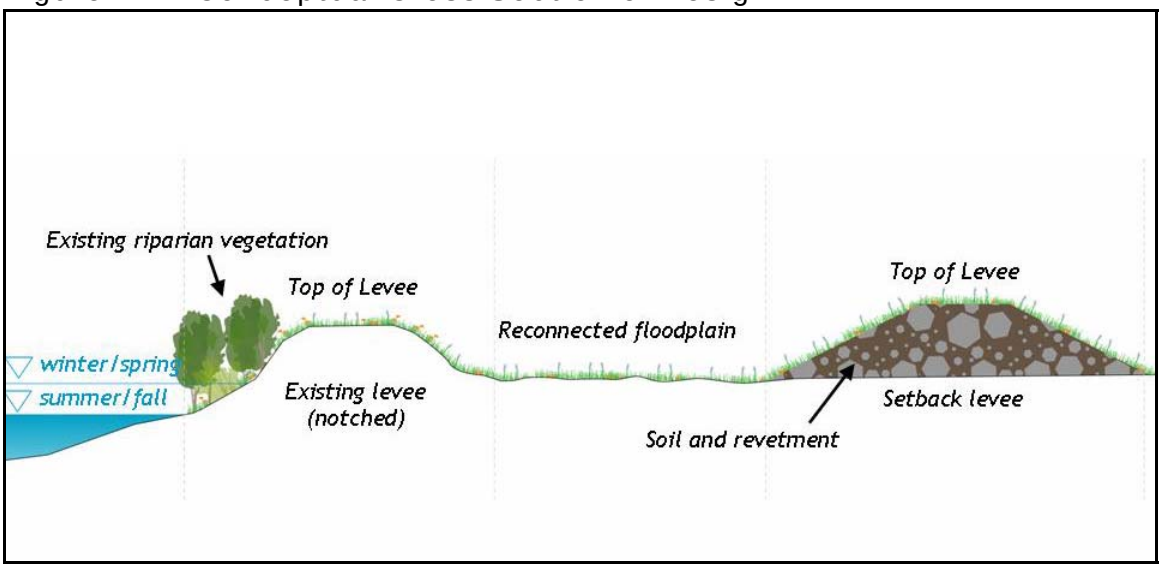


2.2.4. Design 4 – Setback Levee

Design 4 consists of the construction of a setback levee to address the erosion concerns. A setback levee allows ongoing erosion to continue at the existing levee, while protecting the surrounding landscape from being flooded. Setback levees are built on the landward side of existing levees. These levees are usually smaller than levees placed immediately adjacent to the river channel and are designed to prevent erosion and/or flooding in a specific reach in the river channel.

Three erosion sites would be addressed by construction of setback levees: CC 2.8L, CC 3.4L, and DC 0.9N. Figure 2-4 provides a conceptual illustration of the Design 4 model.

Figure 2-4 Conceptual Cross-Section of Design 4



2.3. Alternative 2: Thin Rock Armor

Under this alternative, vegetation would be cleared from the levee and a thin layer of rock would be placed over the existing levee slope. This alternative would likely limit or completely prevent implementation of beneficial actions, including planting native riparian vegetation, installation of IWM, and development of riparian benches. Placement of a thin layer of rock would protect the bank from erosion, but would not address stability issues. When placed on a slope of 2:1 (horizontal to vertical) or greater, the life span of this type of repair is estimated at only 25 years. The erosion repair would leave the sites generally barren of vegetation, and mitigation for lost habitat values would be arranged at an offsite location.

2.4. Overall Project Features under Proposed Action

Under the proposed action, the project footprint consists of the entire area subject to slope protection. The repairs have been designed to maintain public safety, restore the structural stability of the levee sections, maximize slope stability, retain the essential features of the channel, and retain existing trees and wildlife habitat values to the extent practicable. Beneficial design features of the proposed action include:

- Reinforcement of upper banks that, in some cases, would permit the preservation of existing riparian vegetation. Wherever possible, all trees greater than 4 inches dbh shall be retained.
- Creation of waterside, low quarry-stone riparian benches to provide near-bank, shallow-water habitat for fish with IWM anchored to the bench surface.
- Creation of waterside, low quarry-stone riparian and wetland bench combinations designed to provide near-bank, shallow-water habitat year-round.

- Construction of setback levee structures where practicable that avoid disturbances to existing riparian areas.
- Exclusive use of clean stone fill or quarry-stone rock beneath the water surface, where construction materials would be directly exposed to streamflow.
- Revegetation of revetted and natural surfaces. Nursery-grown native species would be used for revegetation.

Setback levees would be constructed at three erosion sites (CC 2.8L, CC 3.4L, and DC 0.9N). The setback levees would be built landward of the existing levees and would not result in disturbance to the stream channel or riparian areas. Two of the erosion sites (SAC 8.0L and SAC 10.8L) would not include repairs below the MSWL. For these sites, the planned design is to repair the upper bank with soil-filled quarry stone. The soil-filled quarry stone would be placed from the MSWL to the levee crest.

The remaining 20 erosion sites would be repaired by placing clean quarry stone from the toe of the levee slope (i.e., the bottom of the channel) to the MSWL and placing quarry stone and soil-filled quarry stone on the levee slope above the MSWL. The materials would be placed from the waterside using equipment mounted on barges or from the landside with equipment located on the levees. The proposed repairs would include initial site preparation, installation of a fabric layer between the quarry stone and soil-filled quarry stone, construction of riparian benches, placement of IWM along the lower slope, and revegetation of the site with native plant species. These elements of the proposed repairs are discussed below. Photographs of construction activities during previous levee repair projects are presented in Figures 2-5, 2-6, and 2-7. Details for specific erosion sites are identified in section 2.5.

2.4.1. Site Preparation

Site preparation activities would include the removal or protection of facilities (e.g., pumps, piping) and vegetation and the development of onsite construction access. There are limited facilities within the erosion sites, most of which would not need to be removed or relocated. Facilities that are to remain would be protected, and appropriate coordination and authorizations would be obtained before any facilities would be relocated or removed.

Wherever possible, all native trees greater than 4 inches dbh would be preserved and protected. Trees to be preserved would be trimmed as necessary and the trunks of the trees wrapped with layers of a protective fabric. Elderberry shrubs present on the site would be protected in place or removed and transplanted to an appropriate location (e.g., USFWS-authorized mitigation bank). Invasive pest plants, including black locust, tamarisk, and giant reed, would be removed along with all herbaceous and woody vegetation less than 4 inches dbh. All vegetation would be removed manually. No herbicides or chemicals would be used. Vegetation would be cleared to the ground surface, and large tree roots would be removed. The surface of the erosion sites would not be subject to grubbing or contouring. Materials removed from the erosion sites would be loaded onto trucks or a barge and transported to an appropriate disposal facility.

Photograph 1. Site preparation begins with installing exclusionary fencing around facilities and adjacent areas that are to be protected from construction-related disturbance.

Photograph 2. The next step in site preparation is to remove all herbaceous and woody vegetation less than 4 inches in dbh. This process is typically done manually with various tools such as gas powered hedgers, chain saws, and mowers. No herbicides or chemicals are allowed.

Photograph 3. Invasive non-native trees are also removed from the site. For large non-native trees, the stumps and tree roots are also removed. All materials removed from the site are chipped and taken to an appropriate disposal facility.

Photograph 4. Native trees to be preserved are trimmed of the lower branches to allow for quarry stone to be placed adjacent to the trunks and prevent branch breakage or crushing due to the movement of large equipment and quarry stone.

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Figure 2-5
Repair of Erosion Sites

Photograph 5. After the native trees have been trimmed of lower branches, layers of protective fabric (e.g., burlap) are wrapped around the trunks. In some cases, plywood boxes are constructed around the trunk(s). The protective wrapping is installed to the height that quarry stone will be placed.

Photograph 6. After the protective wrapping is installed, quarry stone is placed around the trees. The protective wrapping is intended to protect the trunks from damage as quarry stone is piled around them.

Photograph 7. Quarry stone is installed along the slopes to provide the required bank stabilization. The quarry stone is initially deposited either from a barge crane (water side) as depicted in this photograph or by a crane located on the levee (land side).

Photograph 8. Quarry stone may be initially placed directly where it is needed or placed in a convenient location where a backhoe operator can redistribute to the necessary location.

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Figure 2-6
Repair of Erosion Sites

Photograph 9. After the quarry stone is installed, a geotextile coir fabric layer is placed over the stone and covered with soil-filled quarry stone. Several layers of stone and soil are deposited and the soil is worked down between the voids of the quarry stone.

Photograph 10. Soil-filled quarry stone is a combination of quarry stone and soil fill material. The intent of the soil component is to fill voids in the quarry stone and provide a medium for vegetation to grow. After the soil-filled quarry stone is installed, the site is ready for planting of replacement vegetation.

Photograph 11. IWM is incorporated into the erosion repair designs to replace and/or enhance the in-stream cover and habitat lost through construction. IWM consists of hardwood tree species that are 10 to 24 inches in diameter with an extensive branch and root structure.

Photograph 12. After completion of erosion repairs, the sites are revegetated with native plant species to offset the loss of habitat values and stabilize the levee repair. A revegetation monitoring and maintenance program is implemented for 3 years following the completion of the levee repairs. After this time, the vegetation is typically established and self-sustaining.

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Figure 2-7
Repair of Erosion Sites

Construction access ramps and construction access areas within the erosion sites would be positioned to minimize the need for tree removal. Signs and fencing would be established at each site to delineate construction areas and protected areas. Warning buoys would be placed in the river at the up- and down-stream boundaries of each site for the safety of boaters and other water users.

2.4.2. Lower Slope Quarry Stone

For all sites requiring repair below the MSWL (all sites except SAC 8.0L and SAC 10.8L), clean quarry stone would be placed from the toe of the levee slope (i.e., the bottom of the channel) to the MSWL. The quarry stone would have a minimum thickness of 2 feet. The slope of the quarry stone below the MSWL would be no steeper than 2H:1V.

2.4.3. Geotextile Coir Fabric

A biodegradable, geotextile coir fabric layer would be placed above the quarry stone on the lower slope to prevent the migration of soil from the soil-filled quarry stone into the underlying quarry stone and to retain soil in the areas to be revegetated. The fabric would be an open weave biodegradable geotextile material with a non-shifting square mesh consisting of 100 percent coir fiber yarns in both the warp and the weft. The fabric would have a thickness of 0.30 inch, a weight of 25 ounces (plus or minus 2 ounces) per square yard, and a tensile strength of 150 x 100 pounds per inch, dry, and the open area of the fabric would be 40 percent maximum.

2.4.4. Soil-Filled Quarry Stone

After the coir fabric is installed, soil-filled quarry stone would be placed on the levee bank slope above the MSWL. Soil-filled quarry stone is a combination of quarry stone and soil fill material. The purpose of the soil component is to fill voids in the quarry stone and provide a medium for vegetation to grow. The top elevation for placement of the soil-filled quarry stone was designed on a site-by site-basis based on water velocities and shear stresses along the levee. At most sites, the top elevation of the soil-filled quarry stone would be level with the edge of the levee's upper bench.

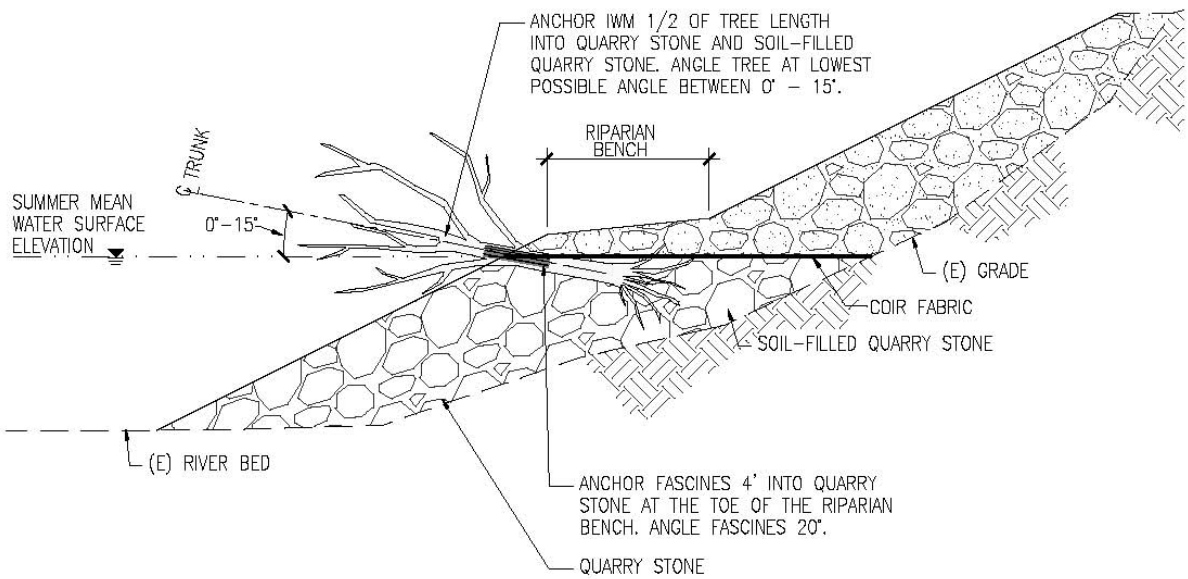
2.4.5. Riparian Bench

The design of most of the erosion repair sites incorporates a riparian bench. The riparian bench is a vegetation-supporting low bench constructed of soil-filled quarry stone that would project into the channel along the length of the erosion site. The vegetation is intended to provide overhead cover and near-shore aquatic habitat during the low-flow season. At some sites, the riparian bench may also be used as a construction platform to help avoid impacts to existing vegetation during the construction of the upper slope bank fill revetment. The riparian benches would be 10 to 20 feet wide with an average elevation set 2 to 3 feet above the MSWL to provide a substantial volume of moist but unsaturated soil as a growing medium.

2.4.6. In-Stream Woody Material

IWM is incorporated into the erosion repair designs to replace and/or enhance the instream cover and habitat lost through construction. IWM would consist of hardwood tree species 10 to 24 inches in diameter with an extensive branch and root structure. Almond and walnut trees are typically used for IWM, although pistachio, orange, and lemon trees may also be used. The IWM would be placed on the lower slope near the MSWL and anchored into the quarry stone by the root ball and half of the tree length. The IWM would be angled at 0 to 15º from the MSWL, oriented with the tree canopy in a downstream direction, spaced at 5- to 10-foot intervals, and placed in groups of alternating numbers of either 3 or 5 trees. Bundled fascines are also incorporated into the site designs to augment the IWM. The fascines would be placed at a 15-foot spacing and anchored at the MSWL. Given that the IWM and fascines would protrude from the riparian bench at the MSWL, they would also serve as a visual warning to river users that a bench is present. A typical cross-section of IWM placement is shown in Figure 2-8.

Figure 2-8 Typical Cross-Section of IWM Placement



2.4.7. Site Revegetation

As discussed above, selective clearing of the bank slopes would occur prior to the placement of quarry stone, and all trees greater than 4 inches dbh (other than undesirable invasive species) would be retained where possible. After completion of erosion repairs, the sites would be revegetated to offset the loss of habitat values and stabilize the levee repair. The upper slope would also be hydroseeded and treated with other erosion control measures to minimize bank erosion before plantings have had time to become established.

Willow cuttings, container plants, and herbaceous vegetation would be installed after construction in the fall. Beaver exclusion fencing would be installed around the planted vegetation to prevent damage from beavers. The fencing typically consists of a welded wire fence with 2-inch-square openings that is buried 6 inches into the topsoil and secured every 8

feet with rebar or posts. Vegetation planted at the sites would be in conformance with Corps criteria for vegetation in the vicinity of levee structures. No woody plants or plants that would obstruct the view of the levee would be planted within 15 feet from the waterside toe of the levee slope (i.e., vegetation-free zone). As long as the vegetation-free zone is maintained and flood protection is not threatened, the replacement vegetation would be allowed to grow naturally in response to the varying riverine conditions.

2.4.8. Monitoring and Maintenance

Monitoring and maintenance would be necessary to ensure that the replacement vegetation is successfully establishing and that the IWM is functioning as intended. Within approximately 90 days from the completion of construction, the Corps would submit a detailed maintenance and monitoring plan (MMP) for the resource agencies to review. The MMP would include: (1) success criteria to provide a standard to assess whether mitigation efforts successfully replace lost habitat value; (2) a program to monitor the development of shaded riverine aquatic (SRA) cover and riparian habitat; (3) a protocol for implementing remedial actions should any success criteria not be met; and (4) the required duration of the monitoring efforts. Monitoring reports that evaluate the progress of each erosion site in meeting the success criteria would be submitted to the resource agencies by December 31 of each monitoring year.

It is estimated that limited maintenance of replacement vegetation would be required for approximately 3 years following the completion of the levee repairs. After this time, it is anticipated that the vegetation will be established and self-sustaining. Anticipated activities during the 3-year establishment period include removal of problematic invasive species, irrigation and pruning of vegetation to promote optimal growth, replacement of any dead and/or declining vegetation, and maintenance of beaver exclusion fencing.

Maintenance activities may also include monitoring the vegetation and IWM to ensure that hazards to navigation are not present, assessing the status of the rock revetment and soil fill during high flow events, and monitoring the sites for vandalism. Yearly maintenance at each site should require the placement of no more than 600 cubic yards of material. Should a greater volume be required, the necessary permits/authorizations would be obtained from the appropriate regulatory agencies. Any in-water maintenance work would be conducted in coordination with the applicable federal and state resource agencies to avoid adverse effects to sensitive fish species.

2.5. Work at Each Erosion Site

Construction activities would occur in 2009 and 2010. It is anticipated that construction would take place between April 1 and November 30, with in-water construction activities to be conducted between August 1 and November 30. No construction would be permitted during the winter months (i.e., December through March). The anticipated construction season may need to be modified to respond to high water levels in the river, the presence of special-status species, or other constraints.

For waterside construction, work would be conducted from cranes mounted on barges, with the crane (boom) systems mechanically placing the rock along the shore and beneath the

water line. Waterside construction would result in less noise, fewer traffic disturbances, and smaller effects on existing vegetation than landside construction. The contractor may choose to use excavators, loaders, and other construction equipment once the revetment has reached the MSWL.

Landside construction would take place at sites that are not accessible from the waterside. A crane located on the levee would be used to mechanically place the rock along the shore and beneath the water line. The contractor may choose to use excavators, loaders, and other construction equipment along the benches on sites that are inappropriate for a crane and/or once the revetment has reached the MSWL. Protective fencing would be installed to prevent construction crews from getting too close to the waterside edge of the existing bank materials and sensitive resources such as elderberry shrubs.

The Corps would be responsible for implementing the levee repairs at 19 of the erosion sites, and DWR would be responsible for implementing the levee repairs at six of the erosion sites. The Corps would issue a total of five construction contracts, and DWR would issue a total of two construction contracts. The erosion sites that would be repaired under these contracts are identified below.

2.5.1. Corps Contract 1

Corps contract 1 would include four sites (SAC 73.5L, SAC 78.8L, SAC 87.0L, and FR 5.5L). If these sites are included among those that will be repaired under the current authorization, construction would occur during summer/fall 2009. All work is anticipated to be accessed from the landside.

2.5.1.1. SAC 73.5L

The observed levee erosion at SAC 73.5L is likely caused by high flows, high wind, and boat wake wave action. Tidal drawdown failures of the very erodible silty sand riverbank materials may also be contributing to the observed erosion. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of the significant erosion observed along these areas, such as animal burrows, significant gullies, and scarps.

Appendix A-1 provides a conceptual design cross-section of the proposed repairs at SAC 73.5L, and Table 2-2 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.

- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas at either end of the site.

Table 2-2 SAC 73.5L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1,100
Site area (acres), including construction easement	6.33
Quarry stone volume (cubic yards)	15,196
Soil-filled quarry stone volume (cubic yards)	12,824
Soil cover (cubic yards)	1,261
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	331
IWM to be anchored at MSWL (linear feet)	550

2.5.1.2. SAC 78.8L

The observed levee erosion at SAC 78.8L is likely due to high-velocity flood flows and boat wake wave impacts. Tidal drawdown failures of the very erodible silty sand riverbank materials may also be contributing to the observed erosion. Animal burrowing may also be contributing to the erosion. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of the significant erosion observed along these areas, such as animal burrows, significant gullies and scarps.

Appendix A-2 provides a conceptual design cross-section of the proposed repairs at SAC 78.8L, and Table 2-3 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas at either end of the site.

Table 2-3 SAC 78.8L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	260
Site area (acres), including construction easement	1.66
Quarry stone volume (cubic yards)	6,680
Soil-filled quarry stone volume (cubic yards)	3,676
Soil cover volume (cubic yards)	347
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	99
IWM to be anchored at MSWL (linear feet)	130

2.5.1.3. SAC 87.0L

The levee erosion at site SAC 87.0L is likely due to high-velocity flood flows directed at the broad outside meander, boat wake wave impacts, and erodible natural river terrace materials. The narrowing of the river also increases the velocities at this site. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is required at SAC 87.0L because of scarps up to 20 feet high, evidence of slumping, undermined/rotated trees, undercut slopes, and other indications of erosion. Rock revetments are not required on the upper bank because it did not show significant erosion.

Appendix A-3 provides a conceptual design cross-section of the proposed repairs at SAC 87.0L, and Table 2-4 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the bottom of the riparian bench 2 feet above the summer MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas at either end of the site.

Table 2-4 SAC 87.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	750
Site area (acres), including construction easement	8.20
Quarry stone volume (cubic yards)	12,054
Soil-filled quarry stone volume (cubic yards)	11,750
Soil cover volume (cubic yards)	838
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within riparian bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	15
IWM to be anchored at MSWL (linear feet)	375

2.5.1.4. FR 5.5L

The levee erosion at site FR 5.5L is likely due to high flood flows, boat wake wave impacts, and erodible levee materials. Large, undermined trees along the toe of the levee slope exacerbate the erosion by creating eddies around the root balls. A rock revetment on the upper bank is proposed because of the significant slopes and obvious erosion (slumping, scarps up to 4 feet high). A rock revetment at the levee toe is not proposed in order to minimize the potential for adverse effects to valuable fish habitat provided by shade, the shallow nature of the shoreline, and the fine natural substrate in place over much of the site.

Appendix A-4 provides a conceptual design cross section of the proposed repairs at FR 5.5L, and Table 2-5 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct riparian and wetland bench with a slope of 6H:1V. Vegetation will be planted on the bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian/wetland bench.
- Set the middle of the bench to the summer MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone with sand infill below the MSWL.
- Locate staging areas at either end of the site.

Table 2-5 FR 5.5L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	832
Site area (acres)	6.22
Quarry stone volume (cubic yards)	7,687

Table 2-5 FR 5.5L General Site Characteristics

Repair Site Characteristics	
Soil-filled quarry stone volume (cubic yards)	6,922
Soil cover volume (cubic yards)	1,128
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within riparian bench (H:V)	6:1
IWM to be removed (linear feet along bankline)	235
IWM to be anchored at MSWL (linear feet)	416

2.5.2. Corps Contract 2

Corps contract 2 would include five sites (SAC 93.7L, SAC 114.5R, SAC 136.9R, SAC 136.7R, and SBP 0.4E). If these sites are included among those that will be repaired under the current authorization, construction would occur during summer/fall 2009. Work is expected to be entirely from the landside.

2.5.2.1. SAC 93.7L

The observed levee erosion at SAC 93.7L is likely due to high-velocity flood flows directed toward the outside of the bend, wind and boat wake wave action, and the erodible sandy silt levee materials. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of the significant erosion observed along these areas, such as animal burrows, significant gullies, and scarps.

Appendix A-5 provides a conceptual design cross-section of the proposed repairs at SAC 93.7L, and Table 2-6 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Tie in the repairs to the riprap located upstream and downstream of the site.
- Locate staging areas at either end of the site.

Table 2-6 SAC 93.7L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1,050
Site area (acres)	6.41
Quarry stone volume (cubic yards)	18,829
Soil-filled quarry stone volume (cubic yards)	9,399
Soil cover (cubic yards)	1,162
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	0
IWM to be anchored at MSWL (linear feet)	525

2.5.2.2. SAC 114.5R

The observed levee erosion is likely due to high flood flows, high wind, boat wake wave action, large animal burrows in the toe of the riverbank, and drawdown failures of the very erodible silty sand levee materials. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of the significant erosion observed along these areas, such as animal burrows, significant gullies, and scarps.

Appendix A-6 provides a conceptual design cross-section of the proposed repairs at SAC 114.5R, and Table 2-7 identifies the general site characteristic. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas at either end of the site.

Table 2-7 SAC 114.5R General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1,500
Site area (acres), including construction easement	8.40
Quarry stone volume (cubic yards)	26,374
Soil-filled quarry stone volume (cubic yards)	12,596

Table 2-7 SAC 114.5R General Site Characteristics

Repair Site Characteristics	
Soil cover (cubic yards)	1,548
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	457
IWM to be anchored at MSWL (linear feet)	750

2.5.2.3. SAC 136.9R

The observed levee erosion is likely due to high-velocity flood flows, boat wake wave impacts, and erodible sandy silt materials overlying a more resistant mud platform along the shoreline. Animal burrowing is contributing to the degradation of the waterside levee slope and to erosion of the riverbank. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of the significant erosion observed along these areas, such as animal burrows, significant gullies, and scarps.

Appendix A-7 provides a conceptual design cross section of the proposed repairs at SAC 136.9R, and Table 2-8 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas will be located at either end of the site.

Table 2-8 SAC 136.9L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	900
Site area (acres), including construction easement	5.19
Quarry stone volume (cubic yards)	9,370
Soil-filled quarry stone volume (cubic yards)	6,698
Soil cover (cubic yards)	1,047
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1

Table 2-8 SAC 136.9L General Site Characteristics

Repair Site Characteristics	
IWM to be removed (linear feet along bankline)	38
IWM to be anchored at MSWL (linear feet)	450

2.5.2.4. SAC 136.7R

The levee erosion at site SAC 136.7R is likely due to high-velocity flood flows, boat wake wave impacts, and erodible levee materials. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is recommended because of scarps up to 20 feet high, evidence of slumping, undermined/rotated trees, undercut slopes, and other indications of erosion. Because the upper bank lacked erosion features, a rock revetment is not recommended.

Appendix A-8 provides a conceptual design cross-section of the proposed repairs at SAC 136.7R, and Table 2-9 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the bottom of the riparian bench 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Tie in the repairs to the riprap located north of the site.
- Locate staging areas at either end of the site.

Table 2-9 SAC 136.7R General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	300
Site area (acres), including construction easement	2.82
Quarry stone volume (cubic yards)	3,139
Soil-filled quarry stone volume (cubic yards)	1,312
Soil cover (cubic yards)	545
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	2
IWM to be anchored at MSWL (linear feet)	150

2.5.2.5. SBP 0.4E

The levee erosion at SBP 0.4E is likely due to high flood flows and erodible levee materials. The presence of large, undermined trees along the toe of the levee slope exacerbates the erosion by creating eddies around the root balls. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is recommended because of creep and slump-type landsliding observed on the highly eroding riverbank as well as ground cracks along the edge of the dirt road, suggesting incipient cracking. Rock revetments would not be required on the upper bank because it did not show significant erosion.

Appendix A-9 provides a conceptual design cross-section of the proposed repairs at the site, and Table 2-10 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the lower bank with a rock slope of 2H:1V.
- Construct a 15-foot-wide bench with a slope of 10H:1V. Vegetation will be planted on the bench for bank stabilization and giant garter snake habitat.
- Set the bottom of the bench approximately 2 feet above the MSWL.
- Place IWM at the site above and below the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas at either end of the site.

Table 2-10 SBP 0.4E General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	365
Site area (acres)	2.53
Quarry stone volume (cubic yards)	1,489
Soil-filled quarry stone volume (cubic yards)	530
Soil cover (cubic yards)	160
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	28
IWM to be anchored at MSWL (linear feet)	36.5

2.5.3. Corps Contract 3

Corps contract 3 would include four sites (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 41.9R). If these sites are included among those that will be repaired under the current authorization, construction would occur during summer/fall 2010. Work is anticipated to be conducted from the waterside.

2.5.3.1. SAC 8.0L

The levee erosion at SAC 8.0L is likely due to high flood flows directed at the broad outside meander, high wind wave action (particularly at high tide), possibly cyclic (tidal) drawdown failure of the unprotected slopes, and very erodible levee materials. Erosion of the older riprap-mantled slopes in the northern portion of the site may also be due to undersized riprap and erosion of the underlying sandy silt levee materials. A rock revetment of the upper bank is proposed because of the significant steep slopes, soft friable levee material, and obvious erosion (slumping, scarps 10 to 15 feet high). In addition, Highway 160 is located on the levee crest; the highway has a narrow shoulder, which has the potential to continue to erode and possibly affect highway stability. A rock revetment will not be placed at the levee toe in order to preserve the existing wetlands, which provide valuable fish habitat and suitable habitat for Mason's lilaeopsis (*Lilaeopsis masonii*), a species listed as rare under the California Native Plant Protection Act.

Appendix A-10 provides a conceptual design cross-section of the proposed repairs at SAC 8.0L, and Table 2-11 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from water.
- Repair the upper bench with rock at a varied slope. Vegetation will be planted on the upper bank for bank stabilization and riparian habitat.
- Place IWM above and below the MSWL.
- Place soil-filled quarry stone from the levee crest to the MSWL.
- Place repairs at the site over the existing riprap.
- Locate staging areas at either end of the site.

Table 2-11 SAC 8.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1550
Site area (acres), including construction easement	16.43
Soil-filled quarry stone volume (cubic yards)	6,788
Soil cover volume (cubic yards)	1,136
Final bank slope outside of planted bench areas (H:V)	Varies
Final bank slope within bench (H:V)	n/a
IWM to be removed (linear feet along bankline)	761
IWM to be anchored at MSWL (linear feet)	930

2.5.3.2. SAC 10.8L

The levee erosion at SAC 10.8L is likely due to high flood flows directed at the very broad outside meander, high wind wave action (particularly at high tide), possibly cyclic (tidal)

drawdown failure of the unprotected slopes, and very erodible levee materials. Erosion of any older riprap-mantled slopes may also be due to undersized riprap and erosion of the underlying sandy silt levee materials. A rock revetment is recommended for the upper bank because of the significantly steep slopes, soft friable levee material, and obvious erosion (slumping, scarps 3 to 5 feet high). However, in the central portion of the site, where the existing riprap is performing well, no action will be taken. A rock revetment will not be placed at the levee toe in order to preserve the existing fish habitat provided by the site vegetation and the wave barrier.

Appendix A-11 provides a conceptual design cross section of the proposed repairs at SAC 10.8L, and Table 2-12 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from water.
- Repair the upper bench with rock at a varied slope. Vegetation will be planted on the upper bank for bank stabilization and riparian habitat.
- Place IWM above and below the MSWL.
- Place soil-filled quarry stone from the levee crest out to the MSWL.
- Tie in repairs at the site to the existing riprap on the site.
- Locate staging areas at either end of the site.

Table 2-12 SAC 10.8L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	550
Site area (acres), including construction easement	17.67
Soil-filled quarry stone volume (cubic yards)	1,754
Soil cover volume (cubic yards)	460
Final bank slope outside of planted bench areas (H:V)	Varies
Final bank slope within bench (H:V)	n/a
IWM to be removed (linear feet along bankline)	400
IWM to be anchored at MSWL (linear feet)	330

2.5.3.3. SAC 26.0L

The levee erosion at site SAC 26.0L is likely due to high velocity flood flows, boat wake wave impacts, and erodible levee materials. The slumping and raveling of the riprap present at the site may be due to settlement and/or erosion of weak, sandy silt foundation materials. The presence of large, undermined trees along the toe of the levee slope exacerbates the erosion by creating eddies around the root balls. Some of the riprap appears to be loosely placed (i.e., is not interlocking) and may have settled since placement. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is recommended because of the significantly steep slopes, soft friable levee material, and obvious erosion (slumping, scalloping up to 15 feet)

along the lower bank and levee toe. The upper bank did not show significant erosion and thus will not require rock revetments.

Appendix A-12 provides a conceptual design cross-section of the proposed repairs at SAC 26.0L, and table 2-13 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access from water.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat.
- Place IWM above and below the MSWL.
- Set the bottom of the bench 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Either tie in the repairs to the riprap existing on the site or cover the existing riprap.
- Locate staging areas at either end of the site.

Table 2-13 SAC 26.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	2,005
Site area (acres), including construction easement	10.24
Quarry stone volume (cubic yards)	13,854
Soil-filled quarry stone volume (cubic yards)	6,823
Soil cover volume (cubic yards)	1,446
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	863
IWM to be anchored at MSWL (linear feet)	1,203

2.5.3.4. SAC 41.9R

The levee erosion at site SAC 41.9R is likely due to high-velocity flood flows, boat wake wave impacts, and erodible levee materials. The presence of large, undermined trees along the toe of the levee slope exacerbates the erosion by creating eddies around the root balls. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of significant erosion observed along these areas, such as animal burrows, significant gullies, scarps up to 10 feet high, and other indications of erosion.

Appendix A-13 provides a conceptual design cross-section of the proposed repairs at SAC 26.0L, and Table 2-14 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access from water.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the bottom of the riparian bench 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Tie in the repairs to the riprap existing downstream of the site.
- Locate staging areas at either end of the site.

Table 2-14 SAC 41.9R General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1515
Site area (acres), including construction easement	11.96
Quarry stone volume (cubic yards)	11,930
Soil-filled quarry stone volume (cubic yards)	11,280
Soil cover volume (cubic yards)	2,355
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	966
IWM to be anchored at MSWL (linear feet)	757.5

2.5.4. Corps Contract 4

Corps contract 4 would include five sites (SAC 71.3R, SAC 130.0L, SAC 157.7R, FR 1.0L, and FR 3.7L). If these sites are included among those that will be repaired under the current authorization, construction would occur during summer/fall 2010. Work is expected to be entirely from the landside.

2.5.4.1. SAC 71.3R

The levee erosion at site SAC 71.3R is likely due to high-velocity flood flows, boat wake wave impacts, and erodible levee materials. The presence of large, undermined trees along the toe of the levee slope exacerbates the erosion by creating eddies around the root balls. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is required at SAC 71.3R because of slumping and steep undercutting observed on the highly eroding

riverbank, as seen during field investigations. Rock revetment is not required on the upper bank because it did not show significant erosion.

Appendix A-14 provides a conceptual design cross section of the proposed repairs at SAC 71.3R, and Table 2-15 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench.
- Set the riverside edge of the bench to the summer MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Tie in the repairs to the riprap located adjacent to the site.
- Locate staging areas at either end of the site.

Table 2-15 SAC 71.3R General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	515
Site area (acres)	4.48
Quarry stone volume (cubic yards)	6,675
Soil-filled quarry stone volume (cubic yards)	4,452
Soil cover volume (cubic yards)	727
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within riparian bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	123
IWM to be anchored at MSWL (linear feet)	257.5

2.5.4.2. SAC 130.0L

The levee erosion at site SAC 130.0L is likely due to high-velocity flood flows directed at the broad outside meander, boat wake wave impacts, and erodible levee materials. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is recommended because of slumping and steep undercutting observed on the highly eroding riverbank. A rock revetment is not recommended for the upper bank because it lacked erosion features.

Appendix A-15 provides a conceptual design cross-section of the proposed repairs at SAC 130.0L, and Table 2-16 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench to MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Tie in the repairs to the riprap located adjacent to the site.
- Locate staging areas at either end of the site.

Table 2-16 SAC 130.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	345
Site area (acres), including construction easement	3.49
Quarry stone volume (cubic yards)	4,477
Soil-filled quarry stone volume (cubic yards)	1,838
Soil cover volume (cubic yards)	394
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	15
IWM to be anchored at MSWL (linear feet)	172.5

2.5.4.3. SAC 157.7R

The levee erosion at site SAC 157.7R is likely due to high flood flows, high wind and boat wake wave action, the erodible sandy to clayey silt materials, animal burrowing, and possibly shallow slumping. Overall, erosion at the site is due to the narrowing of the river opposite a gravel bar that increases flow velocity, and the progressive downstream migration of the river bends. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetments at the levee toe and along the upper bench are recommended because of the significant erosion observed along these areas, such as animal burrows, significant gullies, and scarps.

Appendix A-16 provides a conceptual design cross-section of the proposed repairs at SAC 157.7R, and Table 2-17 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.

- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas at either end of the site.

Table 2-17 SAC 157.7R General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1,000
Site area (acres), including construction easement	5.94
Quarry stone volume (cubic yards)	16,785
Soil-filled quarry stone volume (cubic yards)	5,726
Soil cover (cubic yards)	615
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	278
IWM to be anchored at MSWL (linear feet)	500

2.5.4.4. FR 1.0L

The levee erosion at site FR 1.0L is likely due to high flood flows, boat wake wave impacts, and erodible levee materials. The presence of large, undermined trees along the toe of the levee slope exacerbates the erosion by creating eddies around the root balls. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A rock revetment at the levee toe is recommended because of the steep slopes and obvious erosion (gullying, slumping, and scarps up to 4 feet high) observed during field investigations. The upper bank lacked erosion features and will not require rock revetments.

Appendix A-17 provides a conceptual design cross-section of the proposed repairs at FR 1.0L, and Table 2-18 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct riparian and wetland bench with a slope of 6H:1V. Vegetation will be planted on the bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian/wetland bench above and below the MSWL.
- Set the middle of the bench to the MSWL.

- Place soil-filled quarry stone above the MSWL and quarry stone with sand infill below the MSWL.
- Tie in the repairs to the riprap located north of the site.
- Locate staging areas at either end of the site.

Table 2-18 FR 1.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	980
Site area (acres), including construction easement	8.36
Quarry stone volume (cubic yards)	5,399
Soil-filled quarry stone volume (cubic yards)	8,269
Soil cover volume (cubic yards)	1,436
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	6:1
IWM to be removed (linear feet along bankline)	132
IWM to be anchored at MSWL (linear feet)	490

2.5.4.5. FR 3.7L

The levee erosion at site FR 3.7L is likely due to high flood flows, high wind and boat wake wave action, drawdown failures of the very erodible silty sand levee materials, vehicular traffic, animal burrowing, and possibly shallow slumping of the sandy soils. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. Rock revetment at the levee toe would be avoided in order to preserve existing fish habitat. However, rock revetment at the upper bank is required due to the significantly steep slopes and obvious erosion (e.g., undercutting, slumping, scarps up to 4 feet high).

Appendix A-18 provides a conceptual design cross-section of the proposed repairs at FR 3.7L, and Table 2-19 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct sloping riparian bench with a slope of 6H:1V. Vegetation will be planted on the bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the middle of the bench to the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone with sand infill below the MSWL.
- Locate staging areas at either end of the site.

Table 2-19 FR 3.7L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	2,300
Site area (acres), including construction easement	17.31
Quarry stone volume (cubic yards)	47,889
Soil-filled quarry stone volume (cubic yards)	27,267
Soil cover volume (cubic yards)	2847
Sand infill volume (cubic yards)	6,723
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	6:1
IWM to be removed (linear feet along bankline)	743
IWM to be anchored at MSWL (linear feet)	1,150

2.5.5. Corps Contract 5

Corps contract 5 would include one site, DC 0.9N. If this site is included among those that will be repaired under the current authorization, construction would occur during summer/fall 2010. Work is expected to be entirely from the landside.

2.5.5.1. DC 0.9N

The levee erosion at site DC 0.9N is likely due to animal burrowing and the site's location on the outside river meander. The exposed soils erode easily near the animal burrow area. The underlying bedrock protects the lower bank. However, during high water flow, exposed soils in the upper bank erode easily. Field observations conducted in 2008 confirmed the severity of the existing erosion and the potential for further deterioration of the waterside levee. A setback levee is recommended because construction on the riverbank would disturb the high-quality fish habitat on the site.

Appendix A-19 provides a conceptual design cross-section of the proposed repairs at DC 0.9N, and Table 2-20 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Build a setback levee with a landslide slope of 3H:1V, with a 50H:1V slope for the land beyond the slope, and a waterside slope of 3H:1V with a 25-foot-wide bench about 7.5 feet above the summer MSWL.
- Construct the setback levee approximately 150 feet back from Deer Creek.
- Place the levee approximately 8 feet above the MSWL. The levee road is planned to be 12 feet wide.
- Locate staging and repair areas on the landside of the levee.

Table 2-20 DC 0.9N General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	800
Site area (acres), including construction easement	3.90
Embankment (cubic yards)	231
Soil cover volume (cubic yards)	659
Landside bank slope (H:V)	3:1
Waterside bank slope within bench (H:V)	3:1
IWM to be removed (linear feet along bankline)	0
IWM to be anchored at MSWL (linear feet)	0

2.5.6. DWR Contract 1

DWR contract 1 would include four sites (SAC 35.4L, FR 7.0L, LAR 10.0L, and LAR 10.6L). If these sites are included among those that will be repaired under the current authorization, construction would occur during summer/fall 2009. Work for site SAC 35.4L would be conducted from the waterside or landside. Work at the remaining sites would be conducted from the landside.

2.5.6.1. SAC 35.4L

SAC 35.4L is located on the left bank of the Sacramento River. Besides one large tree on the bench of levee that will need to be protected during construction, there is minimal vegetation along this reach. The existing materials of the upper bank consist of fine silty sands, while the lower riverbank materials are estimated to be fine silts with some sand present. The primary causes for the erosion at SAC 35.4L are assumed to be river flow velocities and wind- and boat-generated wave action during periods of low flow. The recommended repair for this site is a riparian bench and bank fill revetment to repair the eroded bank and reduce the need for a stability-type remediation.

Appendix A-20 provides a conceptual design cross-section of the proposed repairs at SAC 35.4L, and Table 2-21 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from the waterside or landside.
- Repair the upper bench with a rock slope of 3H:1V.
- Construct a 15-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.

- Locate staging areas along the access road shoulder upstream and downstream of the site.

Table 2-21 SAC 35.4L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1,070
Site area (acres), including construction easement	8.25
Quarry stone volume (cubic yards)	24,146
Soil-filled quarry stone volume (cubic yards)	2,196
Soil cover volume (cubic yards)	1,591
Final bank slope outside of planted bench areas (H:V)	3:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	0
IWM to be anchored at MSWL (linear feet)	428

2.5.6.2. FR 7.0L

FR 7.0L is located on the left bank of the Feather River, just west of Garden Highway and Lee Road in Sacramento. This site is in a reach of the river with a slight bend. There are numerous large trees in the area near the levee face, and the landside of the levee abuts River Oaks Golf Course. The site is characterized by a steep waterside slope with evidence of erosion along the toe and a larger mass failure on the riverbank and levee slope. Soils within the levee are assumed to be silty sands and sandy silts. The recommended repair for this site is a stability berm along the lower slope to provide stability and erosion protection with a riparian bench for environmental mitigation. A soil rock mix will extend to the base of the upper bank and will be planted with native riparian vegetation.

Appendix A-21 provides a conceptual design cross-section of the proposed repairs at FR 7.0L, and Table 2-22 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 10-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas near the levee crest within the construction easement.

Table 2-22 FR 7.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	520
Site area (acres), including construction easement	3.69
Quarry stone volume (cubic yards)	7,500
Soil-filled quarry stone volume (cubic yards)	2,996
Soil cover volume (cubic yards)	5,400
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	8
IWM to be anchored at MSWL (linear feet)	208

2.5.6.3. LAR 10.0L

LAR 10.0L is located on the left bank of the American River just upstream of Watt Avenue. The site is directly upstream from a previously repaired erosion site, which will be used as a transition point. LAR 10.0L is located in a relatively straight reach of the river, with a mature riparian corridor. This site is characterized by a steep waterside slope with large fluvial scours at the toe of the lower embankment bench. Soils within the levee are dense to loose sands. The primary cause of the lower bench erosion at LAR 10.0L is river flows and wave action. The erosion of the lower bench steepens the slope, causing upper bank slumping and associated stability problems. The recommended repair for this site is a stability berm along the lower slope to provide stability and erosion protection with a riparian bench for environmental mitigation. A soil/rock mix will extend to the base of the upper bank slope and will be planted with native riparian vegetation.

Appendix A-22 provides a conceptual design cross-section of the proposed repairs at LAR 10.0L, and Table 2-23 identifies the general site characteristics. Details of the proposed levee repairs at LAR 10.0L include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 10-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas near levee crest within construction easement.

Table 2-23 LAR 10.0L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	740
Site area (acres), including construction easement	3.91
Quarry stone volume (cubic yards)	4,857
Soil-filled quarry stone volume (cubic yards)	4,974
Soil cover volume (cubic yards)	2,094
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	70
IWM to be anchored at MSWL (linear feet)	296

2.5.6.4. LAR 10.6L

LAR 10.6L is located on the left bank of the American River, upstream of LAR 10.0L. The site is in a relatively straight reach of the river, across from an in-channel island that splits flows through this stretch of the river. The site has numerous large trees; ground vegetation and IWM are also present. LAR 10.6L is characterized by a steep waterside slope with large fluvial scours at the toe of the lower embankment. Soils within the embankment are dense to loose sands. The recommended repair for this site is a stability berm along the lower slope to provide stability and erosion protection with a riparian bench for environmental mitigation. A soil/rock mix will extend to the base of the upper bank slope and will be planted with native riparian vegetation.

Appendix A-23 provides a conceptual design cross-section of the proposed repairs at LAR 10.6L, and Table 2-24 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Repair the upper bench with a rock slope of 2.5H:1V.
- Construct a 10-foot-wide riparian bench with a slope of 10H:1V. Vegetation will be planted on the riparian bench for bank stabilization and riparian habitat. IWM will be anchored to the riparian bench above and below the MSWL.
- Set the riverside edge of the bench approximately 2 feet above the MSWL.
- Place soil-filled quarry stone above the MSWL and quarry stone below the MSWL.
- Locate staging areas near levee crest within construction easement.

Table 2-24 LAR 10.6L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	670
Site area (acres), including construction easement	3.38

Table 2-24 LAR 10.6L General Site Characteristics

Repair Site Characteristics	
Quarry stone volume (cubic yards)	4,044
Soil-filled quarry stone volume (cubic yards)	4,895
Soil cover volume (cubic yards)	1,758
Final bank slope outside of planted bench areas (H:V)	2.5:1
Final bank slope within bench (H:V)	10:1
IWM to be removed (linear feet along bankline)	187.5
IWM to be anchored at MSWL (linear feet)	268

2.5.7. DWR Contract 2

DWR contract 2 would include two sites (CC 2.8L and CC 3.4L). If these sites are included among those that will be repaired under the current authorization, construction would occur during summer/fall 2010. Work would be conducted from the landside.

2.5.7.1. CC 2.8L

CC 2.8L is located on the left bank of Cache Creek, just east of the southern end of County Road 98A. The sides of the river channel are sheared due to excessive erosion. Soils within the levee are assumed to be homogeneous embankment fill composed of clayey silt, while the riverbanks consist of silty sand to sandy silt, with layers of lean clay. In some areas, the bank has eroded to within a few feet of the waterside levee toe. The narrow channel width and relatively low level of flood protection contribute to frequent high-flow events with high river velocities that continuously erode the riverbanks. There are very steep slopes and the bench has been intensely eroded, compromising the stability of the levee. This site is in a relatively straight reach of the river. There are private properties and a power pole on the landside of the levee, along with overhead lines crossing Cache Creek.

The alignment of the levee-protected river channel is restricted to conform to property boundaries, as opposed to the natural unrestricted alignment. The existing levees provide approximately 10-year flood protection. The opposite bank (right bank) is experiencing similar levels of erosion; however the bench width leading up to the right levee is wide enough to provide adequate protection for the levee. The recommended repair for this site is a setback levee, placed at an offset distance that will accommodate 50 years of erosion from the existing site. Construction of a setback levee will provide flood protection without hydraulically affecting the channel.

Appendix A-24 provides a conceptual design cross-section of the proposed repairs at CC 2.8L, and Table 2-25 identifies the general site characteristics. Details of the proposed levee repairs at this site include:

- Provide construction access to the site from land.
- Build a setback levee with a waterside slope of 3H:1V and a landside slope of 3H:1V.

- Construct the setback levee approximately 125 feet back from the existing levee.
- Notch existing levee crowns down to the floodplain elevation in several locations along their lengths in order to allow inundation of the reconnected floodplain area during high winter and spring flows.
- The elevation of the setback levee will vary along the alignment. At transition points, the elevation will match the existing levee.
- The road constructed on the setback levee will be a minimum of 12 feet wide.
- Staging and repair will be performed landside.

Table 2-25 CC 2.8L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	1,300
Site area (acres), including construction easement	9.68
Excavation and backfill (cubic yards)	4,470
Imported compacted embankment (cubic yards)	10,997
Aggregate base (cubic yards)	218
Landside bank slope (H:V)	2:1
Waterside bank slope within bench (H:V)	3:1
IWM to be removed (linear feet along bankline)	0
IWM to be anchored at MSWL (linear feet)	0

2.5.7.2. CC 3.4L

CC 3.4L is located on the left bank of Cache Creek, just east of the northern end of County Road 99A. The sides of the levee are sheared due to excessive erosion. There are very steep slopes and the bench has been intensely eroded, compromising the stability of the levee. This site is in a relatively straight reach of the river just downstream of a large bend. There are numerous large trees and existing vegetation. There are private properties and a power pole on the landside of the levee. In addition, there are pump facilities that draw water from the creek just upstream of the repair site. This stretch of the river is characterized by narrow channel widths with steeply eroded banks. The existing levees provide approximately 10-year flood protection. Soils within the levee are assumed to be homogeneous embankment fill composed of clayey silt, while the riverbanks consist of silty sand to sandy silt with layers of lean clay. The sheared sides of the levee have caused the bench to be intensely eroded, compromising the stability of the levee. The narrow channel width and relatively low level of flood protection contribute to frequent high-flow events, with high river velocities that continuously erode the riverbanks.

The recommended repair for this site is a setback levee, placed at an offset distance that will accommodate 50 years of erosion from the existing site. Construction of a setback levee will provide flood protection without hydraulically affecting the channel.

Appendix A-25 provides a conceptual design cross-section of the proposed repairs at CC 3.4L, and Table 2-26 identifies the general site characteristics. Details of the proposed levee repairs at CC 3.4L include:

- Provide construction access to the site from land.
- Build a setback levee with a waterside slope of 3H:1V and a landside slope of 3H:1V.
- Construct the setback levee approximately 125 feet back from the existing levee.
- Notch the existing levee crowns down to the floodplain elevation in several locations along their lengths in order to allow inundation of the reconnected floodplain area during high winter and spring flows.
- The elevation of setback levee will vary along the alignment. At transition points, the elevation will match the existing levee.
- The road constructed on the setback levee will be a minimum of 12 feet wide.
- Staging and repair will be performed landside.

Table 2-26 CC 3.4L General Site Characteristics

Repair Site Characteristics	
Length of repair (feet)	900
Site area (acres), including construction easement	4.67
Excavation and backfill (cubic yards)	3,460
Imported compacted embankment (cubic yards)	7,400
Aggregate base (cubic yards)	170
Landside bank slope (H:V)	2:1
Waterside bank slope within bench (H:V)	3:1
IWM to be removed (linear feet along bankline)	0
IWM to be anchored at MSWL (linear feet)	0

2.6. Habitat Disturbance

Construction would be conducted in a manner that minimizes disturbance to existing vegetation. No excavation or movement of in situ soils or slope protection would occur. Unless removal is required for safety reasons, all native trees greater than 4 inches dbh would be preserved and protected. Herbaceous and woody vegetation, other than preserved trees, would be manually cleared to the ground surface. Clearing of vegetation would be limited to the extent required to place bank protection material or provide construction access. Necessary pruning and trimming of preserved trees, as determined at the time of construction, may be conducted prior to the placement of rock slope protection. All construction activities, including pruning and trimming of vegetation, would be supervised by a qualified biologist to ensure a minimal effect on natural resources. Disturbed areas, including staging areas, would be seeded and covered with mulch to prevent erosion following project build-out.

2.7. Construction Staging Areas

Staging areas have been identified for each erosion site. These areas will be the sole locations used for staging of vehicles, materials, and other associated construction equipment. The staging areas have been subject to the same environmental review as the project footprint to ensure that any potential resources will not be adversely affected. Established staging areas for each erosion site are shown in Table 2-27.

Table 2-27 Construction Staging Areas

Site Name	Staging Area
SAC 8.0L	Parking/staging only at south side of highway turn-out, adjacent to call box
SAC 10.8L	Parking/staging only at south side of highway turn-out, adjacent to call box
SAC 26.0L	Parking/staging only within construction easement
SAC 35.4L	Shoulder of access road at upstream and downstream ends of site
SAC 41.9R	Parking/staging only at parking lot at upstream end of site
SAC 71.3R	Within construction easement
SAC 87.0L	Within construction easement
SAC 130.0L	Shoulder of access road at downstream end of site
SAC 136.7R	Within construction easement
FR 1.0L	Within construction easement
FR 3.7L	Within construction easement
FR 5.5L	Within construction easement
FR 7.0L	Staging area will be located near levee crest within construction easement
LAR 10.0L	Staging area will be located near levee crest within construction easement
LAR 10.6L	Staging area will be located near levee crest within construction easement
CC 2.8L	Within construction easement
CC 3.4L	Along access road to the north of the site
DC 0.9N	Within construction easement
SBP 0.4E	On top of levee adjacent to Highway 20

Table 2-27 Construction Staging Areas

Site Name	Staging Area
SAC 73.5L	Within construction easement
SAC 78.8L	Within construction easement
SAC 93.7L	Within construction easement
SAC 114.5R	Within construction easement
SAC 136.9R	Within construction easement
SAC 157.7R	Within construction easement

2.8. Haul Routes, Borrow Areas, and Traffic

Depending on the site location, materials would be brought to the sites by either barge (waterside) or via surface roads (landside). Table 2-28 identifies the most likely construction access (i.e., landside or waterside). Hauling routes to those sites requiring landside access would be via interstate and U.S. highways, state highways, county and city roads, and levee access roads. Construction materials, including quarry stone, would be hauled from a commercial or previously permitted quarry or borrow site located within 100 miles of the site. Temporary lane closures may be required. Construction signs would be posted along the haul routes and flaggers would be used, as necessary, to minimize traffic problems and ensure public safety near the construction sites.

Table 2-28 Construction Access

Erosion Site	Construction Access
Corps Contract 1	
SAC 73.5L	Landside
SAC 78.8L	Landside
SAC 87.0L	Landside
FR 5.5L	Landside
Corps Contract 2	
SAC 93.7L	Landside
SAC 114.5R	Landside
SAC 136.9R	Landside
SAC 136.7R	Landside
SBP 0.4E	Landside

Table 2-28 Construction Access

Erosion Site	Construction Access
Corps Contract 3	
SAC 8.0L	Waterside
SAC 10.8L	Waterside
SAC 26.0L	Waterside
SAC 41.9R	Waterside
Corps Contract 4	
SAC 71.3R	Landside
SAC 130.0L	Landside
SAC 157.7R	Landside
FR 1.0L	Landside
FR 3.7L	Landside
Corps Contract 5	
DC 0.9N	Landside
DWR Contract 1	
SAC 34.5L	Waterside or Landside
FR 7.0L	Landside
LAR 10.0L	Landside
LAR 10.6L	Landside
DWR Contract 2	
CC 2.8L	Landside
CC 3.4L	Landside

CHAPTER 3

Affected Environment and Environmental Consequences

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Chapter 3 describes the affected environment and the environmental consequences of implementing the alternatives described in Chapter 2. Resource elements addressed include land use; aesthetics; recreation; cultural resources; biological resources; hydrology and water quality; geomorphology; air quality; traffic and circulation; noise; hazardous, toxic, and radioactive waste; and socioeconomics and environmental justice. A discussion of the environmental setting, regulatory setting, environmental effects, and mitigation measures is provided for each resource element.

For NEPA purposes, the assessment of potential impacts takes into consideration the significance of the proposed action in terms of its context and its intensity (40 CFR 1508.27). To aid in the evaluation of context, the Corps has determined that the affected region is the Sacramento River watershed and the locality of the proposed action is the SRBPP planning area. Intensity refers to the severity of potential impact. The intensity of the potential impacts for each resource element is addressed under Environmental Effects.

Because of the requirement under CEQA to mitigate "significant effects on the environment" when feasible, all impacts identified for the proposed action are characterized as being either "significant" or "less than significant." The CEQA significance criteria were developed using the CEQA Guidelines, agency standards, legislative or regulatory requirements as applicable, and professional judgment. All impacts that do not exceed the stated significance criteria described for each section are assumed to be less than significant and are therefore not discussed in detail (PRC Section 21100 and CEQA Guidelines Section 15128).

Under NEPA, there are no specific statutes or regulations that explicitly require that any adopted mitigation measures developed as part of an EA be "monitored" to ensure that they are carried out. Under CEQA, Public Resources Code Section 21081.6(a) requires lead agencies to "adopt a reporting and mitigation monitoring program for the changes to the project which it has adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment." Where potential impacts have been determined to be potentially significant under the CEQA significance criteria, mitigation measures are clearly identified and presented in a manner that will facilitate establishment of a monitoring and reporting program. Any mitigation measures adopted by the CVFPB as conditions of project approval will be included in a Mitigation Monitoring and Reporting Program (MMRP) to verify compliance.

3.1. Land Use

3.1.1. Environmental Setting

Land uses in the Sacramento River Basin are principally agriculture, silviculture, open space, and urban use, with urban development centered around the city of Sacramento and other communities, including Redding, Chico, and Red Bluff. More than half the region's population

lives in the greater metropolitan Sacramento area. Agriculture is the dominant land use on the valley floor, followed by urban development (Sacramento Valley Water Quality Coalition 2004).

Levees serve as a buffer between a waterway and surrounding land uses. Although often zoned the same as the surrounding zoning, the main purpose of the levees is the protection of the neighboring area from flooding. As a result, the land use of most levee sites is not the same as the possible development scenarios set forth by the land's zoning designations. The levees in the SRBPP vary in their specific land use, but are generally vacant properties that support wildlife habitat, recreation, and aesthetic resources. Table 3-1 summarizes the current and surrounding zoning of the erosion sites.

Table 3-1 Erosion Site Zoning and Surrounding Zoning Designations

Site Name	Zoning	Surrounding Zoning
SAC 8.0L	▪ Delta Waterways Land Use Zone (DW)	▪ Delta Waterways Land Use Zone (DW) ▪ Permanent Agricultural Extensive Land Use Zone (AG-80)
SAC 10.8L	▪ Delta Waterways Land Use Zone (DW)	▪ Delta Waterways Land Use Zone (DW) ▪ Permanent Agricultural Extensive Land Use Zone (AG-80) ▪ Permanent Agricultural Intensive Land Use Zone (AG-20)
SAC 26.0L	▪ Delta Waterways Land Use Zone (DW)	▪ Delta Waterways Land Use Zone (DW) ▪ Permanent Agricultural Extensive Land Use Zone (AG-80) ▪ Permanent Agricultural Intensive Land Use Zone (AG-20)
SAC 35.4L	▪ Delta Waterways Land Use Zone (DW) ▪ Permanent Agricultural Intensive Land Use Zone (AG-20) ▪ Permanent Agricultural Extensive Land Use Zone (AG-80)	▪ Delta Waterways Land Use Zone (DW) ▪ Permanent Agricultural Intensive Land Use Zone (AG-20) ▪ Permanent Agricultural Extensive Land Use Zone (AG-80)
SAC 41.9R	▪ Agricultural General Zone (River) ▪ Community Commercial Zone (C2) ▪ Heavy Industrial Zone (M-2/PD)	▪ Agricultural General Zone (River) ▪ Multiple-Family Residential Zone (R3) ▪ Community Commercial Zone (C2) ▪ Heavy Industrial Zone (M-2/PD)

Table 3-1 Erosion Site Zoning and Surrounding Zoning Designations

Site Name	Zoning	Surrounding Zoning
SAC 71.3R	▪ Agricultural General Zone (River) ▪ Agricultural General Zone (A-1)	▪ Agricultural General Zone (River) ▪ Agricultural General Zone (A-1)
SAC 87.0L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG)
SAC 130.0L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG) Special Flood Plain Combining District (FP)
SAC 136.7R	▪ Floodway (FW)	▪ Exclusive Agriculture (E-A)
FR 1.0L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG)
FR 3.7L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG)
FR 5.5L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG)
FR 7.0L	▪ Park Recreation District (PR) Combining Planned Development District (PD)	▪ Park Recreation District (PR) Combining Planned Development District (PD)
LAR 10.0L	▪ Recreation Zone Parkway Corridor Combining Land Use Zone [O (PC)]	▪ Recreation Zone Parkway Corridor Combining Land Use Zone [O (PC)]
LAR 10.6L	▪ Recreation Zone Parkway Corridor Combining Land Use Zone [O (PC)]	▪ Recreation Zone Parkway Corridor Combining Land Use Zone [O (PC)] ▪ Residential Land Use Zone Parkway Corridor Combining Land Use Zone [RD-5 (PC)]
CC 2.8L	▪ Agricultural Preserve (AP) ▪ Agricultural General (A1)	▪ Agricultural Preserve (AP) ▪ Agricultural General (A1)
CC 3.4L	▪ Agricultural Preserve (AP) ▪ Agricultural General (A1)	▪ Agricultural Preserve (AP) ▪ Agricultural General (A1)
DC 0.9N	▪ Upland Agriculture (UA-AP)	▪ Exclusive Agriculture (EA-AP) ▪ Upland Agriculture (UA-AP)
SBP 0.4E	▪ General Agricultural District (AG)	▪ General Agricultural District (AG) Special Flood Plain Combining District (FP)

Table 3-1 Erosion Site Zoning and Surrounding Zoning Designations

Site Name	Zoning	Surrounding Zoning
SAC 73.5L	▪ Special Planning Area Land Use Zone (SPA) ▪ Permanent Agricultural Intensive Land Use Zone (AG-20)	▪ Special Planning Area Land Use Zone (SPA) ▪ Permanent Agricultural Intensive Land Use Zone (AG-20)
SAC 78.8L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG)
SAC 93.7L	▪ General Agricultural District (AG)	▪ General Agricultural District (AG)
SAC 114.5R	▪ Floodway (FW)	▪ Exclusive Agriculture (E-A)
SAC 136.9R	▪ Floodway (FW)	▪ Exclusive Agriculture (E-A)
SAC 157.7R	▪ Floodway (FW)	▪ Exclusive Agriculture (E-A)

3.1.2. Regulatory Setting

3.1.2.1. Federal and State Laws and Regulations

California Water Code

Under Title 23 of the California Water Code, the CVFPB regulates any encroachments within an adopted flood control area and sets permissible work periods for regulated streams, including the excavation, borrow, and vegetation removal activities within the channel.

The Delta Protection Act of 1992

The Delta Protection Act of 1992 established the Delta Protection Commission (DPC). DPC is a state agency with jurisdiction over the Primary Zone of the Delta. Six of the erosion sites (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, and SAC 71.9R) are located in the Primary Zone of the Delta. DPC is charged with the task of preparing a regional plan to address land uses and resource management for the Delta area. Key land uses identified in the legislation include agriculture, wildlife habitat, and recreation.

DPC adopted its *Land Use and Resource Management Plan for the Primary Zone of the Delta* on February 23, 1995. The plan was forwarded to the counties of Yolo, Solano, Sacramento, Contra Costa, and San Joaquin for incorporation into their general plans and zoning ordinances. The counties carry out the plan through their day-to-day activities.

Farmland Protection Policy (U.S. Code Title 7, Chapter 73)

The purpose of the Farmland Protection Policy is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to ensure that federal programs are administered in a manner that, to the extent practicable, are compatible with state, local, and private programs and policies to protect farmland.

State Lands Commission

The State Lands Commission has exclusive jurisdiction over all ungranted tidelands and submerged lands owned by the state and the beds of navigable rivers, sloughs, and lakes. These lands can only be used for public purposes consistent with provisions of the Public Trust, such as fishing, water-dependent commerce and navigation, ecological preservation, and scientific study. A project cannot use these state lands unless a lease is first obtained from the State Lands Commission. The SRBPP has a master lease (Public Resources Code 7203.9), which was approved by the commission on May 16, 1988, for bank protection work. Each new bank protection project requires an amendment to this lease.

Williamson Act

Known formally as the California Land Conservation Act of 1965, the Williamson Act was designed as an incentive to retain prime agricultural land and open space in agricultural use, thereby slowing the pace of conversion to urban and suburban development. The program entails a minimum of a 10-year contract between a city or county and a land owner whereby the land is taxed on the basis of its agricultural use rather than its market value. Some jurisdictions exercise the option of making the term longer, up to 20 years. The land becomes subject to certain enforceable restrictions, and certain conditions need to be met prior to approval of an agreement. Contracts renew automatically every year unless the nonrenewal process is initiated. A Williamson Act contract goes with the land and is binding on all successors in interest of the landowner.

3.1.2.2. Local Laws and Regulations

Two primary local regulations have jurisdiction over the erosion sites: the applicable General Plan and the Zoning Ordinance. A general plan is implemented by the city or county zoning ordinance (which establishes specific development standards and regulations) and other adopted plans and regulations for land use. In some instances, a separate land use guide is implemented in areas with special land uses, such as the American River Parkway. Current local land use regulations are identified in Table 3-2 and summarized below.

Table 3-2 Local Land Use Regulations

Site Name	Land Use Documents
SAC 8.0L	Sacramento County General Plan
SAC 10.8L	Sacramento County General Plan
SAC 26.0L	Sacramento County General Plan
SAC 35.4L	Sacramento County General Plan
SAC 41.9R	Yolo County General Plan
SAC 71.3R	Yolo County General Plan
SAC 87.0L	Sutter County General Plan
SAC 130.0L	Sutter County General Plan
SAC 136.7R	Colusa County General Plan
FR 1.0L	Sutter County General Plan

Table 3-2 Local Land Use Regulations

Site Name	Land Use Documents
FR 3.7L	Sutter County General Plan
FR 5.5L	Sutter County General Plan
FR 7.0L	Sutter County General Plan
LAR 10.0L	Sacramento County General Plan; American River Parkway Plan
LAR 10.6L	Sacramento County General Plan; American River Parkway Plan
CC 2.8L	Yolo County General Plan
CC 3.4L	Yolo County General Plan
DC 0.9N	Tehama County General Plan
SBP 0.4E	Sutter County General Plan
SAC 73.5L	Sacramento County General Plan
SAC 78.8L	Sutter County General Plan
SAC 93.7L	Sutter County General Plan
SAC 114.5R	Colusa County General Plan
SAC 136.9R	Colusa County General Plan
SAC 157.7R	Colusa County General Plan

American River Parkway Plan

The American River Parkway Plan was adopted in concept by Sacramento County and incorporated in 1962 into the Recreation Element of the Sacramento County General Plan. Several amendments were made in 1968, 1976, and 1985, with a most recent update completed in 2008. The policy document is intended to guide land use decisions to preserve the Parkway's unique natural environment while facilitating human enjoyment of the Parkway. It includes goals and policies oriented primarily towards recreation, land use, and public safety within the Parkway, and is an element of the general plans of both the City and the County of Sacramento. Two erosion sites (LAR 10.0L and LAR 10.6L) are located within the American River Parkway.

Colusa County General Plan

The Colusa County General Plan was adopted on January 13, 1989, by the Board of Supervisors. According to the Colusa County General Plan, erosion site SAC 157.7R, located in an unincorporated area of the county, is in a Designated Floodway (DF).

Sacramento County General Plan

The Sacramento County General Plan was adopted by the Board of Supervisors in 1993, a draft revision was completed in 2007, and full adoption of the General Plan is expected in the winter of 2009. According to the 1993 Sacramento County General Plan, the erosion sites in the unincorporated area of Sacramento County (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, SAC 73.5, LAR 10.0L, and LAR 10.6L) are designated as open space. Sacramento County's General Plan goals and objectives include preserving open space.

Sutter County General Plan

Sutter County's General Plan was updated by the Board of Supervisors in 1996. According to the Sutter County General Plan, erosion sites SAC 87.0L, SAC 130.0L, SAC 136.7R, FR 1.0L, FR 3.8L, FR 7.0L, and SBP 0.4E, located in unincorporated areas of the county, are designated as open space. This designation is intended to protect important open space lands within Sutter County, including non-agricultural areas that contain significant vegetation, wildlife, and/or habitat resources; areas that present conditions hazardous to rural and urban development; and areas required for the managed production of mineral resources.

Tehama County General Plan

The updated Tehama County General Plan was adopted in September 2008. The Land Use element provides policies, programs, and land use maps addressing the general location, density, and intensity of housing, business, industry, open space, education, public buildings and grounds, waste disposal facilities, and other land uses. Erosion site DC 0.9N, located in an unincorporated area of Tehama county, is designated as Valley Floor Agriculture in the County General Plan. The primary uses of Valley Floor Agriculture lands are grazing; production of tree, row and field crops; animal husbandry; dairies; nurseries and greenhouses; and uses integrally related to the processing and sales of agricultural products. The secondary uses include mineral exploration; processing and development of natural resources; residential uses accessory to and supporting an agricultural use; conservation; and outdoor recreation uses.

Yolo County General Plan

Yolo County is currently in process of updating its general plan. The public draft of the 2030 Countywide General Plan was issued in September 2008, and the associated Draft EIR is scheduled to be issued in March 2009. Adoption of the general plan and certification of the EIR is scheduled for September 2009. Until the updated general plan is adopted, land use in Yolo County continues to be governed by the existing (1983) general plan. The Yolo County General Plan identifies goals, policies, and programs representative of the direction of the growth desired by the community. The General Plan identifies goals, policies, and programs representative of the direction of growth desired by the community. The Land Use element of the General Plan identifies policies for the distribution and intensity of land uses in the county. Erosion sites CC 2.8L and CC 3.4L are designated as Agricultural Preserve by Yolo County's General Plan. According to the Yolo County General Plan, Agricultural Preserve is any parcel or area of agricultural land that qualifies for an agricultural preserve contract.

3.1.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Impacts are considered significant under CEQA if the project would:

- Physically divide or affect an established community;
- Conflict with an applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect set forth by an agency with jurisdiction over any of the erosion sites that together make up the project;

- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use;
- Conflict with existing zoning for agricultural use, or a Williamson Act contract; or
- Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use.

3.1.3.1. No-Action Alternative

Under the no-action alternative, no action would be taken to halt erosion at the 25 erosion sites. Land uses associated with the existing levees would remain unchanged for the immediate future. There would be no direct effect on existing land uses, no conversion of existing land uses would occur, and there would be no conflict with any land use policy, plan, or regulation. However, continued erosion at the erosion sites would increase the risk of levee failure and possible flooding of surrounding areas. Levee failure and flooding could result in significant impacts to surrounding land uses and established communities as a result of flooding caused by levee failure.

3.1.3.2. Alternative 1: Proposed Action

Under the proposed action, bank protection measures would be implemented to prevent ongoing erosion and increase levee stability. The proposed bank protection measures include (1) protecting the toe and slopes of the levees with quarry stone; (2) constructing riparian benches at many of the erosion sites; (3) anchoring IWM at and around MSWL to provide instream aquatic structure; and (4) planting native riparian vegetation to stabilize the bank and replace vegetation lost during construction. Setback levees would be built at sites CC 2.8L, CC 3.4L, and DC 0.9N where repair of the existing levees is not practicable.

Land use at the erosion sites where the existing levee would be repaired would remain unchanged from existing conditions. Construction of the setback levees would result in changes in land use in areas adjacent to the existing levees.

Impact LAND1: Changes in Land Use Due to Construction of Setback Levees
Construction of setback levees at sites CC 2.8L, CC 3.4L, and DC 0.9N would require the loss of approximately 8 acres of orchard (designated as prime and unique farmland) and 2 acres of pasture. These areas represent a very small proportion of the agricultural land in active use in the adjacent landscape. Some of the land to be used for construction of the setback levees is currently under Williamson Act contract. Obtaining easements and constructing setback levees would not affect the status of the Williamson Act contracts.

Construction of the setback levees is necessary to provide flood protection. The levees at CC 2.8L, CC 3.4L, and DC 0.9N are at risk of erosional failure during flooding and/or during normal flow conditions, and repair of the existing levees is not practicable. Given the necessity of providing adequate flood protection to surrounding lands and the small

area of land needed to construct the setback levees, impacts to land use are considered to be less than significant. No mitigation is required.

3.1.3.3. Alternative 2: Thin Rock Armor

Under alternative 2, vegetation would be cleared from the levee and a thin layer of rock would be placed over the existing levee slope. Land uses within the erosion sites would remain unchanged from existing conditions. Placement of a thin layer of rock would protect the bank from erosion, but would not address stability issues. When placed on a slope of 2:1 (horizontal to vertical) or greater, the life span of this type of repair is limited (estimated to be 25 years or less). For the Cache Creek sites, the steepness of the existing levee slope may preclude placement of thin rock armor without adversely modifying the hydraulics of the stream, resulting in increased erosion in upstream and downstream reaches. The removal of vegetation and potential for increased erosion associated with this alternative could result in significant impacts to land use.

3.1.4. Mitigation

Implementation of the proposed action would not result in significant impacts to land use. No mitigation is required.

3.2. Aesthetics

For environmental impact assessment purposes, “aesthetic” resources are primarily described in terms of visual features and attributes. In this sense, the aesthetic value of an area is a measure of its visual or “scenic” character and quality combined with the viewers’ responses to these conditions (Federal Highway Administration 1983).

Methods for evaluating visual resources and effects (which are generally derived from established federal visual assessment procedures) typically involve: (1) objectively characterizing the existing visual features, (2) assessing their visual quality relative to the larger regional character, and (3) determining the importance of the view to people (the sensitivity of the landscape).

The visual character of an area is influenced by a number of factors, including landforms, hydrology, vegetation, wildlife presence, recreation potential, and constructed elements of the built environment. Both natural and artificial landscape features contribute to the visual character of an area. Waterways, including rivers, are generally a visually dominant element in characterizing a viewshed.

A commonly used set of criteria for determining visual quality involves the concepts of vividness, intactness, and unity (Federal Highway Administration 1983). These three factors in combination indicate high visual quality. Lower-quality views lack vividness, are not visually intact, and possess a low degree of visual unity. These terms are described below.

- Vividness is the visual power or memorability of landscape components as they combine in striking and distinctive visual patterns.

- Intactness is the visual integrity of the natural and human-built landscapes and their freedom from encroaching elements.
- Unity is the visual coherence and compositional harmony of the landscape as a whole.

In addition to visual character and visual quality, the aesthetic value of an area is further defined by viewer sensitivity or concern. The importance of a view is related to its visibility, number of viewers, frequency and duration of views, types of viewers, and viewers' expectations. Sensitivity is determined through consideration of access availability, travel ways (linear zones that concentrate public viewing), use areas (points of concentrated public viewing), concern levels, and distance zones (foreground, mid-range, and long-range views). Concern levels can be ascertained from the degree of public interest in the scenery, the local or regional importance of the location (including local, state, or federal designations), and the degree of public use (e.g., visitor hours) at the site.

3.2.1. Environmental Setting

The scenic values of the 25 erosion and bank protection sites were assessed during site visits conducted by North State Resources, Inc., in 2008. The qualitative evaluation was conducted using a relative rating scale of low, medium, and high values. Existing conditions were characterized for visual quality in terms of scenic attractiveness on a regional scale, and observations were made regarding potential visual sensitivity in terms of visibility and the likely level of public concern (based on ease of access and evident users). This evaluation resulted in an overall visual quality rating in terms of the existing aesthetic value. Site photographs depicting the existing sites are presented in Appendix B. A summary of the aesthetic value of each of the erosion sites is provided in Table 3-3. This summary is followed by individual descriptions of each erosion repair site.

Table 3-3 Summary of Existing Aesthetic Value at the Erosion Sites

Site Name	Scenic Attractiveness	Landscape Visibility	Concern Level	Existing Aesthetic Value
SAC 8.0L	Low	Moderate	Low	Low
SAC 10.8L	Low	Moderate	Low	Low
SAC 26.0L	Moderate	Moderate	Moderate	Moderate
SAC 35.4L	Low	Moderate	Low	Low
SAC 41.9R	Moderate	High	High	High
SAC 71.3R	Moderate	High	High	High
SAC 87.0L	Low	Low	Low	Low
SAC 130.0L	Low	Moderate	Moderate	Moderate
SAC 136.7R	Low	Moderate	Moderate	Moderate
FR 1.0L	Moderate	Moderate	Low	Moderate
FR 3.7L	Moderate	Moderate	Moderate	Moderate
FR 5.5L	Moderate	Moderate	Low	Moderate
FR 7.0L	Moderate	Moderate	High	Moderate
LAR 10.0L	High	High	High	High

Table 3-3 Summary of Existing Aesthetic Value at the Erosion Sites

Site Name	Scenic Attractiveness	Landscape Visibility	Concern Level	Existing Aesthetic Value
LAR 10.6L	High	High	High	High
CC 2.8L	Moderate	Low	Low	Low
CC 3.4L	Moderate	Low	Low	Low
DC 0.9N	High	Low	Low	Moderate
SBP 0.4E	Moderate	Low	Low	Low
SAC 73.5L	Moderate	High	High	High
SAC 78.8L	Moderate	High	High	High
SAC 93.7L	Low	Low	Low	Low
SAC 114.5R	Moderate	Low	Low	Low
SAC 136.9R	Moderate	Moderate	Moderate	Moderate
SAC 157.7R	Moderate	Moderate	Moderate	Moderate

3.2.1.1. SAC 8.0L

The levee at erosion site SAC 8.0L is located in an agricultural area and is not frequently used by the public. A low-tide beach exists along the length of the site and extends offshore, where tules and other emergent aquatic vegetation are present. The beach is littered with logs, woody material, and trash (e.g., metal, plastic, glass, and tires). Concrete riprap is present along the entire bank. Ruderal vegetation is the dominant vegetation community occurring on the site. Primary views of the site are from Highway 160 on the levee crest and from the opposite bank. Views of this site are limited by the speeds at which motorists travel on Highway 160 and the distance across the river. The erosion site is readily visible from the river; the area is heavily used by anglers and other boaters. Brannan Island State Recreation Area is located approximately 1 mile upstream of this site.

Erosion site SAC 8.0L was determined to have low scenic attractiveness due to the limited riparian vegetation and large amounts of trash and other debris observed on the site. Landscape visibility was rated as moderate because Highway 160 is on the levee crest and receives heavy traffic and because of the site's visibility to boaters. Concern level was rated as low due to the low existing scenic attractiveness and absence of heavy public use of the site. The overall existing aesthetic value at erosion site SAC 8.0L was rated as low.

3.2.1.2. SAC 10.8L

Erosion site SAC 10.8L is located in an agricultural area along Highway 160 and is not frequented by the public. A low-tide beach is present along the northern portion of the site and extends offshore, where tules and other emergent aquatic vegetation are present. The beach contains a significant amount of logs and other woody material. Tree cover is limited. This site is infested with extensive populations of invasive non-native species, including tamarisk (salt cedar) and giant reed (arundo). Views of the erosion site are limited by the speed at which motorists travel along the road. The site can be seen, although not easily, from the shore, along the opposite bank, and by boaters on the river. Boat traffic is relatively infrequent in this area;

fishing traffic may be affected by high winds and little vegetative cover. The site is approximately 0.5 mile north of the Brannan Island State Recreation Area.

The site was rated as low in scenic attractiveness due to the visibility of riprap, lack of vegetative cover, and large amounts of trash. Landscape visibility is moderate as Highway 160 is on the levee crest and receives heavy traffic. Concern level is low due to the absence of any permanent structure in the viewshed. Concern level is low due to the low existing scenic attractiveness and absence of heavy public use of the site. The overall existing aesthetic value at erosion site SAC 10.8L was rated as low.

3.2.1.3. SAC 26.0L

Erosion site SAC 26.0L is located in a primarily agricultural area along the Sacramento River. Views of the site are limited along Isleton Road due to the many trees growing along the riverbank. Two residences are located south of the erosion site; views of the erosion site from these residential locations are obstructed by the intervening levee road. Heavy traffic exists on the opposite bank along Highway 160; views from the opposite bank are limited by the speed of travelers. A wave break is located along the edge of the erosion site at several locations. The Delta communities of Walnut Grove, Locke, and Ryde are located approximately 0.5 mile north of the site.

The site has moderate scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is considered moderate as Highway 160 runs along the levee on the opposite bank and receives heavy traffic. Concern level is moderate due to the presence of residences within the general vicinity of the repair site. The overall existing aesthetic value at erosion site SAC 26.0L was rated as moderate.

3.2.1.4. SAC 35.4L

Erosion site SAC 35.4L is located in an agricultural area and is bordered by a pear orchard. Human activity in the immediate vicinity of the site is minimal and is generally limited to vehicular traffic along the levee road. Some boat traffic is present, and a small community of homes with boat docks is located approximately 0.75 mile downstream from the site. The site is easily viewed from the levee road, the Sacramento River, and South River Road along the opposite bank.

The site has low scenic attractiveness, as ruderal vegetation is the dominant cover on the site. Landscape visibility was rated as moderate because South River Road runs along the levee and receives moderate traffic. Concern level is low due to the general absence of existing scenic attractiveness, absence of residences and other permanent structures with views of the site, and limited public use of the site. The overall existing aesthetic value at erosion site SAC 35.4L was rated as low.

3.2.1.5. SAC 41.9R

Erosion site SAC 41.9R is located in a primarily agricultural area. Residential and commercial uses in the community of Clarksburg are located west of the site. North of the site is

a marina. Boat traffic in the vicinity of SAC 41.9R is high due to the marina; vehicular traffic is moderate along South River Road/Riverview Drive. The site is not easily viewable from South River Road/Riverview Drive due to intervening vegetation and trees, although the site is easily seen by boaters and from the opposite bank of the river along Highway 160.

The site has moderate scenic attractiveness, largely due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is high, given the proximity to the town of Clarksburg. Concern level is high due to the presence of residences and commercial lands uses with views of the site. The overall existing aesthetic value at erosion site SAC 41.9R was rated as high.

3.2.1.6. SAC 71.3R

Erosion site SAC 71.3R is located in a primarily agricultural area with row crops (e.g., tomatoes) and orchards (e.g., walnuts) bordering the site on the opposite side of the levee road. Residences are located along the opposite bank directly across from the site. Light vehicular traffic is present along the levee road. Traffic along I-5 to the south can be heard from the site, as well as aircraft associated with the Sacramento International Airport approximately 2 miles to the east. Boating traffic is moderate, and boat docks are present at the residences along the opposite bank. The site appears to be infrequently used by anglers fishing from the levee.

The site has moderate scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is high, as residences on the opposite bank look directly onto the repair site. Concern level is high due to the moderate scenic attractiveness and presence of residences with views of the site. The overall existing aesthetic value at erosion site SAC 71.3R was rated as high.

3.2.1.7. SAC 87.0L

Erosion site SAC 87.0L is located in an agricultural area; row crops border the site on the opposite side of the levee road. Minimal vegetative cover exists on the site, and vegetation on the levee bank appears to be controlled by burning and discing. Human activity at the site is generally limited to agricultural activity on adjacent lands, vegetation management, and boating activity. Riparian forest is visible on the opposite side of the river from the site.

The site was rated as low for scenic attractiveness because ruderal vegetation is the dominant cover on the site. Landscape visibility was rated as low because no major roads or residences are located near the site. Concern level was rated as low due to the low scenic attractiveness, general absence of human use, and absence of residences and other permanent structures with views of the site. The overall existing aesthetic value at erosion site SAC 87.0L was rated as low.

3.2.1.8. SAC 130.0L

Erosion site SAC 130.0L is located approximately 2 miles south of the town of Meridian, along the left bank of the Sacramento River. The site is located on the outside of a fairly sharp bend in the river. South Meridian Road runs along the crest of the levee, and private residential

driveways connect to South Meridian Road on the levee's landside slope. Surrounding land uses are agricultural. Woody vegetation at the site is limited to two large cottonwoods and a valley oak. Dominant vegetation consists of weedy annual grasses and forbs. Previous revetment of the site has resulted in steep bank slopes into the water, as well as a low percentage of bankline cover and shade. The site is easily visible from the levee road; the view from the adjacent residences is obstructed by the height of the levee road.

The site was rated as low in scenic attractiveness because ruderal vegetation is the dominant cover on the site. Landscape visibility was rated as moderate, given the rural residence located on the landside of the levee repair site. Concern level was rated as moderate due to the presence of rural residences on the opposite side of the levee road. The overall existing aesthetic value at erosion site SAC 130.0L was rated as moderate.

3.2.1.9. SAC 136.7R

SAC 136.7R is located approximately 4 miles southeast of the city of Colusa along the left bank of the Sacramento River. The river course is relatively straight at this location, but the site is part of a broad, gentle river meander bend. A gravel access road runs along the crest of the levee. A rural residence, agricultural outbuildings, and agricultural fields are located adjacent to the site on the opposite side of the levee road. Woody vegetation covers approximately 60 percent of the lower bank; species include box-elder, valley oak, and cottonwood trees. Vegetation along the levee slope is controlled by discing and grazing. Several locked gates have been installed along the levee road, and access to this site is limited. The site is most visible from boats on the river and from the levee road along the opposite bank. A nearby marina to the north provides river access for boaters in this reach of the river.

The site was rated as low in scenic attractiveness because ruderal vegetation is the dominant cover on the site. Landscape visibility is moderate, as rural residences are located on the landside of the levee at the erosion site and on the landside of the levee on the opposite bank. Concern level is moderate due to the presence of residences within the general vicinity of the repair site. The overall existing aesthetic value at erosion site SAC 136.7R was rated as moderate.

3.2.1.10. FR 1.0L

Erosion site FR 1.0L is located approximately 1 mile north of the confluence of the Feather River and the Sacramento River, on the inside of a very gentle bend in the Feather River. The site is characterized by moderately dense riparian vegetation. Woody riparian species include California sycamore, valley oak, interior live oak, Fremont cottonwood, willow, and Oregon ash. Land use in the surrounding area is agricultural; vehicular traffic is limited. The site is subject to moderate human activity from fishing, foot trails, and swimming. A pump station, utility lines, metal pilings, and a metal fish screen are located in the northern portion of the site.

The site was rated as moderate in scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility was rated as moderate because Garden Highway runs along the levee crest. Concern level is low due to the absence of

residences and other permanent structures with views of the site. The overall existing aesthetic value at erosion site FR 1.0L was rated as moderate.

3.2.1.11. FR 3.7L

The primary vegetative cover at erosion site FR 3.7L consists of oak woodland and ruderal cover. Primary views of the site are from Garden Highway, which runs along the levee crest. Human activity at the site is moderate, with footpaths and evidence of fishing along the bank and by boat. A rural farm residence, orchard, and the intersection of Garden Highway and West Catlett Road are located at the northeast end of the site. Traffic activity is low to medium.

The site has moderate scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is moderate, as rural residences are located on the landside of the levee at the erosion site. Concern level is moderate due to the presence of residences within the general vicinity of the repair site. The overall existing aesthetic value at erosion site FR 3.7L was rated as moderate.

3.2.1.12. FR 5.5L

Erosion site FR 5.5L is located approximately 5 miles north of Verona on the left bank of the Feather River, adjacent to Garden Highway. The site is characterized by a discontinuous canopy of riparian forest/scrub with ruderal vegetation throughout. Tree species present include California sycamore, valley oak, and willow. Surrounding land uses are agricultural. Primary views of the site are from Garden Highway, which runs along the levee crest. The intersection of Garden Highway and Worth Road is approximately 500 feet south of the site. Vehicular traffic is light to medium; moderate human activity is evident in terms of fishing, boating, and litter.

The site was rated as moderate in scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is moderate, as Garden Highway runs along the levee crest. Concern level is low due to the absence of residences and other permanent structures with views of the site. The overall existing aesthetic value at erosion site FR 5.5L was rated as moderate.

3.2.1.13. FR 7.0L

Erosion site FR 7.0L is located in an area of moderate recreational use. The site exhibits evidence of recreational use, including swimming and fishing from the bank and boat. The Rio La Paz Golf Club is located on the opposite side of the levee road. Vegetation consists of riparian forest and grassland.

The site was rated as moderate in scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is moderate, as the Rio La Paz Golf Club course is located on the landside of the levee. Concern level was rated as high due to the active public use of the site and the presence of the golf course within the general vicinity of the erosion site. The overall existing aesthetic value at erosion site FR 7.0L was rated as moderate.

3.2.1.14. LAR 10.0L

Erosion site LAR 10.0L is located in the Save the American River Association (SARA) Access Area region of the American River Parkway. Vegetation consists of riparian forest and ruderal cover. A high level of recreational activity occurs at this location, including fishing, swimming, walking, running, and other activities. The area is identified in the American River Parkway Plan as a protected area where the natural characteristics should be retained for the enjoyment of everyone. Public parking access is available. Residential neighborhoods are located along the opposite side of the levee.

The site was rated as high in scenic attractiveness due to the width of the forested riparian corridor. Landscape visibility and concern level are high because the repair site is located within the American River Parkway corridor, which receives many visitors daily and is known for its high scenic quality. The overall existing aesthetic value at erosion site LAR 10.0L was rated as high.

3.2.1.15. LAR 10.6L

Erosion site LAR 10.6L is densely vegetated with riparian vegetation and is located in an area of heavy recreational use. The site is located in the American River Parkway corridor, 0.6 mile upstream from site LAR 10.0L and immediately outside the Sacramento city limits. Recreational uses include fishing, swimming, walking, and biking on the levee. The Larchmont Community Park and residential neighborhoods are located adjacent to the erosion site on the opposite side of the levee. Riffles in this reach of the river and the reach above make this area popular with people using small watercraft like kayaks and rafts. The erosion site is visible only from the levee road and from the river, as the levee obstructs the view from the park and nearby residences.

The site was rated as high in scenic attractiveness due to the width of the forested riparian corridor. Landscape visibility and concern level are high because the repair site is located within the American River Parkway corridor. The overall existing aesthetic value at erosion site LAR 10.6L was rated as high.

3.2.1.16. CC 2.8L

Erosion site CC 2.8L is located in an agricultural area used for orchards. Locked gates have been installed along the levee roads, and human use of the area is limited primarily to agricultural activities. The levee is characterized by steep banks. The vegetation growing on the levee is dominated by annual grass and forbs. A setback levee would be constructed at this location, which would be approximately 150 feet away from the existing levee in an area currently used as an orchard.

The site was rated as moderate in scenic attractiveness due to the established orchard. Landscape visibility is low because no public access is available. Concern level is low due to limited accessibility of the area, the absence of residences and other permanent structures with views of the site, and the extent of surrounding orchards. The overall existing aesthetic value at erosion site CC 2.8L was rated as low.

3.2.1.17. CC 3.4L

Erosion site CC 3.4L is located in an area of agricultural use. Walnut orchards surround the site on both sides of the banks. A setback levee would be constructed at this location, and the portion of walnut orchard within the proposed setback is characterized by mature trees with dense canopy. The creek itself is steeply incised. The creek reaches the Sacramento River only in extremely wet years; at other times, it is often dry except for small pools, which provide aquatic habitat. Human use is generally limited to agricultural activities and use of the levee road by farming equipment.

The site has moderate scenic attractiveness due to the large oaks between the eroding bank and levee crest and the mature walnut orchard. Landscape visibility is low because no public access is available. Concern level is low due to limited accessibility of the area, the absence of residences and other permanent structures with views of the site, and the extent of surrounding orchards. The overall existing aesthetic value at erosion site CC 3.4L was rated as low.

3.2.1.18. DC 0.9N

Erosion site DC 0.9N is located in an area of farming and grazing land. Vegetation on the site consists mostly of riparian forest and pasture dominated by grasses. No levee currently exists at this location. Revetment present on the site was deposited to establish a raised road, which adds approximately 2 feet to the natural creek bank. No public access is available, and human use is generally limited to ranching activity. An agricultural diversion dam is located approximately 0.5 mile downstream of the site.

The stream and riparian corridor were rated high in scenic attractiveness; the pastureland was rated as low. Landscape visibility was rated as low because no public access is available. Concern level is low due to limited accessibility of the area, the absence of residences and other permanent structures with views of the site, and the small area of pasture that would be affected. The overall existing aesthetic value at erosion site DC 0.9N was rated as moderate.

3.2.1.19. SBP 0.4E

Erosion site SBP 0.4E is located in an area of light human use. Evidence of fishing and footpaths are present at the site; the site is not subject to use by boaters. The levee road receives light traffic from agricultural activities. The surrounding agricultural land consists of rice fields and cultivated land.

The site has moderate scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is low because the surrounding roads receive little traffic. Concern level is low due to the absence of residences and other permanent structures with views of the site. The overall existing aesthetic value at erosion site SBP 0.4E was rated as low.

3.2.1.20. SAC 73.5L

Erosion site SAC 73.5L occurs in a primarily agricultural area; however, residences are adjacent to the northeast end of the erosion repair site. Oak woodland and riparian forest provide moderate vegetative cover along the levee. A moderate level of boating activity and fishing occur from boat and shore. Garden Highway runs along the levee crest and receives light to moderate traffic.

The site was rated as moderate in scenic attractiveness due to patches of mature riparian vegetation along the levee slope. Landscape visibility and concern levels were rated as high due to the residence directly adjacent to the north end of the erosion site. The overall existing aesthetic value at erosion site SAC 73.5L was rated as high.

3.2.1.21. SAC 78.8L

Erosion site SAC 78.8L is located in a predominantly agricultural area. The undeveloped portions of the site consist of riparian forest habitat and ruderal vegetation. A mobile home park and a fishing marina resort occur within the site and north of the site, respectively. Boating and fishing activity are moderate. The levee road is Garden Highway, which receives relatively light to moderate traffic.

The site has moderate scenic attractiveness due to patches of mature riparian vegetation along the levee slope. Landscape visibility and concern levels were rated as high due to the presence of a mobile home park and fishing resort/marina just north of the site. The overall existing aesthetic value at erosion site SAC 78.8L was rated as high.

3.2.1.22. SAC 93.7L

Erosion site SAC 93.7L is located in an agricultural landscape. The site consists entirely of ruderal vegetation and barren roads; the opposite bank is heavily vegetated. Boating and shoreline recreation are infrequent.

The site was rated as low in scenic attractiveness because of the ruderal vegetation and barren roads. Landscape visibility is low, as the surrounding roads receive little traffic. Concern level is low due to the low scenic attractiveness and the absence of residences and other permanent structures with views of the site. The overall existing aesthetic value at erosion site SAC 93.7L was rated as low.

3.2.1.23. SAC 114.5R

Erosion site SAC 114.5R is located in a remote agricultural setting, where some recreational use is evident. The site consists of a thin buffer of ash-dominated riparian forest and ruderal vegetation between the levee road and river. A large cottonwood tree has recently slumped into the river. A plowed field and rice field exist on the landside of the levee road, separated by a vegetated irrigation ditch.

The site was rated as moderate in scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is low because the surrounding roads receive little traffic. Concern level is low due to the absence of residences and other permanent structures with views of the site. The overall existing aesthetic value at erosion site SAC 114.5R was rated as low.

3.2.1.24. SAC 136.9R

Erosion site SAC 136.9R is located in an agricultural area with rural housing nearby. Vegetation within the site consists of riparian forest, which provides moderate cover between the levee road and river. Ruderal vegetation occurs on both sides of the levee road. A marina is located to the north on the opposite side of the river, and a pump house is located north of the site. North Meridian Road is located on the opposite levee and receives light vehicle traffic. Boating and fishing activity are light to moderate, with no evidence of fishing from shore at this location.

The site was rated as moderate in scenic attractiveness due to the presence of mature riparian vegetation along the levee slope. Landscape visibility is moderate due to the presence of the marina upstream, North Meridian Road on the opposite levee, and surrounding residences. Concern level was rated as moderate due to the marina north of the repair site. The overall existing aesthetic value at erosion site SAC 136.9R was rated as moderate.

3.2.1.25. SAC 157.7R

Erosion site SAC 157.7R is dominated by large trees and dense ruderal vegetation on the levee slope and crest. A walnut orchard is present on the opposite side of the levee road. Erosion at this site has created steep banks. The dense vegetation and steep banks severely limit access to the river from the levee road. Light traffic occurs along the levee road, and boating activity is generally low. The surrounding area is agricultural, and a gravel bar to the west provides a location for some recreational activity.

The site was rated as moderate in scenic attractiveness due to the presence of patches of mature riparian vegetation along the levee slope. Landscape visibility and concern levels were rated as moderate because some recreational uses were observed in the vicinity. The overall existing aesthetic value at erosion site SAC 157.7R was rated as moderate.

3.2.2. Regulatory Setting

3.2.2.1. Federal and State Laws and Regulations

National and State Wild and Scenic Rivers Acts

The National Wild and Scenic Rivers Act establishes a method for providing federal protection for certain free-flowing rivers to preserve them and their immediate environments for the use and enjoyment of present and future generations. Eligible rivers can be designated as Wild River Areas, Scenic River Areas, or Recreational Rivers. Section 10 of the act includes management direction for these designated rivers. In regard to the designated river, Section

10(a) states that "primary emphasis shall be given to protecting its aesthetic, scenic, historic, archaeologic, and scientific features."

The California Wild and Scenic Rivers Act states that certain rivers that possess extraordinary scenic, recreational, fishery, or wildlife values shall be preserved in their free-flowing state, together with their immediate environments, for the benefit and enjoyment of the people of the state. The California Wild and Scenic Rivers System is similar to the National System. Rivers can be designated as Wild Rivers, Scenic Rivers, or Recreational Rivers. The Act has been amended to provide protection for river segments without formally identifying them as part of the state Wild and Scenic Rivers System. Such protective language for the McCloud River was added to the Act by the 1989 amendment (Section 5093.542), and similar protection was afforded to Deer Creek and Mill Creek in 1995 (Section 5093.70). In contrast to the National System, the State System prohibits state approval or permits for new dams on protected rivers, but the state's authority does not necessarily apply to federal dam projects.

The lower American River from Nimbus Dam to its confluence with the Sacramento River has been designated as a Recreational River under both the National and California Wild and Scenic Rivers Acts. The erosion sites located within the American River Parkway are subject to the conditions of these acts. The National Park Service, working under the United States Department of the Interior, has the jurisdiction for the determination of whether any violations occur. The State of California Natural Resources Agency and Sacramento County are the agencies responsible for managing the lower American River. Preservation of the natural beauty of the American River and surrounding parkway under this act has established a considerable aesthetic resource available for enjoyment by residents and visitors to the Sacramento Region (The Dangermond Group 2000).

California Scenic Highway Program

The California Scenic Highway Program, established in 1963 by the State Legislature, is administered by the California Department of Transportation (Caltrans). The goal of the program is to preserve and protect scenic highway corridors from changes that would degrade the aesthetic quality of lands adjacent to highways. Highway 160 in Sacramento County is designated as a scenic highway from the Contra Costa County line to the south city limit of Sacramento (California Department of Transportation 2007). Erosion sites SAC 8.0L, 10.8L, 26.0L, and 41.9 R are within the viewshed of Scenic Highway 160.

3.2.2.2. Regional and Local Laws and Regulations

At the regional and local levels, aesthetic resource policies provide for the maintenance and protection of significant visual and aesthetic resources that contribute to the identity and character of an area, through sensitive planning and design, maintenance, and code enforcement.

American River Parkway Plan

Aesthetics are an important component of the American River Parkway. A primary goal in the American River Parkway Plan is enhancing scenery and aesthetics. In order to accomplish this goal, impacts (including aesthetics) must be minimized. Policies to prevent loss of aesthetic value include development and implementation of an anticipatory erosion control program based on identifying and treating eroding sites before they become a critical threat to the levee system

and ideally before the riparian corridor is lost. When necessary to prevent such a loss, appropriate erosion control measures must be designed and constructed. Each project must consider the nature of the erosion threat and the most effective method for controlling erosion with the least damage to riparian vegetation, wildlife, and the aesthetics of the final product. Portions of the Parkway may be temporarily closed to certain uses in order to restore habitat values, visual quality, and recreation opportunities, upon assessment that the environmental resources, aesthetics, or recreational setting of the Parkway have become degraded. If artificial lighting is needed after dusk during the construction phase of the erosion control project, it shall be carefully planned to provide essential human safety and security while minimizing impacts to wildlife and night sky aesthetics (Sacramento County 2008).

Colusa County General Plan

Policy OS-13, Community Character, of the Colusa County General Plan establishes the policy that views of regional focal points, such as the Sutter Buttes, the Sacramento River, Snow Mountain, and St. John Mountain should be preserved wherever possible. This policy is consistent with the county's objective to conserve the natural beauty of county rivers, streams, and hillsides (Open Space and Recreation, Objective f) (Colusa County 1989).

Sacramento County General Plan

Sacramento County first adopted a Scenic Highways Element of the Sacramento General Plan in 1974. The primary goal of this element was to "preserve and enhance the aesthetic quality of scenic roads without encouraging unnecessary driving by personal automobile." More recently, Sacramento County adopted a Scenic Highway Element as part of the General Plan in 1993. The purpose of this element is to take initial steps toward protection of the scenic values of routes nominated or designated as State Scenic Highways.

The element identifies the major visual problem associated with the preservation of River Road's scenic qualities as the removal of vegetation that historically took place in conjunction with revetment. Cited in this element is Senate Concurrent Resolution No. 151 of July 10, 1969, with states that "the preservation of natural beauty, shade and wildlife habitat on the levees is important from a recreational and aesthetic viewpoint."

County roads that are protected under scenic corridor designations include the county roads that run on the crowns of the levees along the rivers and sloughs of the Delta, and Garden Highway, which also runs along the crown of the Sacramento River levee, from the Sacramento City limits north to the Placer County line.

In addition, the Sacramento and American Rivers are protected within Sacramento County by scenic corridors that extend 500 feet to each side of the river, as measured from the middle of the channel, or by a minimum corridor 300 feet from the edge of the river (Sacramento County 1993).

Sutter County General Plan

As established in Policy 1.H-2, under Visual and Scenic Resources, Sutter County requires that new development along Highway 20 incorporate design and development standards that protect the views of the Sutter Buttes. (Sutter County 1996)

Tehama County General Plan

Policy OS-11, in the Aesthetic and Visual Resources section of the Tehama County General Plan, establishes a policy to protect the visual integrity of scenic viewsheds, such as the Sacramento River, Coast Ranges, Mt. Shasta, and Mt. Lassen along the county-designated scenic highways. The goal of the General Plan concerning aesthetic and visual resources is to preserve the aesthetic and scenic beauty of Tehama County (Tehama County 2008).

Yolo County General Plan

Policy OS 9, Scenic Areas, of the current Yolo County General Plan establishes a policy to maintain scenic highways and waterways or riverbank corridor areas of scenic value as part of the county's open space preservation program. It is a stated goal of the general plan to encourage "landscaping to enhance the community and preservation of rural scenery" (GPG 25) (Yolo County 1983).

3.2.3. Environmental Effects

The existing visual quality characteristics and ratings for the 25 sites were compared to the anticipated changes in the visual character for the purpose of evaluating the potential impacts to visual resources associated with the proposed erosion repairs. An impact to aesthetic resources was identified when changes in viewer response would likely occur as a direct or indirect result of project implementation, including both construction and operation.

Impacts would be considered significant under CEQA if the project would:

- Have a substantial adverse effect on a scenic vista;
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- Substantially degrade the existing visual character or quality of the site and its surroundings; or
- Create a new source of light or glare that would adversely affect day or nighttime views of the area.

3.2.3.1. No-Action Alternative

Under the no-action alternative, no activities would be conducted to halt erosion at the 25 erosion sites. Aesthetic resources associated with the existing levees would remain unchanged for the immediate future. Over time, wave wash, flood flows, and human disturbance would contribute to continued erosion and risk of levee failure. Given the extent of existing erosion, it is likely that the erosion would increase in severity to the point that pre-failure emergency repairs would be warranted or the levee would fail, resulting in flooding, greatly accelerated erosion, and the need for post-failure emergency repairs. Either of these outcomes would likely result in potentially significant impacts to the existing aesthetic values, as well as other resources.

When pre-failure emergency repairs are required, failure of the levee is imminent and little to no opportunity is available to incorporate measures into the project design that would minimize impacts to aesthetic resources. Additionally, if the erosion has been allowed to occur

and continue, larger disturbance areas would need to be treated to repair the levee, resulting in a larger footprint of impact.

Similarly, if post-failure emergency repairs are required, they would be unlikely to incorporate measures to protect aesthetic values into the project design. The required post-failure emergency repairs could have a significantly larger footprint given the damage to the levee incurred as a result of the failure. Levee failure and resultant flooding would result in at least temporary impacts to existing aesthetic resources on the levees (e.g., loss of trees from accelerated erosion) and degradation of the visual character and quality of the flooded areas.

3.2.3.2. Alternative 1: Proposed Action

The existing aesthetic resources at the 25 erosion sites range from low to high in scenic attractiveness, landscape visibility, concern level, and overall aesthetic value. Extensive mature riparian vegetation communities, fish and wildlife resources, recreational opportunities, and frequent or prolonged views are characteristic of the sites with high scenic value. Other erosion repair sites consist entirely of barren ground and ruderal vegetation (e.g., SAC 93.7L) or have concrete riprap along the entire bank (e.g., SAC 8.0L). Other sites are within established parks and have wide riparian corridors with dense vegetation between the levee toe and crest (e.g., LAR 10.0L, LAR 10.6L). Public accessibility to areas within the viewshed of the erosion sites and the duration of public viewing determine landscape visibility. Many of the sites are accessible and/or viewable by motorists, residents, recreationists, and other members of the public, while a few sites are in areas where there is no public access.

The series of photographs presented in Figures 2-5, 2-6, and 2-7 depict the erosion site repair process; these photographs are also useful representations of the visual effects of construction activities and the appearance of the completed and revegetated levee. The levee repairs would require heavy equipment, construction crews, and materials to be onsite for the duration of construction (approximately 120 days). Construction activities would be visible at most erosion sites by boaters, anglers, recreationists, nearby residents, and other individuals, including motorists on adjacent roads in some cases.

Riparian vegetation communities along the levee slopes are the primary component of the existing aesthetic resources present at the erosion sites. Under the proposed action, trees greater than 4 inches dbh would be retained unless they posed a safety hazard. All other vegetation would be cleared. Rock and soil would be deposited on the sites above the waterline, IWM would be replaced or enhanced, and the levee slopes would be replanted with native vegetation (see Figures 2-5, 2-6, and 2-7). These design elements would create a more uniform appearance in the repaired areas; this is not considered a significant effect because the levees are already a built element in the landscape. Implementation of the design features would largely preserve or enhance the long-term aesthetic value of the levee landscapes, while accomplishing the levee repairs necessary for flood protection.

Impact AES1: Temporary Changes in Visual Resources During Construction
Project activities would temporarily reduce the aesthetic qualities of the erosion sites by introducing barges, cranes, backhoes, and other construction equipment, materials, and work crews into the viewsheds of boaters, recreationists, motorists, residents, and other

people in the vicinity of the erosion sites. Construction at sites SAC 8.0L, SAC 10.8L, SAC 26.0L, and SAC 41.9R would be visible from Scenic Highway 160. At most of the erosion sites, the construction areas would be distant from and/or screened from most viewers. Construction equipment at the erosion sites would be visible until the repairs were completed (approximately 120 days). Given the short-term and temporary nature of the construction activities and the presence of construction equipment, the impact on the visual quality of the erosion sites is considered to be less than significant. No mitigation is required.

Impact AES2: Long-Term Changes in Visual Resources From Levee Repairs
The aesthetic value of the levee and river landscapes that contain the erosion sites is derived primarily from the presence of the waterway and associated riparian vegetation. Riparian vegetation is absent from some of the erosion sites, while other sites are characterized by dense riparian forest. The proposed action would not result in the removal of native trees greater than 4 inches dbh unless removal is required for safety reasons. The remaining vegetation would be removed from the sites and revetment (i.e., quarry stone) would be placed on the levee slope to provide bank protection and prevent continuing erosion. Soil-filled quarry stone would be placed over the revetment and planted with native riparian vegetation. For sites with low existing aesthetic value and a prevalence of non-native vegetation, the levee repairs would substantially improve the visual resources. While the new construction would be evident until the vegetation was re-established, the effect would not be significant. Given the elements involving retention of native tree resources and planting of native riparian vegetation that are incorporated into the proposed action, the impacts to aesthetic resources are considered to be less than significant. No mitigation is required.

3.2.3.3. Alternative 2: Thin Rock Armor

Under this alternative, the majority of vegetation would be cleared from the levee work sites in order to install a thin layer of rock armor over the existing levee slope. Opportunities to incorporate the planting of native riparian vegetation would be limited. After completion of the levee repair, the sites would be generally barren of vegetation. Over time, some vegetative cover could become established on the erosion sites, but it would likely be sparse and consist of a dominance of non-native weedy species. The existing aesthetic value of levee and river landscapes that contain the erosion repair sites is due primarily to the presence of native riparian vegetation. The removal of vegetation from the erosion sites and replacement with a thin layer of rock armor would result in a substantial reduction of the visual character and quality for most of the erosion sites.

3.2.4. Mitigation

Implementation of the proposed action would not result in significant impacts to aesthetic resources. No mitigation is required.

3.3. Recreation

3.3.1. Existing Conditions

Many different recreational activities take place on the Sacramento River, Feather River, American River, Cache Creek, Deer Creek, and the Sutter Bypass. Typical water-based activities include fishing, rafting, sailing, boat cruising, operating personal watercraft, canoeing, kayaking, houseboating, and swimming. Common terrestrial recreation activities near these waterbodies include hiking, picnicking, horseback riding, walking for pleasure, running, bicycling, viewing and photographing wildlife, bird watching, and sightseeing.

Observed recreational uses in the vicinity of the 25 erosion sites are shown in Table 3-4.

Table 3-4 Recreational Uses

Erosion Site	Recreational Use
SAC 8.0L	Moderate use for boating and fishing (not from shore).
SAC 10.8L	Low use for boating and fishing.
SAC 26.0L	Low use for boating and fishing from the river.
SAC 35.4L	Low use for boating.
SAC 41.9R	High use for boating and shore fishing. Marinas located nearby contribute to high boat activity.
SAC 71.3R	Moderate use for boating/fishing on the river and low use for fishing from shore. Individual boat docks are located across the river from the site.
SAC 87.0L	Low use for boating.
SAC 130.0L	Low use for boating.
SAC 136.7R	Low use for boating.
FR 1.0L	Moderate use for fishing and swimming. Some footpaths along levee.
FR 3.7L	Low use for boating, fishing and walking.
FR 5.5L	Moderate use for fishing. Low use for boating.
FR 7.0L	Moderate use for swimming (nearby rope swing) and fishing. Low use for boating. Located near the Rio La Paz Golf Club.

Table 3-4 Recreational Uses

Erosion Site	Recreational Use
LAR 10.0L	High use for fishing, swimming, walking and running. Bike paths are found along the river above the levee. Site is located in the Watt Avenue area of the American River Parkway, which is very popular for fishing, biking, hiking, and equestrian use. There are nearby facilities for car-top and trailer boat launching. Due to the nearby riffles, it is highly used as a rafting spot. Residential area is located on opposite site of levee and street.
LAR 10.6L	Moderate use for fishing, swimming, and walking on the levee. Located near a park and residential area. This area is in a protected zone that is designated not to include any additional recreational development. Current activities include hiking, biking, rafting, boating, fishing, and equestrian use.
CC 2.8L	The site is located on private land with no public access. Recreation opportunities are generally limited to property owners.
CC 3.4L	The site is located on private land with no public access. Recreation opportunities are generally limited to property owners.
DC 0.9N	Low, if any, recreation use for swimming. Low (daily) use of all-terrain vehicles (ATVs) by farmers and ranchers. Special fishing regulations are in effect for Deer Creek below the USGS gaging station. Catch and release fishing is allowed only from June 16 through September 30. The site is located on private land with no public access.
SBP 0.4E	Light to moderate use for fishing and walking along footpaths. No boating.
SAC 73.5L	Moderate use for boating and fishing, including fishing from shore.
SAC 78.8L	Moderate use for boating and fishing.
SAC 93.7L	Low use for boating and shoreline recreation.
SAC 114.5R	Low use for boating.
SAC 136.9R	Moderate use for boating and fishing.
SAC 157.7R	Low use for boating.

3.3.2. Regulatory Setting

3.3.2.1. Federal and State Laws and Regulations

National and State Wild and Scenic Rivers Acts

The lower American River has been designated as a Recreational River under both the federal and state Wild and Scenic Rivers Acts (see section 3.2.2.1). The erosion sites located in the American River Parkway are subject to these acts, which protect recreational use.

3.3.2.2. Local Laws and Regulations

American River Parkway Plan

The American River Parkway Plan strives to preserve, protect, and improve the recreational resources of the parkway. The parkway is oriented toward passive, unstructured water-enhanced recreation activities. The plan encourages the proactive management of erosion sites to protect recreational resources. Policy 3.14 states: "Portions of the Parkway may be temporarily closed to certain uses in order to restore habitat values, visual quality, and recreation opportunities, upon assessment that the environmental resources, aesthetics, or recreational setting of the Parkway have become degraded" (Sacramento County 2008).

Colusa County General Plan

Objectives "a" and "g" under the Open Space and Recreation Goal of the Colusa County General Plan are to preserve and promote the Sacramento River as a recreational asset and to maintain expansive open spaces, uninterrupted by urban development, both on the valley floor and in upland valleys (Colusa County 1989).

Sacramento County General Plan

Policy CO-77 of the Conservation element of the Sacramento County General Plan states that the county will encourage habitat restoration and increasing recreational opportunities as an integral part of stabilization efforts (Sacramento County 1993).

Sutter County General Plan

Goal 5.A of the Recreation and Cultural Resources element of the Sutter County General Plan Policy Document is to provide adequate park and open space areas for passive and active recreational, social, educational, and cultural opportunities (Sutter County 1996).

Tehama County General Plan

It is a stated goal in the Tehama County General Plan to promote outdoor recreational opportunities, such as agri-tourism, nature-tourism, and environmental learning tourism and to protect reasonable access to resource land areas (Policy OS-9.2 and 9.4) (Tehama County 2008).

Yolo County General Plan

A fundamental goal of the Yolo County General Plan (GPG 4) is to provide recreational opportunities (Yolo County 1983).

3.3.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Impacts are considered significant under CEQA if the project would:

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated;
- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment;
- Result in a substantial loss of recreational opportunities; or
- Substantially increase the risk of injury to the public on, or adjacent to, the proposed repair sites.

3.3.3.1. No-Action Alternative

Under the no-action alternative, no action to halt erosion would be taken at the 25 erosion sites. The erosion sites and recreational uses would remain unchanged from current conditions for the immediate future. The erosion sites would be subject to continued erosion and risk of levee failure. Failure of the levee at an erosion site would result in potentially significant impacts to recreational resources and public safety.

3.3.3.2. Alternative 1: Proposed Action

As shown in Table 3-4, there is significant variability in the intensity and types of recreational uses at the 25 erosion sites. Some of the erosion sites are not open to the public and receive little to no recreational use (e.g., CC 2.8L, CC 3.4L). Other sites are located in very popular recreational areas and receive intensive use (e.g., LAR 10.0L, LAR 10.6L). The range of recreational uses at the erosion sites and adjacent areas includes fishing, swimming, boating, rafting, kayaking, hiking, biking, running, photography, bird watching, and other outdoor activities. Boating and fishing are among the most popular recreational uses in the vicinity of the erosion sites.

During construction of the levee repairs, the erosion sites and adjacent areas (approximately 100-foot radius) would be closed to public access. On sites where construction access is from the waterside of the levee, barges and tugboats would occupy approximately 200 linear feet of the river channel. Detours, alternate routes, and limited passage would be implemented as necessary. This would result in the short-term loss of recreational opportunities.

The recreational opportunities that exist at the erosion sites and the corresponding recreational uses are largely driven by the scenic value of riparian vegetation communities and the existing resources for fish and wildlife (e.g., riparian forest, IWM structure for fish). The proposed action would not result in the removal of native trees greater than 4 inches dbh unless required for safety reasons. The proposed action incorporates the installation of IWM to replace or enhance existing structure for fish and the planting of native riparian vegetation. These

actions are designed to retain and/or enhance the natural qualities of the erosion sites, while providing the required erosion protection. The long-term result would be the preservation and/or enhancement of recreational opportunities at or near the erosion sites.

When construction activities are conducted in areas subject to recreational use, public safety is always a primary concern. Given that the proposed action involves the placement of materials (e.g., rock, IWM) that may alter water depths and/or may be submerged, ensuring that users of the waterways are not subject to increased aquatic safety hazards is also a primary concern.

Potentially significant impacts resulting from implementation of the proposed action and the required mitigation measures are identified below.

Impact REC1: Temporary Loss of Recreational Opportunities during Construction
Construction activities would result in the short-term loss of recreational opportunities available at the erosion sites. Recreational use of the erosion sites and adjacent areas (approximately 100-foot radius) would be prohibited throughout the duration of project construction (approximately 120 days). Given the prevalence of recreational opportunities available in the project region, the temporary loss of recreational opportunities at the erosion sites during project construction is not considered to be a significant impact. However, some of the erosion sites are regularly used for recreational purposes and the lack of proper notification for limited recreational access could result in potentially significant impacts. Implementation of Mitigation Measure REC1 would reduce potential impacts to a less-than-significant level.

Impact REC2: Long-Term Changes in Recreational Opportunities
The recreational opportunities present within and near the erosion sites are highly influenced by the visual resources present and the accessibility of the site. Implementation of the proposed action would not result in significantly reduced accessibility to recreational opportunities compared to existing conditions. The proposed action includes the retention of native trees greater than 4 inches dbh (unless removal is required for safety reasons), installation of IWM to replace and enhance aquatic structure for fish species, and the planting of native riparian vegetation to replace vegetation removed and enhance the aesthetic appeal of the site after repairs are completed. Although the proposed action would result in a short-term loss of recreational opportunities, no long-term loss of recreational opportunities is anticipated. Impacts are considered to be less than significant, and no mitigation is required.

Impact REC3: Public Safety Hazards to Recreational Users
The proposed action includes the installation of IWM within the flowing channel of the erosion sites. The presence of IWM can present a potential hazard to swimmers, boaters, and other users of areas near the riverbank. Implementation of Mitigation Measure REC2 would reduce potential impacts to a less-than-significant level.

3.3.3.3. Alternative 2: Thin Rock Armor

This alternative proposes to place a thin layer of rock revetment over the existing, eroded levee face to a height sufficient to preclude further erosion. During construction activities, site access would be eliminated and detours on local trails may be required. It is unlikely that these temporary activities would negatively affect the recreational carrying capacity of the surrounding areas.

Covering the erosion sites in rock revetment would temporarily fix the erosion problems, but would not address issues associated with slope stability. Access to recreational users would possibly be limited by their ability to safely access the sites. Furthermore, the barren landscape that would result from revetment activities may not be as aesthetically pleasing to potential recreationists. As a result, it is possible that fewer people would use the sites.

3.3.4. Mitigation

Implementation of the following mitigation measures would reduce potential impacts from the proposed action to a less-than-significant level.

Mitigation Measure REC1: Temporary Loss of Recreational Opportunities during Construction

a. Signage and/or buoys shall be provided at each of the erosion sites to warn of the potential hazards during construction. Construction personnel shall warn the public (e.g., boaters, recreationists) to stay away if they approach within 100 feet of construction equipment (e.g., barges, cranes).

b. Where construction zones encompass recognized recreational trails, alternate routes and detours shall be imposed. Signage shall be placed around the construction areas to identify the closed areas and alternate routes.

Mitigation Measure REC2: Public Safety Hazards to Recreational Users

a. The design of the restored levees shall ensure local approach visibility for recreational boaters through the use of natural indicators, such as highly visible emergent portions of IWM and vegetation on the low-elevation areas, to act as visual warning of the presence of shallowly submerged hardscape. IWM shall be oriented in a downstream direction to reduce potential straining effects on river users and the subsequent danger of entrapment.

3.4. Cultural Resources

Archaeological sites, historic buildings and structures, landscapes, and objects are the fabric of our shared human and national heritage. Collectively known as cultural resources (or sometimes heritage assets), they are our tangible links with the past. Cultural resources that retain significance under state and federal law such as CEQA and the National Historic Preservation Act (NHPA) are considered *historical resources* (CEQA) or *historic properties*

(NHPA). This section describes the cultural (historical, archaeological, and paleontological) resources present, or potentially present, on the 25 erosion sites.

To determine if prehistoric or historic cultural resources have previously been recorded within a 0.5-mile radius around each of the 25 erosion sites, cultural resources literature searches were performed by SWCA Environmental Consultants (SWCA) in August 2008 and North State Resources, Inc., in October and December 2008 and January 2009 at the appropriate California Historical Resources Information System (CHRIS) center. In addition, the terrestrial portions of each erosion site were investigated by SWCA archaeologists through intensive-level pedestrian surveys during August 2008 and by North State Resources, Inc. archaeologists in October 2008. Finally, submerged portions of sites SAC 8.0L, SAC 26.0L, SAC 41.9L, and SAC 130.0L (i.e., those portions inundated by the Sacramento River) were investigated in late January and early February 2009 by Panamerican Consultants, Inc. as part of the inventory effort.

3.4.1. Environmental Setting

3.4.1.1. Prehistoric, Ethnographic, and Historic Context

Human occupation of the Sacramento Valley and Sacramento–San Joaquin Delta is believed to have occurred as early as 12,000 years ago. However, it is likely that alluvial deposits of recent origin have buried many prehistoric sites in this area. Experts have estimated that as much as 33 feet of sediment have accumulated along the lower stretch of the Sacramento River drainage system during the last 5,000 to 6,000 years (Moratto 1984).

The erosion sites lie within a region historically occupied by five Native American groups (Kroeber 1925, Levy 1978, Goldschmidt 1978, J. Johnson 1978, P. Johnson 1978, Wilson and Towne 1978). These groups include the Yahi, a subgroup of the Yana, who occupied the foothills east of the Sacramento River, particularly the watersheds of Mill Creek, Deer Creek, and the upper reaches of Pine and Rock creeks; the River Nomlaki who occupied both banks of the Sacramento River from Cottonwood Creek in present-day Tehama County south to Toomes Creek; the River Patwin who occupied the lower western half of the Sacramento Valley west of the Sacramento River from Princeton in the north to near the confluence of the Sacramento and Feather rivers on the south (Kroeber 1932); the Nisenan Maidu (Southern Maidu) who occupied a territory along the lower Feather River, the eastern bank of the Sacramento River between Sacramento and Marysville, and east along the American and Cosumnes rivers; and the Plains Miwok, a subgroup of the Eastern Miwok, who occupied the Delta area south of Sacramento.

Yahi villages were usually placed along the major tributary streams such as Deer Creek that feed into the Sacramento River. Villages were typically placed near the canyon mouths at the sharp demarcation between the valley and foothills that is easily seen on the eastern side of the Sacramento Valley; however, smaller villages or temporary camps were found along the waterways in the valley and along the Sacramento River itself. The Nomlaki generally placed their villages on ridges and high spots near major waterways, including major tributaries to the Sacramento River, whereas River Patwin villages were usually established along the natural levee of the Sacramento River. The Valley Nisenan generally constructed semi-permanent settlements or winter villages on low, natural rises along streams and rivers, including the American, Feather, and Sacramento rivers. Permanent settlements of the Plains Miwok were

located on high ridges or knolls near watercourses, including the Sacramento River, or on the sandy islands in the Delta.

A wide variety of tools, implements, and enclosures were used to hunt, collect, and process natural resources, including bows and arrows, spears, traps, slings, blinds, bone harpoons, hooks, nets, and weirs. Woven tools, such as seed beaters, burden baskets, ropes, and carrying nets, as well as sharpened digging sticks were used to collect plant resources. For processing food, a variety of tools were used, including bedrock mortars, portable mortars (predominantly basket hopper mortars) and pestles, stone knives, mussel shell knives, stone scrapers, and a variety of bone tools.

Early historic contact between the Sacramento Valley Native Americans and Euro-Americans came with the occasional expeditions of the Spanish and later Mexican governments into the valley in search of escaped neophytes (baptized Indians) from the missions or new peoples to convert. In general, the Spanish influence in California was confined to the coastal area from present-day San Francisco in the north to present-day San Diego in the south; however, ripples of contact were felt into the interior valleys including the Central Valley (Lightfoot 2005). The founding of Mission San José in 1797 began a period of initial or indirect contact with the inland tribal groups east and north of the Bay Area, including the Southern Patwin, Plains Miwok, and possibly the Nisenan and River Patwin around present-day Sacramento.

The earliest recorded contact with the River Patwin and Nisenan occurred in 1808 when Gabriel Moraga traveled through Nisenan territory, and in 1821 when Luis Arguello and a small military expedition moved through the Sacramento Valley following the western bank of the Sacramento River (Wilson and Towne 1978, White 2005). In the early 19th century, the Hudson's Bay Company's Southern Brigade trappers and traders led by Alexander Roderick McLeod, John Work, Michael La Framboise, Thomas Mckay, Peter Skene Ogden and others worked their way from Fort Vancouver in Washington State down through much of northern California (Mackie 1997). Between 1826 and 1845, 12 Hudson's Bay Company expeditions trapped in the watersheds of the Sacramento, Pit, and Feather rivers, and in the delta of the Sacramento and San Joaquin rivers (Mackie 1997).

In an effort to increase control over its territory, the Mexican government began granting large tracts of land to foreigners who naturalized and became Mexican citizens. The earliest such grantee in the Sacramento Valley was John Sutter who, in 1839, settled in the area that is present-day Sacramento. He became a naturalized Mexican citizen in 1840, and in 1841 he was granted 43,466.3 acres from the Mexican government for Rancho New Helvetia (Street 2004).

Largely as a result of the Gold Rush, California became the 31st state in 1850. By 1853, the population of the state exceeded 300,000, and in 1854 Sacramento became the state capital. Sacramento, Sutter, Yolo, and Colusa counties were each one of the original 27 counties created when California achieved statehood. Tehama County was formed in 1856 from portions of Colusa, Butte, and Shasta counties (Gudde 1998; Hoover et al. 2002 as cited in Martinez and Arrington 2008).

The Gold Rush promoted the growth of settlement and economic development of the region, with the river systems, particularly the Sacramento River, a main route for supplies. Today's city of Sacramento, for example, served as a river transportation hub and had 12 stage lines by 1853. Sacramento was also the westernmost point of the Pony Express and the terminus of the first California railroad (Beck and Haase 1974 as cited in Martinez and Arrington 2008).

Navigation and transportation of cargo, people, and produce on the Sacramento and Feather rivers and in the Delta have been intertwined with reclamation efforts and agricultural production. Travel on the rivers during the Spanish Era was primarily exploratory in nature. During the Mexican Era, the interior valley became parceled out in large land grants, often to naturalized citizens of American or other European origin as an attempt by the Mexican government to maintain control of Alta California and prevent the incursion of the Americans and Russians. The founding of New Helvetia at present-day Sacramento, which served as a hub of activities in the Sacramento Valley and Sierra Nevada, began the era of regular river travel.

With the advent of the Gold Rush, movement of people into California became a flood and all manner of ships were found traveling the rivers, delivering supplies and people to points further and further up river. The demands of the mining and agricultural industries on California's streams and rivers caused a massive re-working of the entire water system. Mining activities moved and re-routed stream channels, caused severe changes in water flow, and deposited massive amounts of debris into the water system of California. The debris deposition was so severe it raised the Sacramento riverbed 6.5 feet between 1849 and 1888 (Mitchell 1994).

With the need for supplies in the mines came the beginnings of intensive agriculture in California. Many settlers, after a brief stay in the mines, returned to agricultural pursuits with which they were familiar. Farms were located near water sources, in particular along the perennial waterways such as the Feather, American, and Sacramento rivers.

To move the produce grown at these farms, small and large landings were built by the landowners along the riverbanks for ease of shipping. The small landings were ephemeral in nature and not built to handle large amounts of traffic; however, the larger landings were built to be ports of traffic and were often more substantial (California State Lands Commission 1988). These large landings were most often located at major towns along the river (California State Lands Commission 1988). By the early 20th century, river travel became less a means of cargo transport and more a recreational pursuit. The railroad and the automobile provided a quicker, cheaper, and often more reliable means to move produce to markets.

Early levee construction focused on the American and Sacramento rivers near the Sacramento business district and the delta. In 1850, following flooding in the city of Sacramento, an earthen berm ranging in height from 3 to 5 feet was constructed along the Sacramento River from near today's William Land Park in Sacramento to the river's confluence with the American River (Marschner 2001 as cited in Martinez and Arrington 2008). In the roughly 15 years that followed, several subsequent flooding events resulted in periods of levee construction. Between 1864 and 1868, the last 2 miles of the American River was channelized.

Agriculturalists, cities, and others involved river transportation and travel protested against the unrestrained deposition of debris by the mining companies and pursued legal

solutions, leading to the passing of the 1893 Caminetti Act which, among other things, created the California Debris Commission (Mitchell 1994). The Commission, composed of three Army Corps engineers, was tasked with finding a way to resume mining without the debris passing into the water system. In 1910, the Commission initiated a dredging plan, the Minor Project, to clean out the lower Sacramento River in an effort to restore shipping lanes and reduce flooding, and in 1911, the Commission submitted a flood control plan, the Major Project, to Congress (Lund et al. 2007). The Major Project plan proposed bypasses, channel dredging, and levee specifications that eventually became the basis for the system of bypasses and levees in place today (Lund et al. 2007). This also initiated the cooperation of the federal and state government on flood control and reclamation projects in California.

3.4.1.2. Current Setting

The erosion sites are located in the Great Valley geologic province (U.S. Forest Service 1997a) along the banks of the Sacramento and Feather rivers between Princeton in Colusa County on the north and Emmaton, in Sacramento County on the south, as well as Cache Creek in Yolo County, Deer Creek in Tehama County, and the Sutter Bypass in Sutter County. The Central Valley has undergone drastic environmental changes in the past 170 years, including the alteration and channelization of rivers and waterways, dramatic changes to plant regimes, and removal or alteration of animal habitat. The plant communities within the erosion sites include a mixture of native and non-native plants, including the Fremont cottonwood series, emergent aquatic communities along streams, and needlegrass grasslands on levees and floodplains (U.S. Forest Service 1997b).

Geologically, the erosion sites lie in the broad alluvial plains and on natural levees adjacent to the rivers and drainages. The topography of the erosion sites is generally level, with elevations ranging from approximately 0 to 260 feet above mean sea level. The general climate of the area is categorized as Mediterranean, with hot, dry summers and mild winters (U.S. Forest Service 1997a). Average air temperatures range from a January low of 36º F to an average July high of 98º F. Average annual precipitation is approximately 17 inches, with most precipitation falling between November 1 and April 30 as rain (Western Regional Climate Center 2008).

The land surrounding the erosion sites is currently used for agricultural crops, livestock grazing, open space, and residential and commercial developments.

3.4.1.3. Federal and State Laws and Regulations

Historic Sites Act of 1935

Under the Historic Sites Act of 1935 (16 USC 461 et seq.), Congress established a national policy to preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States. This act authorized the Historic American Building Survey (HABS), the Historic American Engineering Record (HAER), the National Survey of Historic Sites, the establishment of National Historic Sites, and the designation of National Historic Landmarks. The act also authorized interagency, intergovernmental, and interdisciplinary efforts for the preservation of cultural resources. Implementing regulations of the act are found in 36 CFR Part 60 series.

National Historic Preservation Act of 1966

The National Historic Preservation Act (NHPA) (16 USC 470 et seq.) created the National Register of Historic Places (NRHP), which includes cultural resources of national, state, and local significance. The act established a system for state historic preservation programs under State Historic Preservation Offices (SHPO). The act also established the Advisory Council on Historic Preservation, an independent agency which is responsible for implementing Section 106 of NHPA through the development of procedures to protect cultural properties included in, or eligible for inclusion in, the NRHP. Regulations are published in 36 CFR Part 60 and 63, and 36 CFR Part 800.

National Environmental Policy Act of 1969

NEPA mandates the protection of cultural resources within its general policy for environmental protection. It requires the preservation of important historic, cultural, and natural aspects of our national heritage, and the maintenance, wherever possible, of an environment that supports diversity and a variety of individual choice. Regulations promulgated by the Advisory Council on Historic Preservation provide for the coordination of NEPA and NHPA compliance, under 36 CFR Part 800.14(a). Regulations for implementing the procedural provisions of NEPA are available at 40 CFR Part 1500-1508.

Executive Order 11593

Executive Order 11593 (Protection and Enhancement of the Cultural Environment, May 13, 1971) (16 USC 470) outlines federal procedures for protecting cultural resources under federal ownership and provides direction on the process by which eligible properties are nominated to the NRHP. Under Section 1(3), the lead federal agency is required to contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural, or archaeological significance. This order strengthened Section 106 of the NHPA by extending the requirements of the law to protect eligible and potentially eligible NRHP properties. (Rules and regulations concerning this order are found in 36 CFR Part 60 and 63, and 36 CFR Part 800.)

Historical and Archaeological Data Preservation Act of 1974

The Historical and Archaeological Data Preservation Act of 1974 (16 USC 469 et seq.), also called the Moss-Bennett Act, provides for the preservation of historic American sites, buildings, objects, and antiquities of national significance, and for other purposes by specifically providing for the preservation of historical and archaeological data (including relics and specimens) which may otherwise be irreparably lost or destroyed as a result of any alteration of the terrain caused by any federal construction project or federally licensed activity or program. It requires the federal agency to notify the Secretary of the Interior if a project threatens the loss or destruction of significant historic or archaeological data. The lead federal agency's Section 106 compliance process provides substantially the same protection.

American Indian Religious Freedom Act of 1978

The American Indian Religious Freedom Act of 1978 (42 USC 1996) states it shall be the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian,

Eskimo, Aleut, and Native Hawaiians, including access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

Archaeological Resources Protection Act of 1979

The purpose of the Archaeological Resources Protection Act of 1979 (16 USC 470aa et seq.) is to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data that were obtained before October 31, 1979. Under this act, no person may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands or Indian lands unless such activity is pursuant to an exemption contained in, or a permit issued under or referred to in, Section 4 of the Act.

Abandoned Shipwreck Act of 1987

The Abandoned Shipwreck Act of 1987 (Pub.L. 100-298; 43 USC 2101-2106) declares that states have the responsibility for management of a broad range of living and non-living resources in state waters and submerged lands; included in the range of resources are certain abandoned shipwrecks that have been deserted and to which the owner has relinquished ownership rights with no retention.

Native American Graves Protection and Repatriation Act of 1990

The 1990 law known as the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 USC 3001 et seq.) requires federal agencies and museums receiving federal funds to inventory and repatriate human remains and associated funerary objects, including items of cultural patrimony. The agencies and museums must offer to return these remains and objects to the Native American groups who are judged to be the most likely descendants or most closely culturally affiliated. The law also protects Native American graves and other cultural items located within archeological sites on federal and tribal land.

36 CFR Part 800 Protection of Historic Properties

Implementing Regulations for Section 106 of the National Historic Preservation Act

As directed by the NHPA, particularly Section 106, the implementing regulations direct all federal agencies to take into account the effects of the agency's undertakings on NRHP listed or eligible properties, and to coordinate compliance efforts. Federal agencies must follow the process described in this set of regulations. Compliance with the regulations that implement Section 106 is commonly referred to as the “106 Process.” Section 106 requires the lead federal agency to “take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register,” and afford the Advisory Council on Historic Preservation “a reasonable opportunity to comment with regard to such undertaking.” Included in the regulations are methods federal agencies can use to coordinate the compliance requirements of NEPA, NHPA, and other federal historic preservation laws.

36 CFR Part 63 and 36 CFR Part 60

Implementing Regulations National Register of Historic Places Determinations of Eligibility National Historic Preservation Act

Federal agencies use the procedures established by implementing regulations to identify and evaluate cultural resources, and to determine their eligibility for inclusion in the NRHP, in accordance with 36 CFR Part 800.

California Environmental Quality Act of 1970

CEQA (Public Resources Code Section 21000 et seq.) declares that it is state policy to "take all action necessary to provide the people of this state with...historic environmental qualities." It further states that public or private projects financed or approved by the state are subject to environmental review by the state. All such projects, unless entitled to an exemption, may proceed only after this requirement has been satisfied. CEQA requires detailed studies that analyze the environmental effects of a proposed project. In the event that a project is determined to have a potential significant environmental effect, the act requires that alternative plans and mitigation measures be considered. CEQA includes historic and archaeological resources as integral features of the environment.

California Register of Historical Resources

California Public Resources Code Section 5024.1 establishes the California Register of Historical Resources (CRHR). The register is a listing of all properties considered to be significant historical resources in the state. The CRHR includes all properties listed or determined eligible for listing for the NRHP, including properties evaluated under Section 106, and State Historical Landmarks from No. 770 on. The criteria for listing are essentially the same as those of the NRHP. The CRHR statute specifically provides that historical resources listed or determined eligible for listing on the CRHR by the State Historical Resources Commission, or resources that meet the CRHR criteria, are resources that must be given consideration under CEQA. Other resources, such as resources listed on local registers of historic registers or in local surveys, may be listed if they are determined by the State Historic Resources Commission to be significant in accordance with criteria and procedures to be adopted by the Commission and are nominated for listing in the CRHR; their listing in the CRHR is not automatic.

Disturbance of an Archeological Site

Section 5097.5 of the California Public Resources Code makes it a misdemeanor for anyone to knowingly disturb any archaeological, paleontological, or historical feature situated on public lands.

Native American Religious Freedom

Section 5097.9 et seq. of the California Public Resources Code prohibits public agencies from interfering with the free expression or exercise of Native American religion, or causing severe or irreparable damage to any Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine located on public property. The only exception occurs when it can be clearly and convincingly demonstrated that the public interest and necessity require such action.

Native American Grave Artifacts

Section 5097.991 of the California Public Resources Code states that "it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated."

Native American Heritage Commission

Section 5097.9 of the California Public Resources Code establishes the California State Native American Heritage Commission (NAHC). The code stipulates that no public agency may alter, modify, disturb, remove, destroy, or damage any Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine except with the consent of the NAHC. In addition, the NAHC can mediate disputes relating to treatment of human remains and designate "most likely descendants" of encountered human remains.

State Executive Order W-26-92

The Governor's Executive Order W-26-92 directs all state agencies to administer the cultural and historic properties under their control, regardless of who owns the resources, and to initiate measures to preserve, restore, and maintain significant state-owned properties. It specifically requires agencies to appoint an agency preservation officer, to develop management plans for their significant heritage resources, to complete the inventories of their state-owned historical resources as directed in California Public Resources Code Section 5024, and to report annually to the State Historic Preservation Officer on these activities.

State of California Health and Safety Code 7050.5

Disturbance of Human Remains

Health and Safety Code Section 7050.5 establishes intentional disturbance, mutilation, or removal of interred human remains as a misdemeanor. Upon discovery of human remains outside of a dedicated cemetery, the code requires that further excavation or disturbance of land, cease until a county coroner makes a report. It also requires a county coroner to contact the Native American Heritage Commission within 24 hours if the coroner determines that the remains are not subject to his or her authority and if the coroner recognizes the remains to be those of a Native American.

State of California Health and Safety Code 7051

Removal of Human Remains

Health and Safety Code Section 7051 establishes the removal of human remains from interment, or from a place of storage while awaiting interment or cremation, with the intent to sell them or to dissect them with malice or wantonness, as a public offense punishable by imprisonment in a state prison.

State of California Health and Safety Code 7052

Felony Offenses Related to Human Remains

California Health and Safety Code Section 7052 states that willing mutilation of, disinterment of, removal from a place of disinterment of, and sexual penetration of or sexual contact with any remains known to be human are felony offenses.

State of California Health and Safety Code 7054

Depositing Human Remains Outside of Cemetery

California Health and Safety Code Section 7054 exempts the reburial of Native American remains pursuant to Section 5097.94 from definition of a misdemeanor.

State of California Health and Safety Code 8010-8011

The California Native American Graves Protection and Repatriation Act establishes a state repatriation policy intent that is consistent with and facilitates implementation of the federal Native American Graves Protection and Repatriation Act (NAGPRA). The act strives to ensure that all California Indian human remains and cultural items are treated with dignity and respect. It encourages voluntary disclosure and return of remains and cultural items by publicly funded agencies and museums in California. The act intends for the state to provide mechanisms for aiding California Indian tribes, including non-federally recognized tribes, in filing repatriation claims and getting responses to those claims.

3.4.1.4. Local Laws and Regulations

Colusa County General Plan

Conservation Element: Cultural Resource Policies

Colusa County's goal is to encourage a balanced mix of conservation, utilization, and development of Colusa County's natural resources. The following policies have been implemented by Colusa County in order to meet that goal:

- The preservation and re-use of historical sites and structures in the County should be encouraged;
- The County should apply for landmark status or NRHP listing for any historical sites which may be eligible;
- The County should encourage and cooperate with cities, special districts, state and federal agencies, and private landowners in acknowledging and preserving the County's cultural heritage, historical and archaeological structures, sites and landmarks; and
- An archaeological survey should be required prior to approval of any project which would require excavation in an area known to contain archaeological resources (Colusa County 1989).

Sacramento County General Plan

Section VI: Cultural Resources

One of Sacramento County's goals is to "promote the inventory, protection and interpretation of the cultural heritage of Sacramento County, including historical and archaeological settings, sites, buildings, features, artifacts and/or areas of ethnic historical, religious or socio-economical importance" (Sacramento County 1993). Sacramento County has implemented the following policies to meet that goal:

- Attention and care must be taken during project review and construction to ensure that cultural resource sites, either previously known or discovered on the project site, are properly protected with sensitivity to Native American values;
- Structures with architectural or historical importance must be preserved to maintain exterior design elements; and
- Known archaeological and historic sites must be protected from vandalism, unauthorized excavation, or accidental destruction (Sacramento County 1993).

Sutter County General Plan

Section 5: Conservation/Open Space-Recreation and Cultural Resources

Sutter County's General Plan strives "to identify, protect, and enhance Sutter County's important historical, archaeological and cultural sites" (Sutter County 1996). The County promotes the registration of historic sites, buildings, structures and objects in the NRHP, and inclusion in the California State Office of Historic Preservation's California Points of Interest and the CRHR. Additionally, the County solicits the views of the local Native American community in the cases where development may result in disturbance to sites containing evidence of Native American activity and/or tomb sites of cultural importance (Sutter County 1996).

Tehama County General Plan

Section 6.0: Open Space and Conservation

The goal of the historical, archaeological, and cultural resources sections of the Tehama County General Plan is "to preserve the historical and archaeological resources of the County for their scientific, educational, aesthetic, recreational, and cultural values" (Tehama County 2008: 6.0-24). The following policies have been implemented in the Tehama County General Plan to attain that goal:

- Significant archaeological and cultural resources should be protected and preserved;
- Rehabilitation, preservation, and utilization of historic buildings that are representative examples of the County's heritage should be encouraged;
- Incentive programs will be available and the private sector will be encouraged to preserve, protect, or enhance historic, archaeological, and cultural resources; and
- Inter-agency cooperation to protect historic, archaeological, and cultural resources will be promoted (Tehama County 2008).

Yolo County General Plan

Chapter 7: Section F Cultural Resources

The goal of the cultural resources section of the Yolo County General Plan is to preserve and protect cultural resource values within the county (Yolo County 2009). The County requires evaluation and protection of archaeological resources discovered in the course of construction and development. This is implemented by coordinating planning decisions involving

agricultural/open space land with public agencies involved in conservation, preservation, and protection of natural resources (Yolo County 2009).

3.4.2. Findings

The archaeological investigation, including archival research, tribal outreach, and pedestrian surface surveys, was conducted to determine if repair of the erosion sites could have an impact on historical resources or historical properties on the terrestrial surface of each erosion site.

Buried or submerged resources, if any, might not be located during a pedestrian surface reconnaissance investigation. Therefore, there is the potential for buried or submerged cultural resources to exist at each erosion site.

3.4.2.1. Archival Research

Cultural resources literature searches were conducted at the appropriate CHRIS centers for an area that included a 0.5-mile radius around each of the 25 erosion sites. SWCA conducted cultural resources literature searches for 19 of the erosion sites in August 2008 at the North Central Information Center, Sacramento (NCIC); the Northeast Information Center, Chico (NEIC); and the Northwest Information Center, Sonoma (NWIC). North State Resources, Inc. conducted cultural resources literature searches for seven of the erosion sites in October 2008 at the NEIC, in December 2008 at the NCIC, and in January 2009 at the NWIC.

The NRHP, the California Historical Landmarks Listing, the CRHR, the California Points of Historical Interest, the California State Lands Commission's on-line shipwreck database, the Bureau of Land Management General Land Office records, and the Caltrans Bridge Inventory were consulted as part of the literature searches. In addition to these searches, historic maps and official records housed at the Information Centers and other information depositories were consulted.

The literature review revealed the following documented resources in or adjacent to the erosion sites:

- P-34-2143. This historic-era archaeological site consists of one 2.2-mile segment and one 8.5-mile segment of four recorded segments of earthen levee along the left bank of the Sacramento River within SAC 8.0L at Horseshoe Bend, and within SAC 10.8L at Brannan Island. At present, it exhibits erosional disturbance. Although the levee is part of an early levee system constructed in the late 19th century and an integral component of the history of the Sacramento Valley and the Delta, the entire system has been rebuilt, built upon, or subsumed into the modern levee system. Therefore, it appears that P-34-2143 is not eligible for listing in the NRHP or the CRHR as "it does not retain sufficient integrity of setting or physical integrity to convey its period significance" (Martinez and Arrington 2008).

- CA-SAC-482H (P-34-509). This is an historic-era archaeological site consisting of one 11.3-mile segment of federal levee along the left (south) bank of the American

River within LAR 10.0L and LAR 10.6L. This levee is part of the pre-1944 Sacramento River Flood Control Plan and was upgraded prior to 1948 to meet the standards of the day. It appears that CA-SAC-482H (P-34-509) would not qualify as eligible for listing on the NRHP or the CRHR as "it does not retain sufficient integrity of setting or physical integrity to convey its period significance" (Martinez and Arrington 2008).

- CA-SUT-136H. This historic-era archaeological site, recorded in 2007, is a farming complex consisting of several residences, a barn, and outbuildings located on the landside of the levee immediately adjacent to but outside of the SAC 78.8L erosion site. At the time of the archaeological survey, the built environment (barn, house, outbuildings) of CA-SUT-136 had been removed from the landscape and an agricultural field had been put in its place. The removal of the built environment greatly reduces the integrity, location, design, setting, materials, workmanship, feeling, and association of the site. The site, when extant, did not fulfill any of the criteria for the NRHP nor the criteria of the CRHR, and therefore appears not eligible for either register. As such, construction activities at SAC 78.8L would not affect CA-SUT-136.

3.4.2.2. Field Surveys

Non-submerged portions of 19 of the erosion sites were investigated during August 2008 by SWCA archaeologists Amanda Martinez, Phil Hanes, and Lori Harrington, who meet or exceed the Secretary of the Interior's Standards. Non-submerged portions of seven of the erosion sites were investigated in October 2008 by North State Resources, Inc. archaeologist Kristina Crawford, who meets the Secretary of the Interior's Standards. Submerged portions of four of the erosion sites were investigated during late January and early February 2009 by Panamerican Consultants, Inc. maritime archaeologists who meet or exceed the Secretary of the Interior's Standards.

Both the SWCA and North State Resources, Inc. archaeologists conducted intensive-level pedestrian surveys with transect intervals spaced no more than 15 meters apart. Photographs of the erosion sites, potential archaeological resources, and other items of interest were recorded with digital cameras. Identified resources were formally recorded on California Department of Parks and Recreation series 523 forms in accordance with instructions from the State Office of Historic Preservation. Formal coordinates (UTMs) were recorded with a hand-held Garmin global positioning system (GPS). The ground surface, as well as cut banks, eroding banks, roads, dirt tracks and trails, rodent burrows, and other areas of exposed mineral soil, were inspected for soil discoloration, general soil information, and archaeological resources. Inundated portions of the erosion sites were not surveyed. Because no ground-disturbing activities (i.e., digging in pre-project soils) is proposed for the undertaking, formal subsurface testing, beyond occasional scrapes to reveal mineral soil, was not conducted. Ground surface visibility at the erosion sites varied from 50 percent to 85 percent. Factors inhibiting clear sight of soils included thick riparian vegetation (i.e., blackberry and other briar-like plants), steep cutbanks treacherous to traverse, mats of thick dry grasses, and flooded areas (i.e., those portions of the erosion sites inundated by river flows).

3.4.2.3. Results

During the course of the pedestrian surveys, several cultural features were noted or recorded within or immediately adjacent to the erosion sites. These features include:

- SAC 8.0L Pilings. Eleven wood pilings aligned north-south and parallel to the eastern shore of the Sacramento River, and thought to be from an early 20th century construction, were noted within SAC 8.0L. Magnetometer, sidescan sonar, and archival investigations of the pilings revealed the pilings coincide with a "fish wharf" depicted on historic maps (Panamerican Consultants, Inc. 2009). Additionally, the pilings may also coincide with landings depicted on 1913 and 1931 maps and a landside homestead (Panamerican Consultants, Inc. 2009). Panamerican Consultants, Inc. (2009) determined that the submerged resources at SAC 8.0L are not considered historically significant.

- SAC 26.0L Pilings. Wooden pilings (arranged in a 1,550-foot line) and metal pilings were noted within site SAC 26.0L. Previously investigated by SWCA, the 2008 report stated that "metal pilings were noted within the water portion of the SAC 26.0L area of potential effects (APE). These pilings do not appear on either the 1978 or 1906–1908 USGS Isleton quadrangles; therefore, it is likely that these are modern. Further, the metal pilings are tall and appear to have a continued function since lights atop the pilings are still used" (Martinez and Sikes 2008). Magnetometer and sidescan sonar investigations of the pilings revealed a cluster of modern steel pilings, two groups of wooden pilings, and a large rock or rock pile (Panamerican Consultants, Inc. 2009). The wooden pilings, while thought to represent late 19th century or early 20th century landings recorded in historical documentation, are not considered historically significant by themselves (Panamerican Consultants, Inc. 2009) Therefore, the pilings located at SAC 26.0L appear to be ineligible for listing on either the NRHP or the CRHR.

- SAC 130.0L Pilings. A "single line" of wooden pilings were noted in the upstream side portion of the erosion site (Panamerican Consultants, Inc. 2009). Magnetometer and sidescan sonar investigations of the pilings revealed these pilings to possibly be recently installed bank erosion control pilings and therefore "the pilings are not considered historically significant" (Panamerican Consultants, Inc. 2009).

- SAC 41.9R Pilings. During the 2008 SWCA survey, multiple groups of pilings were observed in the river but were not identified as significant (Martinez and Sikes 2008). Analysis of magnetometer and sidescan sonar data revealed remains associated with the Clarksburg Ferry Landing, the Clarksburg Wharf, the Union Oil Company wharf, and the Standard Oil Company wharf. The wooden pilings, representing the landing and wharves, by themselves are not considered historically significant (Panamerican Consultants, Inc. 2009).

- CA-Yol-223H. The Clarksburg Ferry is located within erosion site SAC 41.9R. During the 2008 SWCA survey, multiple groups of pilings were observed in the river but were not identified as significant (Martinez and Sikes 2008). A subsequent

survey was conducted by SWCA of a historic wooden watercraft in the APE after a reduction in river levels exposed the remains. Identified as a potentially significant historical resource, it was thought that the remains could be a ferry that operated at this location during the 1920s and 1930s and that had capsized (Martinez and Sikes 2008). Analysis of magnetometer and sidescan sonar data revealed remains associated with the Clarksburg Ferry. The Clarksburg Ferry wreck is considered to be historically significant and eligible for inclusion in the NRHP and CRHR as it retains its integrity of location, design, setting, materials, and workmanship, and may meet the requirements of Criteria A/1 (association with events significant in local, national, regional state history), Criteria C/3 (embodies distinctive characteristics of construction), and Criteria D/4 (the potential to yield information important in history) of the NRHP and CRHR (Panamerican Consultants, Inc. 2009).

- NSR-SPB-001. This historic archaeological site, located approximately 60 meters south of SAC 157.7R, is the remains of a concrete structure, possibly the "Maxwell Irrigation District Pump" illustrated on the 1924 State of California Department of Public Works' *Sacramento Flood Control Project map, Sheet 2*. It appears that NSR-SPB-001 is ineligible for listing on either the NRHP or the CRHR as it lacks integrity and does not meet any of the criteria for such listing (i.e., the property is not associated with important individuals or historic events, the structure does not exhibit distinctive architectural characteristics, and is a common form unlikely to yield further information).

- Cemetery. A historic cemetery is located 100 meters outside the boundary of SAC 157.7R. Historic maps (U.S. Army Corps of Engineers 1911, U.S. Geological Survey 1917) dating before and after construction of the levee, indicate the presence of buildings and an "Indian village" near the erosion site. The cemetery is still in active use and lies in land owned by the Cachil Dehe Band of Wintun Indians of Colusa. Because the cemetery may represent continuous traditional use of the vicinity, it appears to fulfill the criteria of eligibility for both the NRHP and the CRHR and is considered to be a significant resource.

- NSR-SRB-002. This historic resource located within the SAC 73.5L undertaking area is the discontiguous remains of an earthen levee of unknown association and construction date, paralleling the existing levee and situated on the eroding bank of the Sacramento River. The levee has experienced heavy erosion along the extant alignment, destroying the profile and removing the materials used in the construction. It appears that NSR-SPB-002 is ineligible for listing on either the NRHP or the CRHR as it does not meet any of the criteria for such listing (i.e., the property lacks integrity, is not associated with important individuals or historic events, does not exhibit distinctive architectural characteristics, and is a common form unlikely to yield further information).

- Possible potentially significant prehistoric subsurface deposit. A potentially significant prehistoric subsurface deposit is reported to be located within the SAC 73.5L erosion site (Lee, pers. comm. 2009; Huddleston pers. comm. 2009; EDAW

field archaeologists, pers. comm. 2009). The potentially significant prehistoric subsurface deposit is reported to be eroding out of the riverbank; however, it may have been removed or destroyed by high water flows in February. Further investigations were not possible due to high water. Because the potentially significant prehistoric subsurface deposit may possess important research potential and because it may retain integrity of association, the potentially significant prehistoric subsurface deposit appears to fulfill the criteria of eligibility for the NRHP or the CRHR and is considered to be a significant resource.

Paleontological Resources

In addition to the historical resources review, a fossil and geology review completed for each of the 25 erosion sites determined that none of the fossil localities documented within Colusa, Sacramento, Sutter, Tehama, and Yolo counties occur within the project areas (University of California Museum of Paleontology 2009). The erosion sites generally occur in stream channel deposits and soil formations laid down during the Recent Quaternary Period and are not likely to contain fossils.

3.4.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Cause a substantial adverse change in the significance of a historical or archaeological resource pursuant to CEQA (Section 15064.5);
- Result in an adverse impact to a historical resource listed in, or eligible for listing in either the CRHR or the NRHP;
- Directly or indirectly destroy a unique paleontological resource or site; or
- Disturb any human remains, including those interred outside of formal cemeteries.

3.4.3.1. No-Action Alternative

Under the no-action alternative, no action would be taken to repair the existing erosion and protect the levee at the 25 erosion sites, therefore eliminating the possibility of discovering undocumented cultural resources. This alternative would allow forces of erosion to persist. Continued erosion at the erosion sites would increase the risk of levee failure and possible flooding of surrounding areas. Potential impacts to cultural resources associated with implementation of the no-action alternative are identified below.

Potential impacts to documented and undocumented cultural resources associated with the no-action alternative would result from the erosion becoming so severe that pre-failure emergency repairs are required or the levee fails, resulting in flooding. When repairs are conducted under these conditions, there is little to no opportunity to properly conduct environmental studies, assess environmental impacts, and incorporate environmental protection and mitigation measures into the project design. Also given that the erosion would have been

allowed to continue, a larger disturbance area would be required to repair the levee, resulting in a larger footprint of environmental impact.

Failure of the levee and subsequent flooding would result in greatly accelerated erosion and the need for post-failure emergency repairs. Flooding could result in significant damage to cultural resources in a large geographic area through erosion and inundation. The required post-failure emergency repairs could have a significantly large footprint and the urgent need to immediately repair the levee would preclude proper planning and environmental protection.

3.4.3.2. Alternative 1: Proposed Action

Under the proposed action, bank protection measures would be implemented to prevent ongoing erosion and increase levee stability. The proposed bank protection measures include: (1) protecting the toe and slopes of the levees with quarry stone; (2) constructing riparian benches at many of the erosion sites; (3) anchoring the IWM at the MSWL to provide instream aquatic structure; and (4) planting native riparian vegetation to stabilize the bank and replace vegetation lost during construction. Setback levees would be built at sites CC 2.8L, CC 3.4L, and DC 0.9N where repair of the existing levees is not practicable. Potential impacts to cultural resources associated with implementation of the proposed action are identified below:

Impact CR1: Submerged Pilings
Historic-era pilings are known to exist below the waterline at SAC 8.0L, SAC 26.0L, SAC 41.9R, and SAC 130.0L. The proposed action could result in direct impacts to these features either through removal of the pilings to accommodate waterside access or crushing from the addition of rock revetment at the lower slope and toe of the levees. Based on the results of underwater remote sensing and diver investigations, it was determined that the pilings by themselves do not fulfill the criteria of eligibility for the NRHP or the CRHR and are not considered to be historically significant (Panamerican Consultants, Inc. 2009). Therefore, impacts to the submerged pilings are considered to be less than significant. No mitigation is required.

Impact CR2: Segments of Historic-Era Levees
Segments of historic-era levees are present at sites SAC 8.0L, SAC 10.8L, SAC 73.5L, LAR 10.0L, and LAR 10.6L. These features do not appear to fulfill the criteria of eligibility for the NRHP or the CRHR and are not considered to be significant resources (Martinez and Arrington 2008; North State Resources, Inc. 2009a). Construction activities at these sites would involve the addition of rock and soil revetment on top of the existing levee slope; no materials would be excavated from the erosion site. Impacts to segments of historic-era levees are considered to be less than significant. No mitigation is required.

Impact CR3: Remains of the Clarksburg Ferry
CA-Yol-223H is the remains of the Clarksburg Ferry, built in 1920 and wrecked in 1928. Magnetometer and sidescan sonar investigations of the wreck, conducted in late January 2009, revealed it to be relatively intact (Panamerican Consultants, Inc. 2009). The Clarksburg Ferry wreck is considered to be historically significant as it retains its integrity of location, design, setting, materials, and workmanship, and may meet the

requirements of Criteria A, C, and D of the National Register, and Criteria 1, 3, and 4 of the CRHR (Panamerican Consultants, Inc. 2009). Undertaking activities associated with Design 2 will adversely affect CA-Yol-223H either through removal of, or crushing by, the rock revetment and construction activities. CA-Yol-223H is located within erosion site SAC 41.9R. Impacts to CA-Yol-223H are considered to be potentially significant. Implementation of Mitigation Measure CR1 would reduce the impact to a less-than-significant level.

Impact CR4: Potentially Significant Prehistoric Subsurface Deposit
A potentially significant prehistoric subsurface deposit is reported to be to be eroding out of the riverbank at SAC 73.5L. It may have been removed or destroyed by high water flows in February, and additional investigation would be required to determine if the deposit is present within the erosion site. The resource, by nature, retains tribal values, and the resource may be related to a nearby archaeological site currently under investigation by EDAW for a project not related to the current undertaking. Because work at SAC 73.5L may affect as of yet undisclosed tribal values germane to the resource, archaeological monitoring of project activities at the SAC 73.5L erosion site is recommended. Implementation of Mitigation Measure CR2 would reduce the impact to a less-than-significant level.

Impact CR5: Unknown Traditional Use Resources
Culturally significant traditional cultural use areas (e.g., Traditional Cultural Properties), if any, might not be located during a pedestrian surface reconnaissance investigation. Therefore, there is the potential for traditional cultural properties to exist at any of the erosion sites. Impacts to as of yet unidentified traditional use resources are considered to be potentially significant. Implementation of Mitigation Measure CR3 would reduce impacts to a less-than-significant level.

Impact CR6: Unknown Cultural Resources
Buried, submerged or obscured resources, if any, might not be located during a pedestrian surface reconnaissance investigation. Therefore, there is the potential for buried, submerged, or obscured cultural resources to exist at any of the erosion sites. Impacts to as of yet unidentified cultural resources are considered to be potentially significant. Implementation of Mitigation Measure CR4 would reduce impacts to a less-than-significant level.

3.4.4. Mitigation

Implementation of the following mitigation measures would reduce potential impacts to a less-than-significant level.

Mitigation Measure CR1: Remains of the Clarksburg Ferry

a. Prior to initiation of construction activities at SAC 41.9R, the Clarksburg Ferry shall be formally evaluated for eligibility for listing in the National Register of Historic Places (NRHP) and the California Register of Historical Resources (CRHR). The determination of eligibility shall be made in consultation with the

State Historic Preservation Officer (SHPO). If the Clarksburg Ferry is determined to not be eligible for listing, no further measures are required. If the Clarksburg Ferry is determined to be eligible for listing in the NRHP or the CRHR, the proposed designs for bank protection at SAC 41.9R shall be modified, as practicable, to avoid effects to the Clarksburg Ferry. If effects can be completely avoided, no further measures are required. If effects cannot be avoided, the following measures shall be implemented.

b. Prior to any construction activities at SAC 41.9R, data recovery for the Clarksburg Ferry shall be completed. The data recovery shall include: 1) limited excavation to expose construction details; 2) recordation of all construction details, including the plan view, exposed cross-section details, and specific vessel components (e.g., rudder, guard); 3) photographic documentation including video and still images; 4) collection and/or conservation of select artifacts (e.g., rudder, fasteners, wood samples) if appropriate and authorized; and 5) archival research that captures the informational value of the resource and its role in the maritime history of the Sacramento River and the local community (e.g., Nunes Brothers boat builders). These data recovery measures are recommended treatment measures for inclusion in a Historic Properties Treatment Plan (HPTP) to address project-related effects to the Clarksburg Ferry. Final treatment measures to address project-related effects will be specified in the HPTP as stipulated in a Memorandum of Agreement between the Corps and SHPO.

c. Prior to any construction activities at SAC 41.9R, Section 106 consultation with the SHPO shall be completed.

Mitigation Measure CR2: Potentially Significant Prehistoric Subsurface Deposit

a. All prehistoric subsurface deposits at SAC 73.5L shall be preserved in place, unless other arrangements are requested by the appropriate tribal government. To accomplish preservation in place, the following steps shall be taken:

- Vegetation to be removed from the site shall be removed manually using hand tools (e.g., chainsaws, mowers, gas-powered hedgers). No grubbing or excavation of any kind (e.g., excavation for tree root removal) shall be allowed. No large mechanical equipment (e.g., tractors, crawlers, bulldozers) shall be used for vegetation removal.

- Coir fabric or similar sterile natural fabric shall be placed over the entire area containing the subsurface deposits (approximately 165 feet long). At least 2 feet of soil shall be placed on the fabric before placing the rock revetment.

- A qualified professional archaeologist shall be retained to conduct on-site monitoring during vegetation removal and construction activities at SAC 73.5L. At the discretion of the monitoring archaeologist, any

construction activities shall be slowed or halted at any time if a suspected archaeological object or archaeological site is encountered.

b. If a possible significant cultural resource is encountered, all construction activity in the vicinity of the discovery shall be stopped. The monitoring archaeologist shall work with the construction contractor and the Corps/CVFPB to determine appropriate conservation measures. Construction activities in the vicinity shall not resume until appropriate conservation measures have been implemented. Appropriate conservation measures may include, but are not limited to, evaluating the find for significance, formal recording and data recovery, erecting exclusionary fencing, and consultation with SHPO and appropriate tribal governments.

Mitigation Measure CR3: Unknown Traditional Use Resources

a. In the event ongoing interagency consultation reveals potentially significant tribal values (pursuant to NHPA) ascribed to or affected by work at any of the 25 erosion sites, then, prior to any construction (e.g., ground disturbance, viewshed disturbance), the Corps/CVFPB shall formally record the affected resource to the extent permitted by the affected tribal government and to a degree that would allow for evaluation and treatment. The affected resource shall be evaluated pursuant to the NRHP and the CRHR by a professional archaeologist retained by the Corps/CVFPB. The archaeological recording and eligibility determination shall be conducted in coordination with the Office of Historic Preservation (and the Advisory Council on Historic Preservation, if any consulting party requests). If the affected resource is determined to not be eligible for listing on either the NRHP or the CRHR, then no further mitigation is required. If the affected resource is determined to be eligible (or potentially eligible) for the listing on either the NRHP or the CRHR (in consultation with the Office of Historic Preservation), then mitigation measure CR-3b shall be implemented.

b. If the affected resource is determined to be eligible (or potentially eligible) for listing on either the NRHP or the CRHR, impacts shall be avoided to the extent practicable. Measures required to achieve avoidance shall be determined in consultation with the Corps/CVFPB, the Office of Historic Preservation, and the affected tribal government(s); and shall be written in a memorandum of agreement. Avoidance measures may include, but are not limited to, installing exclusionary fencing during project development; providing permanent protection from disturbance through a deed restriction, conservation easement, or other legal instrument. If disturbance to the affected resource is completely avoided, no further mitigation is required. If consultation fails to achieve methods of avoidance or practical mitigations, the wording of the memorandum of agreement may allow the project to affect the resource. If a memorandum of agreement is issued that would allow disturbance to the affected resource, then no further mitigation is required.

Mitigation Measure CR4: Unknown Cultural Resources

a. In the event archaeological resources (e.g., buildings, structures, or objects older than 45 or 50 years of age) other than those determined to lack eligibility for either the NRHP or the CRHR, are discovered as a result of construction activities, all work in the immediate vicinity of the discovery shall be stopped immediately and the Corps/CVFPB shall be notified. An archaeologist meeting the Secretary of Interior's Professional Qualifications Standards in prehistoric or historical archaeology, as appropriate, shall be retained to evaluate the find and recommend appropriate conservation measures. Conservation measures shall be implemented prior to reinitiation of activities in the immediate vicinity of the discovery.

b. If human remains are discovered during construction activities, all activities in the vicinity of the find shall be suspended and the appropriate County Coroner's Office shall be notified. If the coroner determines that the remains may be those of a Native American, the coroner shall contact the Native American Heritage Commission (NAHC). Treatment of the remains shall be conducted in accordance with the direction of the County Coroner or the NAHC, as appropriate.

3.5. Biological Resources

3.5.1. Environmental Setting

This section describes the biological resources, including vegetation communities, fish and wildlife habitats, and special-status species, potentially present at the erosion sites. Biological field surveys were conducted at each of the erosion sites from August 2008 through February 2009. The purpose of the field surveys was to 1) map vegetative cover types; 2) assess and map all trees greater than 4 inches in diameter at breast height (dbh); 3) assess fish and wildlife resources; 4) determine the presence or absence of suitable habitat for special-status species; and 5) assess the presence of invasive plant species. Field surveys consisted of tree surveys, elderberry (*Sambucus* sp.) surveys, instream woody material (IWM) surveys, botanical surveys for special-status plants, and plant and animal inventories. The methodology and results of the field surveys are detailed in the site characterization reports prepared for the proposed action (North State Resources, Inc. 2009b, 2009c). Copies of these reports are provided in Appendix C.

3.5.1.1. Community Types

Communities mapped within the 25 erosion sites include vegetated and unvegetated types. Vegetated communities present primarily include riparian forest, oak woodland, riparian scrub, ruderal vegetation, and emergent vegetation. Unvegetated communities include open water, revetment, and barren areas, such as roadways, disced agricultural fields, and other bare land. Percent cover of the various community types for each of the 25 erosion sites is summarized in Table 3-5. Maps illustrating the community types are provided in the site characterization reports (Appendix C).

Table 3-5 Percent Cover by Community Type at Each Erosion Site

Erosion Site	Community Types								
	Riparian Forest	Oak Woodland	Riparian Scrub	Ruderal Vegetation	Emergent	Revetment	Barren	Open Water	Other
SAC 8.0L	0	0	4.43	0	4.92	0	0.63	90.02	0
SAC 10.8L	0	0	3.41	0	1.41	0	0.54	94.65	0
SAC 26.0L	7.91	4.13	15.67	11.60	0.43	0.37	1.11	58.77	0
SAC 35.4L	0	0	5.12	2.47	0	3.51	10.50	78.39	0
SAC 41.9R	14.68	0	2.31	1.00	0	0.27	2.25	79.48	0
SAC 71.3R	1.55	3.52	20.25	7.76	0	0	4.26	62.64	0
SAC 87.0L	2.08	0	5.41	7.83	0	0	6.56	75.53	2.60
SAC 130.0L	4.98	0	3.95	29.90	0	0	5.92	55.25	0
SAC 136.7R	4.58	7.77	0.76	31.53	0	0	3.05	52.28	0
FR 1.0L	16.47	0	4.34	6.42	0	0	1.04	69.72	2.00
FR 3.7L	13.80	0	4.88	11.66	0	0	0.20	68.49	0.97
FR 5.5L	12.75	0	4.37	4.27	0	0.23	0	78.34	0
FR 7.0L	16.88	0	0.69	17.88	0	0	0.37	64.10	0
LAR 10.0L	34.48	0	0	0	0	0	0	65.51	0
LAR 10.6L	45.28	0	0	13.39	0	0	5.14	36.18	0
CC 2.8L	0	0	12.82	17.95	0	0	10.79	5.52	52.92
CC 3.4L	0	2.88	0.35	21.13	0	0	13.66	0	61.98
DC 0.9N	16.05	0	0.58	2.64	0	1.63	14.33	20.42	44.34
SBP 0.4E	12.18	0	0	47.96	0	0	7.37	32.43	0
SAC 73.5L	13.16	19.25	3.83	4.36	0	0	0.42	58.95	0
SAC 78.8L	31.74	0	0	14.50	0	0	0	53.74	0
SAC 93.7L	0	0	0	33.30	0	0	11.33	38.89	0
SAC 114.5R	44.72	0	0	14.04	0	0	1.99	39.25	0
SAC 136.9R	10.50	0	0	16.06	0	0	0	50.00	23.44
SAC 157.7R	25.47	0	7.12	18.79	0	0	19.09	29.53	0

Riparian Forest

Riparian forests are generally associated with rivers, low gradient streams, floodplains, and occasionally ponds and canals. The composition of species in riparian forest communities is highly variable and dependent on geographic location, elevation, substrate, and groundwater elevation.

The riparian forest community type is dominated by tall, winter-deciduous, broad-leaved trees with open or closed canopies. At some erosion sites, stands of riparian forest have been fragmented by human-caused disturbances associated with levee construction and maintenance. In cases where a particular species dominates the canopy, the riparian community type name includes the name of that species (e.g., riparian – cottonwood or riparian – alder). Generally, the dominant tree species within the sites consist of valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), and white alder (*Alnus rhombifolia*). Associated tree species include northern California black walnut (*Juglans hindsii*), California box-elder (*Acer negundo* var. *californicum*), Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), and Goodding's black willow (*Salix gooddingii*).

Shrub layers present in the riparian forest community range from sparse to dense and are well structured. Dominant species occurring in the shrub layer include buttonbush (*Cephalanthus occidentalis*), blue elderberry (*Sambucus mexicana*), California blackberry (*Rubus ursinus*), Himalayan blackberry (*Rubus discolor*), California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversilobum*), and California wild grape (*Vitis californica*).

The herbaceous ground layer is typically a mix of native and introduced species. Common native plant species include California mugwort (*Artemisia douglasiana*), horsetail (*Equisetum* sp.), horseweed (*Conyza canadensis*), and Santa Barbara sedge (*Carex barbarae*). Common non-native species include white sweet-clover (*Melilotus alba*), wild oat (*Avena fatua*), ripgut brome (*Bromus diandrus*), black mustard (*Brassica nigra*), Bermuda grass (*Cynodon dactylon*), yellow star-thistle (*Centaurea solstitalis*), prickly lettuce (*Lactuca serriola*), and curly dock (*Rumex crispus*).

Oak Woodland

The oak woodland community type generally occurs on the upper bank of the levee slope outside of the riparian zone. Oak woodlands are characterized by an open to dense canopy dominated by oak species, including valley oak and coast live oak (*Quercus agrifolia*). The shrub layer is generally sparse to absent, whereas the herbaceous layer is generally well developed. Dominant plants in the herbaceous layer include wild oat, Santa Barbara sedge, horsetail, and ripgut brome.

Riparian Scrub

The riparian scrub community type typically occurs along the toe of levee slopes and supports willows (*Salix* spp.) and other low-growing woody species typically reaching less than 15 feet in height. Dominant shrub species include Goodding's black willow, California wild rose, California blackberry, Himalayan blackberry, blue elderberry, narrowleaf willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*), and buttonbush.

Ruderal Vegetation

Ruderal habitats are typically dominated by short-lived annual and biennial, introduced, non-native herbaceous grasses and broad-leaved forbs that colonize areas subject to regular, periodic disturbance (e.g., plowing, mowing, and herbicidal spraying). Among the various erosion sites, this community type typically occurs along the mid- to upper-slope and levee crown portions. Dominant plants include ripgut brome, Bermuda grass, wild oat, Johnson grass (*Sorghum halapense*), yellow star-thistle, fennel (*Foeniculum vulgare*), horsetail, and Santa Barbara sedge.

Emergent Vegetation

Emergent vegetation is restricted to a relatively narrow saturation zone along the lower bank of the levee slope within a few of the erosion sites, and as vegetated shallows at erosion sites SAC 8.0L and SAC 10.8L. This vegetation community is characterized by the presence of hydrophytic (i.e., "water-loving") herbaceous plant species that are able to tolerate fluctuating water levels and persist in continuously saturated soils. Common emergent vegetation includes tule (*Schoenoplectus acutus* var. *occidentalis*), smartweed (*Polygonum lapathifolium*), creeping water-primrose (*Ludwigia peploides* ssp. *montevidensis*), common rush (*Juncus effusus*), and ladysthumb (*Polygonum persicaria*).

Other Vegetation Communities

Other vegetation communities occurring within some of the erosion sites include horsetail, fig (*Ficus carica*), pasture, and orchard. These vegetation communities are typically a monoculture (i.e., primarily composed of a dominant species, such as horsetail, fig, or English walnut). However, species composition in pasture communities is more complex in that multiple grass and forb species are present. Pasture is found only at DC 0.9N and includes tall fescue (*Festuca arundiaceae*), white clover (*Trifolium repens*), dallis grass (*Paspalum dilatatum*), and chicory (*Chichorium intybus*).

Open Water

The Sacramento River, Feather River, lower American River, Cache Creek, Deer Creek, and Sutter Bypass all provide open water habitat at the 25 erosion sites. Substrates are generally dominated by sand and silt; however, gravel, cobble, and boulders dominate the substrate at Cache Creek, Deer Creek, and portions of the lower American River. Banks are generally steep to the water's edge and are sometimes undercut, providing additional cover for fish species.

IWM, a component of open water habitat, is important in providing cover, structure, basking surfaces, and other resources for fish and aquatic wildlife. For the purposes of this assessment, IWM was defined as any piece of dead wood or other material providing structure (such as logs or metal pipe) 6 inches in diameter or larger, that extended into the water at the mean summer water level (MSWL) and was anchored such that it was not likely to float away during normal high flows. All of the erosion sites contained IWM except for SAC 35.4L and SAC 93.7L. The IWM inventory prepared for the erosion sites is included in the site characterization reports in Appendix C.

Barren

Barren areas generally include paved and dirt roads, dirt lots, and other areas that are denuded of vegetation, usually through vegetation management practices such as burning or

discing (i.e. turning and loosening soil). At SAC 35.4L, recent levee repairs removed vegetation within the site. Barren substrates consist primarily of rock, pavement, and bare soil. Vegetation is typically absent; however, sparse weedy grasses and forbs may be present. Although a subset of the barren classification, revetment was separately mapped to identify areas of existing rock armor. Classes of revetment include angular rock, cobble, and concrete rubble.

3.5.1.2. Fish Resources

Open water habitat includes the active channels of the Sacramento River, Feather River, American River, Cache Creek, Deer Creek, and Sutter Bypass. These watercourses provide multiple resources for fish species.

Native fish species that may occur in the open water habitats of the erosion sites include Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley steelhead (*Oncorhynchus mykiss*), river lamprey (*Lampetra ayresi*), green sturgeon (*Acipenser medirostris*), delta smelt (*Hypomesus transpacificus*), hardhead (*Mylopharadon conocephalus*), Sacramento pikeminnow (*Ptychocheilus grandis*), Sacramento splittail (*Pogonichthys macrolepidotus*), longfin smelt (*Spirinchus thaleichthys*), California roach (*Lavinia symmetricus*), hitch (*Lavinia exilicauda*), Sacramento blackfish (*Orthodon microlepidotus*), and Sacramento sucker (*Catostomus occidentalis*). Non-native fish that may occur in the open water habitats include mosquitofish (*Gambusia affinis*), striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), white catfish (*Ameiurus catus*), channel catfish (*Ictalurus punctatus*), and carp (*Cyprinus carpio*). Many of the non-native fish species are more tolerant of warm water, low dissolved oxygen, and disturbed environments than native species. In general, they are adapted to warm, slow-moving, and nutrient-rich waters (Moyle 2002).

Important attributes of the aquatic habitat at the erosion sites are aquatic vegetation and shaded riverine aquatic (SRA) habitat. SRA is designated by the USFWS as Resource Category 1. Aquatic vegetation is represented by floating, submerged, and emergent vegetation and is measured in the field by estimating the bank-line proportion of vegetation cover along the winter/spring (i.e., high flow) and summer/fall (i.e., low flow) shorelines within the site boundaries. Aquatic vegetation serves as hiding cover and an invertebrate food production base for nearly all aquatic species. The percent of aquatic vegetation cover varies throughout the 25 erosion sites. Shade is represented by overhead canopy cover and is measured by estimating the percent of shoreline in which riparian vegetation extends over the water during average seasonal flows. Overhanging shade is considered to benefit habitat quality by providing hiding cover and increasing food availability for fish species. The existing overhead shade cover at each site was determined by GIS analysis using a digitized canopy shapefile (.shp) layer superimposed upon the seasonal shoreline positions. The proportion of shade cover at the sites ranges from 0 to 100 percent. Generally, greater shade cover occurs during summer when full tree canopies are present. See the standard assessment methodology (SAM) report for modeling of existing shade cover at the erosion sites (Appendix D).

Another important attribute of aquatic habitat at the erosion sites is IWM, which provides essential SRA habitat and velocity refuge. IWM was located at each site and the percent of IWM cover were determined using GIS. The existing IWM coverage at the sites was found to range

from 0 to approximately 73 percent of a site's total length (see Table 3-13 in section 3.7, Geomorphology). Generally, greater IWM cover occurs during winter and spring when a greater proportion of the bank and existing woody materials are submerged during the relatively higher flows. See the SAM report for modeling of existing IWM cover at the erosion sites (Appendix D).

3.5.1.3. Wildlife Resources

Riparian forest, oak woodland, orchard, and riparian scrub communities provide wildlife with dispersal and migration corridors and foraging, cover, nesting, and breeding habitat (including shade and cover for fish and other aquatic species). Many species of amphibians, reptiles, birds, and mammals are known to use riparian habitats and other woody vegetation communities located in proximity to watercourses.

In the vicinity of the erosion sites, species commonly occurring in these habitats include the Pacific treefrog (*Pseudacris regilla*), western fence lizard (*Sceloporus occidentalis*), western scrub-jay (*Aphelocoma californica*), red-shouldered hawk (*Buteo lineatus*), Nuttall's woodpecker (*Picoides nuttallii*), California towhee (*Pipilo crissalis*), spotted towhee (*Pipilo maculates*), black phoebe (*Sayornis nigricans*), mourning dove (*Zenaida macroura*), beaver (*Castor canadensis*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), black-tailed deer (*Odocoileus hemionus*), and raccoon (*Procyon lotor*).

Despite a lack of native plant species richness and complexity, ruderal vegetation habitats provide wildlife species with food resources (e.g., seeds from annual grasses and forbs), as well as foraging, cover, and breeding opportunities. Species commonly occurring within ruderal habitats include the western fence lizard, mourning dove, red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), black-tailed hare (*Lepus californicus*), deer mouse (*Peromyscus maniculatus*), California ground squirrel (*Spermophilus beecheyi*), and pocket gopher (*Thomomys bottae*).

In addition to providing resources for fish, open water habitat provides foraging, cover, reproductive sites, and drinking water for a variety of wildlife species. Western toads (*Bufo boreas*) and Pacific treefrogs use open water and emergent vegetation along riverbanks for reproduction and foraging. Western pond turtles (*Actinemys marmorata*) and western aquatic garter snakes (*Thamnophis couchii*) use IWM and boulders for basking and refuge. Many species of birds, including herons, waterfowl, and insectivorous birds use open water habitats for foraging and resting. Common bird species include the great blue heron (*Ardea herodias*), great egret (*Ardea alba*), common merganser (*Mergus merganser*), double-crested cormorant (*Phalacrocorax auritus*), mallard (A*nas platyrhynchos*), cinnamon teal (*Anas cyanoptera*), Canada goose (*Branta canadensis*), belted kingfisher (*Megaceryle alcyon*), black phoebe (*Sayornis nigricans*), and osprey (*Pandion haliaetus*).

Open water habitat also provides resources for many species of mammals. Several species of bats forage for insects over open water, black-tailed deer and other terrestrial wildlife drink from rivers and streams, and raccoons forage and wash food in nearshore areas. Aquatic and semi-aquatic mammals that use open water habitats include sea lions (in lower reaches of the

Sacramento and American rivers), beaver, river otter (*Lutra canadensis*), mink (*Mustela vison*), and muskrat (*Ondatra zibethicus*).

A summary of wildlife species observed at each of the erosion sites is included in the site characterization reports in Appendix C.

3.5.1.4. Special-Status Species

This section describes the special-status species (listed and other) that have the potential to occur at the erosion sites. For the purpose of this evaluation, special-status fish and wildlife species include species that (1) are listed as threatened or endangered under the federal ESA or the California Endangered Species Act (CESA); (2) proposed for federal listing as threatened or endangered; or (3) state or federal candidates for listing as threatened or endangered. Other special-status fish and wildlife species include those that are identified by DFG as Species of Special Concern and/or California Fully Protected Species. Special-status plant species include plants that (1) are designated as rare by DFG or are listed as threatened or endangered under the ESA or CESA; (2) are proposed for designation as rare or for listing as threatened or endangered; or (3) are candidates for state or federal listing as threatened or endangered. Other special-status plant species are vascular and non-vascular plants included on California Native Plant Society (CNPS) Lists 1A, 1B, or 2.

Special-status species that have the potential to occur in the vicinity of the erosion sites were determined based on a review of pertinent literature, the results of the field surveys, a species list obtained from the USFWS (U.S. Fish and Wildlife Service 2008a), a review of the California Natural Diversity Database (CNDDB), and a review of the CNPS *Electronic Inventory of Rare and Endangered Plants* (California Native Plant Society 2008). For each erosion site, reported occurrences were reviewed for the relevant U.S. Geological Survey (USGS) 7.5-minute quadrangle and the surrounding eight quadrangles.

All special-status species considered for analysis are discussed in the site characterization reports (Appendix C), which provide descriptions of the habitat requirements for each species and an analysis of the habitats present at the erosion sites. Some of these special-status species are found in habitat types that are not present at the erosion sites. These species have been eliminated from further consideration. Special-status species for which potentially suitable habitat was determined to be present are identified in (Table 3-6) and discussed in further detail below.

Table 3-6 Special-Status Species with Potential to Occur at the 25 Erosion Sites

Scientific Name **Common Name**	**Status (Federal/State/ CNPS)**	**Erosion Sites With Potentially Suitable Habitat**
Fish		
Acipenser medirostris Green sturgeon	T/SC	All sites occurring on the Sacramento River, Feather River, American River, and Sutter Bypass.
Hypomesus transpacificus Delta smelt	T/T	SAC 10.8L, SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 73.5L, SAC 78.8L, LAR 10.0L, and LAR 10.6L.
Lampetra ayresi River lamprey	-/SC	All erosion sites except CC 2.8L and CC 3.4L.
Mylopharadon conocephalus Hardhead	-/SC	All erosion sites except CC 2.8L and CC 3.4L.
Oncorhynchus mykiss Central Valley steelhead DPS	T/-	All erosion sites except CC 2.8L and CC 3.4L.
Oncorhynchus tshawytscha Central Valley spring-run Chinook salmon ESU	T/T	All erosion sites except CC 2.8L and CC 3.4L.
Oncorhynchus tshawytscha Winter-run Chinook salmon	E/E	All erosion sites except CC 2.8L and CC 3.4L.
Oncorhynchus tshawytscha Central Valley fall/late fall-run Chinook salmon ESU	SC/SC	All erosion sites except CC 2.8L and CC 3.4L.
Pogonichthys macrolepidotus Sacramento splittail	-/SC	All erosion sites except CC 2.8L and CC 3.4L.
Spirinchus thaleichthys Longfin smelt	-/SC	SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 73.5L, SAC 78.8L, LAR 10.0L, and LAR 10.6L.

Table 3-6 Special-Status Species with Potential to Occur at the 25 Erosion Sites

Scientific Name **Common Name**	**Status (Federal/State/ CNPS)**	**Erosion Sites With Potentially Suitable Habitat**
Wildlife		
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	T/-	Suitable habitat present at SAC 41.9R, SAC 73.5L, SAC 157.7R, FR 1.0L, FR 3.7L, FR 5.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, and CC 3.4L. Suitable habitat within 100 feet of SAC 10.8L and SAC 130.0L.
Actinemys marmorata Western pond turtle	-/SC	All erosion sites.
Thamnophis gigas Giant garter snake	T/T	Suitable habitat present at SBP 0.4E.
Buteo swainsoni Swainson's hawk	-/T	Suitable foraging and/or breeding habitat present at or within a 1-mile radius of all erosion sites, except SAC 8.0L, SAC 10.8L and DC 0.9N.
Dendroica petechia brewsteri Yellow warbler	-/SC	Suitable habitat present at DC 0.9N.
Elanus leucurus White-tailed kite	-/FP	SAC 41.9R, SAC 71.3R, SAC 130.0L, SAC 136.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6, SBP 0.4E, SAC 73.5L, SAC 78.8L, SAC 114.5L, SAC 136.9R, and SAC 157.7R.
Icteria virens Yellow-breasted chat	-/SC	Suitable habitat present at DC 0.9N
Riparia riparia Bank swallow	-/T	Marginally suitable habitat at SAC 136.9R. Suitable habitat adjacent to SAC 130.0L and CC 3.4L.
Lasiurus blossevillii Western red bat	-/SC	SAC 26.0L, SAC 41.9R, SAC 71.3R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, SAC 73.5L, SAC 78.8L, and SAC 157.7R.

Table 3-6 Special-Status Species with Potential to Occur at the 25 Erosion Sites

Scientific Name **Common Name**	**Status (Federal/State/ CNPS)**	**Erosion Sites With Potentially Suitable Habitat**
Plants		
Carex comosa Bristly sedge	-/-/2	Surveys determined this species to be absent.
Cryptantha crinita Silky cryptantha	-/-/1B	Suitable habitat is present at DC 0.9N. Additional surveys would be required to determine the presence/absence of this species.
Hibiscus lasiocarpus Wooly rose-mallow	-/-/2	Suitable habitat is present at SBP 0.4E. Additional surveys would be required to determine presence/absence of this species.
Lathyrus jepsonii var. *jepsonii* Delta tule pea	-/-/1B	Surveys determined this species to be absent.
Lilaeopsis masonii Mason's lilaeopsis	-/R/1B	Observed at SAC 8.0L and SAC 10.8L.
Limosella subulata Delta mudwort	-/-/2	Observed at SAC 10.8L.
Sagittaria sanfordii Sanford's arrowhead	-/-/1B	Surveys determined this species to be absent.
Scutellaria lateriflora Side-flowering skullcap	-/-/1B	Surveys determined this species to be absent.
Symphyotrichum lentum Suisun Marsh aster	-/-/1B	Observed at sites SAC 8.0L and SAC 10.8L.

[1] *Federal and State Codes: E = Endangered; T = Threatened; R = Rare (State); SC = Species of Concern (Federal) or Species of Special Concern (State); FP = Fully Protected (State); DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit*

California Native Plant Society (CNPS) Codes: List 1B = Plants rare, threatened, or endangered in California and elsewhere; List 2 = Plants rare, threatened, or endangered in California but more common elsewhere

Special-Status Fish Species

Green Sturgeon

Status. Green sturgeon (*Acipenser medirostris*) were determined by NMFS to consist of two populations: a northern and a southern distinct population segment (DPS) (68 FR 4433). The Sacramento River supports the southernmost spawning population of green sturgeon (Moyle 2002). The southern DPS of green sturgeon was listed as threatened under the federal ESA on

April 7, 2006 (71 FR 17757) and classified as a Species of Special Concern by DFG in 1995 (Moyle et al. 1995). On March 20, 2006, DFG put into effect emergency green sturgeon regulations that required a year round zero (0) bag limit of green sturgeon in all areas of the state (California Natural Diversity Database 2006). NMFS proposed critical habitat for green sturgeon on September 8, 2008 (73 FR 52084).

Distribution and Life History. The green sturgeon is anadromous, but it is the most marine-oriented of the sturgeon species and has been found in nearshore marine waters from Mexico to the Bering Sea (70 FR 17386). The northern DPS includes known spawning populations in the Rogue, Klamath, and Eel rivers; the southern DPS has a single spawning population in the Sacramento River (National Marine Fisheries Service 2005). Adults typically migrate upstream into rivers between late February and late July. Spawning occurs from March to July, with peak spawning from mid-April to mid-June. Green sturgeon are believed to spawn every 3 to 5 years, although recent evidence indicates that spawning may be as frequent as every 2 years (70 FR 17386). Little is known about the specific spawning habitat preferences of green sturgeon. Adults are believed to broadcast their eggs in deep, fast water over large cobble substrate where the eggs settle into the interstitial spaces (Moyle 2002). Spawning is generally associated with water temperatures from 46 to 57 ºF. In the Central Valley, spawning occurs in the Sacramento River upstream of Hamilton City, perhaps as far upstream as Keswick Dam (Adams et al. 2002), and possibly in the lower Feather River (Moyle 2002).

Green sturgeon eggs hatch in approximately 8 days at 55 ºF (Moyle 2002). Larvae begin feeding 10 days after hatching. Metamorphosis to the juvenile stage is complete within 45 days of hatching. Larval green sturgeon have been captured more frequently in shallow, low slope areas (R. Corwin, U.S. Bureau of Reclamation, pers. comm. to B. Chasnoff, Stillwater Sciences, September 18, 2008). Juveniles spend 1 to 4 years in fresh and estuarine waters (such as the Delta) and migrate to salt water at lengths of 12 to 30 inches (70 FR 17386).

Little is known about movements, habitat use, and feeding habits of green sturgeon. They have been salvaged at state and federal fish collection facilities in every month, indicating that they are present in the Delta year-round. Juveniles and adults are reported to feed on benthic invertebrates, including shrimp and amphipods, and small fish (70 FR 17386).

Potential for Occurrence in the Project Area. Green sturgeon may occur at the erosion sites, either as adults migrating upstream to their spawning habitat, or as juveniles, rearing and migrating towards the ocean. Adult sturgeon tend to utilize deep channel habitat for spawning, and juveniles are likely to utilize bank habitat as it provides increased protection, shade, and food. Green sturgeon have the potential to occur at all sites on the Sacramento River, Feather River, American River, and Sutter Bypass.

<u>*Delta Smelt*</u>

Status. Delta smelt (*Hypomesus transpacificus*) were federally listed as threatened on March 5, 1993 (58 FR 12854) and critical habitat was designated on December 19, 1994 (59 FR 65256). Currently, the USFWS is considering upgrading the status of the delta smelt from threatened to endangered. On March 4, 2009, delta smelt were proposed for endangered status under the CESA by the California Fish and Game Commission (CCR Title 14, Section 670.5).

Distribution and Life History. Delta smelt are endemic to the Sacramento-San Joaquin estuary and are found seasonally in Suisun Bay and Suisun Marsh (Moyle 2002). The species is typically found in shallow water (<10 feet) where salinity ranges from 2 to 7 parts per thousand (ppt), although they have been observed at salinities between 0 and 18.4 ppt (Moyle 2002). Delta smelt abundance and geographic distribution are dependent upon freshwater outflows and the salinity of the San Francisco Estuary and Delta (Moyle 2002, Bennett 2005). Water clarity and salinity seem to be the most reliable abiotic predictors of delta smelt abundance during the summer and fall (Feyrer et al. 2007, Nobriga et al. 2008). In the Sacramento River, they have been documented upstream to the City of Sacramento (RM 60), but they are typically restricted to the Delta and the lower Sacramento River downstream of RM 20 (Moyle 2002). During periods of high river outflow, delta smelt distribution extends from the lower Sacramento River into Suisun Bay, whereas during low flow periods they occur farther upstream, concentrating in the upper Delta and lower Sacramento River (Moyle 2002). Delta smelt have relatively low fecundity and most live for 1 year (Moyle 2002). They feed on planktonic copepods, cladocerans, amphipods, and insect larva (Moyle 2002).

Delta smelt are semi-anadromous. During their spawning migration, adults move into the freshwater channels and sloughs of the Delta between December and January (Moyle 2002). Spawning occurs between January and July, with peak spawning from April through mid-May (Moyle 2002). Spawning locations in the Delta have not been identified and are inferred from larval catches (Bennett 2005). Larval fish have been observed in Montezuma Slough (Wang 1986), Suisun Slough in Suisun Marsh (Moyle 2002), the Napa River estuary (Stillwater Sciences 2006), the Sacramento River above Rio Vista, and Cache, Lindsey, Georgiana, Prospect, Beaver, Hog, Sycamore, and Barker sloughs (U.S. Fish and Wildlife Service 1996). Spawning was also observed in the Sacramento River up to Garcia Bend (RM 50) during drought conditions because of increased saltwater intrusion that moved delta smelt spawning and rearing farther inland (Wang and Brown 1993). Laboratory experiments have found eggs to be adhesive and demersal (i.e., sinking to or deposited on the bottom of a body of water). They are usually attached to substrate, likely composed of gravel, sand, or other submerged material (Moyle 2002, Wang 1991). Hatching takes approximately 9 to 13 days, and larvae begin feeding 4 to 5 days later (Moyle 2002). Newly hatched larvae contain a large oil globule that makes them semi-buoyant and allows them to stay near the bottom (Moyle 2002). As their fins and swim bladder develop, they move higher into the water column and are washed downstream to the open waters of the estuary (Moyle 2002).

Potential for Occurrence in the Project Area. Delta smelt may be present at the erosion sites in the lower Sacramento River (SAC 8.0L, 10.8L, 26.0L, 35.4L, 41.9R) throughout their life cycle; and these areas of the Sacramento River have been designated as critical habitat. Delta smelt have been documented upstream to the City of Sacramento (RM 60) (Moyle 2002) and may occur at SAC 71.3R, SAC 73.5L, SAC 78.8L, LAR 10.0L, and LAR 10.6L. Although it is uncertain if they would be present at sites upstream of RM 60, analysis of the potential effects on delta smelt at all sites upstream of RM 60 in Region 1b (RM 20-80), but not Regions 2 and 3 (RM 80-194), are included for the purpose of this evaluation.

River Lamprey

Status. River lamprey (*Lampetra ayresii*) are designated as a DFG Species of Special Concern (California Department of Fish and Game 2008a).

Distribution and Life History. River lamprey are anadromous. Like salmon, they are born in freshwater streams, migrate to the ocean, and return to fresh water as mature adults to spawn. Also, like the salmon, lampreys do not feed during their spawning migration. Mating pairs of lamprey construct a nest by digging together using rapid vibrations of their tails and by moving stones using their suction mouths. They enter streams from July to October; spawning takes place the following spring when water temperatures are between 50.0 and 62.6 °F. They ascend rivers by alternately swimming upstream in brief spurts and resting by sucking and holding onto rocks. Spawning takes place in low-gradient reaches of streams with gravel and sandy bottoms. Adults die within 4 days of spawning after depositing from 10,000 to 100,000 very small eggs in their nest. The young hatch in 2 to 3 weeks and swim to areas of low-velocity water where sediments are soft and rich in dead plant materials. They quickly burrow into the muddy bottom, where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals.

Potential for Occurrence in the Project Area. River lamprey have the potential to occur at all project sites except CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003).

Hardhead

Status. Hardhead (*Mylopharodon conocephalus*) are designated as a DFG Species of Special Concern (California Department of Fish and Game 2008a).

Distribution and Life History. Hardhead are large cyprinids that closely resemble Sacramento pikeminnow and have a wide distribution in low- to mid-elevation streams in the Sacramento and San Joaquin river drainages. Hardhead typically inhabit undisturbed areas of larger low- to mid-elevation streams, although they are also found in the mainstem Sacramento River at low elevations and in its tributaries to about 4,921 feet. In the Central Valley, the species occupies the relatively undisturbed reaches of larger low- to mid-elevation streams (Moyle and Daniels 1982, Mayden et al. 1991; both as cited in Moyle 2002) and the mainstem Sacramento River (Reeves 1964). They prefer clear, deep pools and runs with slow velocities and occur in streams where summer temperatures reach in excess of 68 ºF (Moyle 2002). They appear to have very restricted microhabitat preferences, being found in large, warm streams that contain deep, rock-bottomed pools (Moyle et al. 1982). Juveniles are found in pools and shallower areas of these same stream reaches (Moyle et al. 1982). Deep pools and runs with sand-gravel-boulder substrates, low turbidities, and low water velocities appear to be preferred (Alley 1977a, b; Cooper 1983; Knight 1985; Moyle and Baltz 1985; Mayden et al. 1991; all as cited in Moyle 2002).

Hardhead reach sexual maturity in their third year (Moyle 2002). Spawning of hardhead occurs primarily in April and May (Reeves 1964, Grant and Maslin 1997; both as cited in Moyle 2002), but may extend into August in some foothill streams (Wang 1986). Adult fish from larger rivers or reservoirs may undertake upstream spawning migrations into tributaries to spawn (Wales 1946, Moyle et al. 1995; both as cited in Moyle 2002). Others may move only a short

distance from a home pool upstream or downstream to spawn (Grant and Maslin 1997). Although spawning activity has not been observed, hardhead are thought to spawn over gravel in riffles, runs, or the heads of pools (Moyle 2002). Little is known regarding their early life history; larval and post-larval fish likely remain along the edges of streams in dense cover and move into deeper habitats as they grow (Moyle 2002). Juvenile hardhead rear in shallow backwater areas (Moyle 2002).

Historically, hardhead have been regarded as widespread and abundant in central California and are still widely distributed in foothill streams. Hardhead are a Species of Special Concern because their increasingly isolated populations make them vulnerable to localized extinctions. Hardhead also tend to be absent from streams where introduced species dominate (Moyle and Daniels 1982, Mayden et al. 1991), and from streams that have been severely altered by human activity (Baltz and Moyle 1993).

Potential for Occurrence in the Project Area. Hardhead have the potential to occur at all project sites except CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm.. 2003).

Central Valley Steelhead

Status. The Central Valley steelhead (*Oncorhynchus mykiss*) DPS (formerly evolutionarily significant unit (ESU)) was federally listed as threatened on March 19, 1998 (63 FR 13347), reaffirmed in NMFS final listing determination on January 5, 2006 (71 FR 834), and critical habitat for Central Valley steelhead was designated on September 2, 2005 (70 FR 52488). Designated critical habitat for the Central Valley steelhead DPS includes all river reaches accessible to steelhead in the Sacramento and San Joaquin rivers and their tributaries.

Distribution and Life History. Central Valley steelhead ranged throughout the tributaries of the Sacramento and San Joaquin rivers prior to the dam construction, water development, and watershed perturbation of the 19th and 20th centuries. Wild stocks are now mostly confined to the upper Sacramento River downstream of Keswick Dam; upper Sacramento River tributaries such as Deer, Mill, and Antelope creeks; and the Yuba River downstream of Englebright Dam. The abundance of naturally reproducing Central Valley steelhead, as measured by the number of adults returning to spawn, is largely unknown. Natural escapement in 1995 was estimated to be about 1,000 adults each for Mill and Deer creeks and the Yuba River (S. P. Cramer and Associates 1995). Hatchery returns have averaged around 10,000 adults (Mills and Fisher 1994). The most recent annual estimate of adults spawning upstream of Red Bluff Diversion Dam is less than 2,000 fish (71 FR 834).

Steelhead have one of the most complex life histories of any salmonid species, exhibiting both anadromous and freshwater resident life histories. Freshwater residents of the species are referred to as rainbow trout, and those exhibiting an anadromous life history are called steelhead. Steelhead exhibit highly variable life history patterns throughout their range, but are broadly categorized into winter and summer reproductive ecotypes. Winter steelhead is the most widespread reproductive ecotype and the only type currently present in Central Valley streams (McEwan and Jackson 1996). They become sexually mature in the ocean, enter spawning streams in summer, fall, or winter, and spawn later in winter or late spring (Meehan and Bjornn 1991, Behnke 1992).

In the Sacramento River, adult winter steelhead migrate upstream during most months of the year, beginning in July, peaking in September, and continuing through February or March (Hallock 1987). Spawning occurs primarily from January through March, but may begin as early as late December and may extend through April (Hallock 1987). Individual steelhead may spawn more than once, returning to the ocean between each spawning migration.

Juvenile steelhead rear a minimum of 1 year, but typically spend 2 or more years in fresh water before migrating to the ocean during smoltification (the process of physiological change that allows ocean survival). Juvenile migration to the ocean generally occurs from December through August. The peak months of juvenile migration are January to May (McEwan 2001). The importance of main channel and floodplain habitats to steelhead in the lower Sacramento River and upper Delta is not well understood. Steelhead smolts have been found in the Yolo Bypass during the period of winter and spring inundation (T. Sommer, pers. comm. 2002), but the importance of this and other floodplain areas in the lower Sacramento River and upper Delta is not yet clear.

Potential for Occurrence in the Project Area. Central Valley steelhead occur at the erosion sites as adults, migrating upstream to their spawning habitat, and as juveniles and smolts, rearing and migrating toward the ocean. Central Valley steelhead have the potential to occur at all erosion sites except for CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003, National Marine Fisheries Service 2009). Additionally, spawning steelhead have the potential to occur near sites DC 0.9N (McEwan and Jackson 1996) and LAR 10.0L and LAR 10.6L (Hannon and Healy 2007).

<u>*Central Valley Spring-Run Chinook Salmon*</u>

Status. The Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) ESU was federally listed as threatened on September 16, 1999 (64 FR 50394). Their threatened status was reaffirmed in NMFS' final listing determination issued on June 28, 2005 (70 CFR 37160). Critical habitat for Central Valley spring-run Chinook salmon was designated by NMFS on September 2, 2005 (70 FR 52488). Designated critical habitat includes the San Francisco Bay-Delta estuary, mainstem Sacramento River upstream to Keswick Dam, and most of the Sacramento Valley's perennial tributaries with established spring salmon runs, including the Feather River and Feather River Hatchery.

Distribution and Life History. Adult Central Valley spring-run Chinook salmon enter the mainstem Sacramento River from March through September, with the peak upstream migration occurring from May through June (Yoshiyama et al. 1998). They are sexually immature during upstream migration, and adults hold in deep, cold pools near spawning habitat until sexually mature and spawning commences in late summer and fall. Central Valley spring-run Chinook salmon spawn in the upper reaches of the mainstem Sacramento River and tributary streams (Myers et al. 1998), with the largest tributary runs occurring in Butte, Deer, and Mill creeks (Yoshiyama et al. 1998). Spawning typically begins in late August and may continue through October. Juveniles emerge in November and December in most locations, but may emerge later when water temperature is cooler. Newly emerged fry remain in shallow, low-velocity edge water (California Department of Fish and Game 1998).

Juvenile Central Valley spring-run Chinook salmon have highly variable rearing and outmigration patterns, with juveniles rearing anywhere from 3 to 15 months before outmigrating to the ocean (Fisher 1994). Scale analyses indicate that most returning adults (>90 percent) have emigrated as sub-yearlings (Myers et al. 1998). Rearing takes place in their natal streams, the mainstem of the Sacramento River, inundated floodplains (including the Sutter and Yolo bypasses), and the Delta. Based on observations in Butte Creek and the Sacramento River, young-of-year juveniles typically migrate from November through May. Yearling Central Valley spring-run Chinook salmon migrate from October to March, with peak migration in November (S. P. Cramer and Associates 1997, Hill and Webber 1999). Downstream migration of yearlings typically coincides with the onset of the winter storm season, and migration may continue through March (California Department of Fish and Game 1998).

Potential for Occurrence in the Project Area. Central Valley spring-run Chinook salmon occur at the erosion sites, either as adults migrating upstream to their spawning habitat, or as juveniles, rearing and migrating towards the ocean. Juveniles tend to utilize bank habitat more frequently than the main channel because it provides increased protection, shade, and food. Central Valley spring-run Chinook salmon have the potential to occur at all erosion sites except CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003, National Marine Fisheries Service 2009). Spring-run Chinook salmon have the potential to spawn in the vicinity of DC 0.9N, but are more likely to spawn in reaches of Deer Creek further upstream (California Department of Fish and Game 1998, 2004).

Sacramento River Winter-Run Chinook Salmon

Status. The Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) ESU was listed as endangered under CESA and threatened under the federal ESA in 1989 (54 FR 32085). After several years of low escapements, NMFS subsequently upgraded the federal listing to endangered in 1994 (59 FR 440). The endangered status was reaffirmed on June 28, 2005 (70 FR 37160). NMFS designated critical habitat for Sacramento River winter-run Chinook salmon in 1993 (58 FR 33212). The critical habitat designation includes the Sacramento-San Joaquin Delta and the Sacramento River within all accessible reaches.

Distribution and Life History. Sacramento River winter-run Chinook salmon spend 1 to 3 years in the ocean. Adult Sacramento River winter-run Chinook salmon leave the ocean and migrate through the Delta into the Sacramento River from December through July, with peak migration in March (Moyle 2002). Adults spawn from mid-April through August (Moyle 2002), and egg incubation continues through October. The primary spawning habitat in the Sacramento River is above Red Bluff Diversion Dam at RM 243, although spawning has been observed downstream as far as RM 218 (National Marine Fisheries Service 2001). Spawning success below the Red Bluff Diversion Dam may be limited primarily by warm water temperatures (Hallock and Fisher 1985, Yoshiyama et al. 1998).

Downstream movement of juvenile Sacramento River winter-run Chinook salmon begins in August soon after fry emerge. The peak abundance of juveniles moving downstream occurs at Red Bluff in September and October (Vogel and Marine 1991). Juvenile Chinook salmon move downstream from spawning areas in response to many factors, which may include inherited

behavior, habitat availability, flow, competition for space and food, and water temperature. The number and timing of juvenile movements is highly variable. Storm events and the resulting high flow and turbidity appear to trigger downstream movement of substantial numbers of juvenile Chinook salmon. The Sacramento River channel is the main migration route for winter-run juveniles; however, the Sutter and Yolo bypasses also provide significant outmigration passage during higher flow events.

Sacramento River winter-run Chinook salmon smolts (i.e., juveniles that are physiologically ready to enter seawater) may migrate through the Delta and bay to the ocean from November through May (Yoshiyama et al. 1998). In general, juvenile abundance in the Delta increases in response to increased Sacramento River flow (Brandes and McLain 2001). During winter in the Sacramento-San Joaquin system, juveniles rear on seasonally inundated floodplains. Sommer et al. (2001) found higher growth and survival rates of juvenile Chinook salmon that reared on the Yolo Bypass floodplain compared with those that reared in the mainstem Sacramento River.

Potential for Occurrence in the Project Area. Sacramento River winter-run Chinook salmon occur at the erosion sites, either as adults migrating upstream to their spawning habitat or as juveniles, rearing and migrating towards the ocean. Juvenile Chinook salmon tend to utilize bank habitat more frequently than the main channel because it provides increased protection, shade, and food. Sacramento River winter-run Chinook salmon have the potential to occur at all erosion sites except CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003, National Marine Fisheries Service 2009).

<u>*Central Valley Fall/Late Fall-Run Chinook Salmon*</u>

Status. The Central Valley fall-/late fall-run Chinook salmon (*Oncorhynchus tshawytscha*) is not listed under CESA or the ESA, but is classified by NMFS as a Species of Concern (69 FR 19975) and designated as a DFG Species of Special Concern.

Distribution and Life History. Adult Central Valley fall-run Chinook salmon migrate into the Sacramento River and its tributaries from June through December in mature condition and spawn from late September through December, soon after arriving at their spawning grounds (Yoshiyama et al. 1998). The spawning peak occurs in October and November. Emergence occurs from December through March, and juveniles migrate downstream through the Delta and out to the ocean soon after emerging, rearing in fresh water for only a few months. Smolt outmigration typically occurs from March through July (Yoshiyama et al. 1998).

Late Central Valley fall-run Chinook salmon migrate upstream before they are sexually mature and hold near the spawning grounds for 1 to 3 months before spawning. Upstream migration takes place from October through April and spawning occurs from late January through April, with peak spawning in February and March (Yoshiyama et al. 1998). Fry emerge from the redds from April through June. Juvenile Central Valley late fall-run Chinook salmon rear in their natal stream during the summer and in some streams they remain throughout the year. Juveniles rearing in off-channel habitats were found to grow at a higher rate than those in main-channel habitats (Limm and Marchetti, 2003). Smolt outmigration can occur from November through May (Yoshiyama et al. 1998).

Potential for Occurrence in the Project Area. Central Valley fall-/late fall-run Chinook salmon occur at the erosion sites, either as adults migrating upstream to their spawning habitat or as juveniles and smolts, rearing and migrating towards the ocean. Central Valley fall-run Chinook salmon have the potential to occur at all erosion sites except CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003, National Marine Fisheries Service 2009). Additionally, spawning fall-run Chinook salmon have the potential to occur in the vicinity of sites DC 0.9N (California Department of Fish and Game 1998, 2004) and LAR 10.0L and LAR 10.6L, but likely just upstream of these sites (Yoshiyama et al. 1998).

<u>Sacramento Splittail</u>

Status. Sacramento splittail (*Pogonichthys macrolepidotus*) were previously listed under the ESA as a threatened species; however, in 2003 the USFWS removed the listing (FR 68 55140). The Sacramento splittail is currently designated as a DFG Species of Special Concern.

Distribution and Life History. Sacramento splittail are hardy cyprinid minnows capable of tolerating high salinities (<20 ppt) and low levels of dissolved oxygen (<1.0 mg/L) (Young and Cech 1996). Adults move upstream from late November to late January, foraging in flooded areas along the main rivers, bypasses, and tidal freshwater marsh areas of Montezuma and Suisun sloughs and in San Pablo Bay prior to the onset of spawning (Moyle et al. 2001). Feeding in flooded riparian areas prior to spawning may contribute to spawning success and survival of adults after spawning (Moyle et al. 2001). Sacramento splittail migration appears closely tied to river outflow. In wet years with increased river flow, adults will move long distances upstream to spawn, allowing juvenile rearing in upstream habitats. The upstream migration is smaller during dry years, although larvae and juveniles are often found upstream of Sacramento to Colusa or Ord Bend on the Sacramento River (Moyle et al. 2001). Sacramento splittail are thought to be fractional spawners, with individuals spawning over a protracted period, often for as long as several months (Wang 1991). Spawning typically occurs on inundated floodplains from February through June, with peak spawning in March and April. The adhesive eggs are released by the female and fertilized by one or more attendant males. They adhere to vegetation until hatching (Moyle 2002).

After emergence, most larval Sacramento splittail remain in flooded riparian areas for 10–14 days, most likely feeding among submerged vegetation before moving off floodplains into deeper water as they become stronger swimmers (Sommer et al. 1997, Wang 1986; both as cited in Moyle 2002). Although juvenile Sacramento splittail are known to rear in upstream areas for a year or more (Baxter 1999, as cited in Moyle et al. 2001), most move to tidal waters after only a few weeks, often in response to flow pulses (Moyle et al. 2001). Juvenile splittail are found in off-channel and backwater habitat rather than main channel habitats in both upstream and in intertidal areas (Feyrer et al. 2005). The majority of juveniles evidently move downstream into shallow, productive bay and estuarine waters from April to August (Meng and Moyle 1995).

Potential for Occurrence in the Project Area. Adult and juvenile Sacramento splittail may occur at the erosion sites. The species' original range included the Sacramento River as far upstream as Redding, the Feather River upstream to Oroville, and the American River upstream to Folsom. Most Sacramento splittail are currently found in the Delta and Suisun Marsh (Moyle

2002). However, in wet years they have been known to ascend the Sacramento River as far upstream as the Red Bluff Diversion Dam and into the lower Feather and American rivers (Sommer et al. 1997, Baxter 1999, 2000; all as cited in Moyle 2002). Currently the Sutter and Yolo bypasses along the lower Sacramento River appear to be important Sacramento splittail spawning areas (Sommer et al. 1997). Sacramento splittail have the potential to occur at all project sites except CC 2.8L and CC 3.4L as this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003, National Marine Fisheries Service 2009).

Longfin Smelt

Status. A petition to list longfin smelt (*Spirinchus thaleichthys*) under the ESA was submitted to the USFWS in August 2007 (The Bay Institute et al. 2007). In May 2008, the USFWS initiated a status review to determine if a listing was warranted (73 FR 24911). The public comment period ended on July 7, 2008. At present, USFWS is conducting a 12-month status review of the species before a ruling is made. On January 23, 2009, DFG issued a status review of the species to the California Fish and Game Commission (California Department of Fish and Game 2009). On March 4, 2009, the California Fish and Game commission voted to change the status of longfin smelt to threatened (S. Fonbuena, California Department of Fish and Game, pers. comm. to B. Amerson, Stillwater Sciences, March 9, 2009).

Distribution and Life History. Longfin smelt are an anadromous fish that spawns in the Delta. They are locally found in Suisun, San Pablo, and San Francisco bays, as well as the waters immediately outside of the Golden Gate. Longfin smelt typically spawn at 2 years old but some females may spawn in their third year of life. The majority of spawning occurs from February through April. Spawning occurs over a variety of substrates, including sand, gravel, rocks, and plants. Newly hatched larvae migrate downstream towards rearing habitat near RM 20, the upstream extent of the salt and freshwater mixing zone (X2). As they mature, juvenile longfin smelt will migrate farther downstream into Suisun, San Pablo, and San Francisco bays. The primary food source of longfin smelt are opossum shrimp (*Neomysis* spp.), but smaller individuals feed heavily on copepods (Moyle 2002, as cited in Baxter et al. 2008).

Potential for Occurrence in the Project Area. Longfin smelt are found in the project areas only when they enter freshwater to spawn. They are generally found in the Sacramento River downstream of Rio Vista. Their potential for occurrence at the erosion sites is likely similar to that for delta smelt.

Special-Status Wildlife Species

Valley Elderberry Longhorn Beetle

Status. On August 8, 1980, the USFWS listed the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) as threatened and designated critical habitat along the American River Parkway and in an area within the city of Sacramento (45 FR 52803 52807). On October 2, 2006, the USFWS announced a recommendation that this species be delisted (removed from the federal lists of endangered and threatened wildlife and plants) (U.S. Fish and Wildlife Service 2006).

Distribution and Life History. The VELB is an insect endemic to the foothills and Central Valley of California. It inhabits riparian and associated upland habitats where

elderberry, its host plant, grows. Specifically, its range extends throughout the Central Valley and adjacent foothills up to the 3,000-foot elevation level to the east and the Central Valley watershed to the west (U.S. Fish and Wildlife Service 1999). VELB habitat consists of riparian forests whose dominant plant species include cottonwood (*Populus* sp.), sycamore (*Platanus* sp.), valley oak, and willow, with an understory of elderberry shrubs (U.S. Fish and Wildlife Service 1991). Elderberry shrubs with stems measuring 1 inch or larger in diameter at ground level are considered by the USFWS as suitable VELB habitat (U.S. Fish and Wildlife Service 1999).

The VELB life cycle is intimately connected to its habitat, elderberry shrubs. Following mating, the female lays her eggs in crevices in the elderberry bark. Upon hatching (after about 10 days), the larvae bore into the pith of the shrub and feed inside the larger stems for 1 to 2 years until they mature. They emerge as adults during the spring via exit holes chewed through the bark. The adult beetles feed on the elderberry foliage until they mate, completing the cycle. Adults are active from March to June.

Potential for Occurrence in the Project Area. Elderberry shrubs are present at erosion sites SAC 41.9R, FR 1.0L, FR 3.7L, FR 5.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L, SAC 73.5L, and SAC 157.7R. They are not present within erosion sites SAC 10.8L and SAC 130.0L, but occur within 100 feet of these sites. Elderberry shrubs have been reported within 2.2 miles of SAC 130.0L and 0.8 mile of SAC 157.7R (California Department of Fish and Game 2008b). Critical habitat occurs approximately 2.5 miles upstream of LAR 10.0L and LAR 10.6L.

Focused surveys for elderberry shrubs were conducted by North State Resources, Inc., and Parus Consulting at each of the 25 erosion sites from August 2008 through February 2009. These surveys were conducted in accordance with USFWS valley elderberry longhorn beetle conservation guidelines (U.S. Fish and Wildlife Service 1999). Results are presented in the site characterization reports in Appendix C.

<u>*Western Pond Turtle*</u>

Status. The western pond turtle (*Actinemys marmorata*) is designated by DFG as a Species of Special Concern (California Department of Fish and Game 2008a).

Distribution and Life History. The western pond turtle is found in the quiet waters of ponds, marshes, creeks, and irrigation ditches. Pond turtles require basking sites such as partially submerged logs, rocks, mats of floating vegetation, and open mud banks. They frequently bask out of the water on logs or other objects when water temperatures are low and air temperatures are warmer than water temperatures. When air temperatures become too warm, western pond turtles water bask by lying in the warmer surface water layer with their heads out of the water. In colder areas, they hibernate by burrowing in the bottom mud (Zeiner et al. 1988).

Mating typically occurs in late April or early May, but may occur year-round. Nests are located in an upland area that may be up to 0.25 mile from the aquatic site (California Department of Fish and Game 1994a). Hatchling turtles are thought to emerge from the nest and move to the aquatic site in the spring.

Today, the western pond turtle occurs in 90 percent of its historic range in the Central Valley and west of the Sierra Nevada, but in greatly reduced numbers (Jennings and Hayes 1994).

Potential for Occurrence in the Project Area. Western pond turtles may occur at any of the erosion sites. However, Cache Creek contains marginally suitable habitat because its banks are deeply incised. Western pond turtles may use Cache Creek as a migration corridor but it is unlikely they will nest within erosion sites CC 2.8L and CC 3.4L. Aquatic habitat is present at SAC 35.4L, but suitable upland habitat is not present. The area on either side of this site has recently been repaired using angular revetment, limiting suitable breeding and basking habitat for this species.

<u>*Giant Garter Snake*</u>

Status. The giant garter snake (*Thamnophis gigas*) was listed as threatened by the USFWS on October 20, 1993 (58 FR 54053).

Distribution and Life History. The giant garter snake is endemic to the floors of the Sacramento and San Joaquin valleys (Miller et al. 1999). Its current range is from Chico in Butte County to Burrel in Fresno County (California Department of Fish and Game 2007).

This species inhabits fresh water marshes and low gradient streams. Additionally, human-made habitats such as ponds, drainage ditches, and irrigation canals have become important in providing habitat for the species. The development of rice cultivation in the range of the giant garter snake has also contributed to providing habitat for this species as rice cultivation practices mimic the life history cycle of the giant garter snake. Habitat requirements generally consist of adequate water during the species' active season from early spring through mid-fall; emergent herbaceous wetland vegetation providing cover and foraging habitat during the active season; grassy banks and openings in waterside vegetation for basking; and higher elevation uplands for cover and refuge from floodwaters during the species dormant season (Miller et al. 1999). Small mammal burrows with south and west exposures are typically selected for the winter dormancy period (U.S. Fish and Wildlife Service 2007).

Giant garter snakes feed on aquatic prey such as fish and tadpoles. The mating season extends through March and April, with females giving birth from July through early September. The young disperse immediately after hatching, absorbing their yolk sacs, then feeding on their own (U.S. Fish and Wildlife Service 2007).

Potential for Occurrence in the Project Area. Slow-moving water and emergent vegetation coupled with nearby rice cultivation at SBP 0.4E provides potentially suitable habitat for this species. CNDDB records occur at SAC 8.0L and FR 3.7L, respectively (California Department of Fish and Game 2008b); however, the potential for the Sacramento River in the Delta and this portion of the Feather River to support this species is very low. Historically, floodplains of these rivers may have provided habitat in the surrounding marshes and emergent wetlands, but conversion of floodplains to agriculture through the construction of levees has eliminated suitable habitat, and large rivers currently do not support populations of giant garter snake (Miller et al. 1999). The specimens recorded in the CNDDB were likely displaced from suitable habitat or otherwise moving through uncharacteristic habitat.

One CNDDB record occurs approximately 2.2 miles southwest of SBP 0.4E (California Department of Fish and Game 2008b). This species is also known to occur in the Sutter Basin. Additionally, the presence of emergent vegetation and rice fields enhances the suitability of this habitat for the giant garter snake. Therefore, there is potential for this species to occur at SBP 0.4E.

Swainson's Hawk

Status. The Swainson's hawk (*Buteo swainsoni*) was listed by DFG as a threatened species in 1983 (California Department of Fish and Game 2008c).

Distribution and Life History. The Swainson's hawk is a hawk of open habitats and, historically, was once one of the most common birds of prey in the grasslands of California. However, the populations of this species have declined at least 90 percent since 1900, and it is believed that they are still in decline (Thelander and Crabtree 1994). Swainson's hawks once nested in the majority of the lowland areas in the state. Currently, its nesting range is primarily restricted to small areas of the Sacramento and San Joaquin valleys and northeast California (Bloom 1980).

Swainson's hawks preferred prey items are voles (*Microtus* sp.), gophers, birds, and insects such as grasshoppers (Estep 1989). They require large amounts of foraging habitat, preferably grassland or pasture, but have adapted to some croplands, particularly alfalfa, but also including hay, grain, tomatoes, beets, and other row crops (Estep 1989). Crops such as cotton, corn, rice, orchards, and vineyards are not suitable because they lack suitable prey or the prey is unavailable due to the vegetation structure. In the Central Valley, Swainson's hawks generally use riparian habitat for nesting sites (Bloom 1980).

Potential for Occurrence in the Project Area. Potentially suitable nesting and foraging habitat occurs at all erosion sites except SAC 8.0L, SAC 10.8L, and DC 0.9N. SAC 8.0L and SAC 10.8L do not have suitable nest trees or foraging habitat and there are no CNDDB records within 5 miles of these sites (California Department of Fish and Game 2008b). Site DC 0.9N is outside of the known range of Swainson's hawks.

Yellow Warbler

Status. The yellow warbler (*Dendroica petechia brewsteri*) is designated by DFG as a Species of Special Concern (California Department of Fish and Game 2008a).

Distribution and Life History. The yellow warbler is a long-distance migrant, usually arriving in California in April and leaving for the tropics by October. The species breeds from mid-April to early August, building an open cup nest in a tree or shrub. Yellow warblers typically forage by gleaning and hovering for insects and spiders. They generally nest in wet, dense riparian thickets, especially those dominated by willows (Lowther et al. 1999).

In California, yellow warblers are typically distributed in riparian woodlands from the mountains and foothills of the Cascades and Sierra Nevada to the coastal lowlands. They are largely absent from the Central Valley (Lowther et al. 1999); however, new occurrences of yellow warblers are beginning to be found where restoration has taken place (Szlosek 2007).

Potential for Occurrence in the Project Area. Yellow warblers have the potential to nest in the riparian habitat present at site DC 0.9N. However, due to their limited known distribution in the Central Valley, it is unlikely they would nest in riparian habitats present at the remaining erosion sites.

White-Tailed Kite

Status. The white-tailed kite (*Elanus leucurus*) is designated by DFG as a fully protected species (California Department of Fish and Game 2008a).

Distribution and Life History. The white-tailed kite occurs year-round in the lowlands of California's Central Valley. The species can be found in a variety of habitat types, including open grasslands, meadows, emergent wetlands, and agricultural lands. Nests are constructed near the top of dense oaks, willows, or other trees located adjacent to foraging areas. The species forages in undisturbed open grasslands, meadows, farmlands, and emergent wetlands. White-tailed kites are seldom observed more than 0.5 mile from an active nest during the breeding season (Zeiner et al. 1990a).

Potential for Occurrence in the Project Area. Suitable nesting and foraging habitat is present at sites SAC 41.9R, SAC 71.3R, SAC 87.0L, SAC 130.0L, SAC 136.7R, SAC 157.7R, FR 1.0L, FR 3.8L, FR 7.0L, LAR 10.0L, LAR 10.6L, and SBP 0.4E. The remaining sites do not contain sufficient riparian habitat to support breeding. One CNDDB record occurs within sites LAR 10.0L and LAR 10.6L (California Department of Fish and Game 2008b).

Yellow-Breasted Chat

Status. The yellow-breasted chat (*Icteria virens*) is designated by DFG as a Species of Special Concern (California Department of Fish and Game 2008a).

Distribution and Life History. Yellow-breasted chats are Neotropical migrants that occur as summer breeding residents in riparian or marsh habitats throughout northern California. They are found in dense, brushy thickets near water and in the thick understory of riparian woodlands. Yellow-breasted chats typically forage by gleaning insects, spiders, and berries from the foliage of shrubs and low trees. Nests are often low to the ground in dense shrubs along streams.

Yellow-breasted chats are an uncommon summer resident of coastal California and the foothills of the Sierra Nevada. They are generally absent from the Central Valley south of Colusa County (Zeiner et al. 1990a).

Potential for Occurrence in the Project Area. Yellow-breasted chats may nest in the riparian habitats present at site DC 0.9N. They are not likely to occur at erosion sites south of Colusa County. Riparian habitats in erosion sites SAC 130.0L, SAC 136.7L, SAC 136.9L, SAC 157.7R, and SBP 0.4E (i.e., other sites north of Colusa County) do not support riparian areas sufficient to provide nesting habitat.

Bank Swallow

Status. Bank swallows (*Riparia riparia*) are listed as threatened by DFG (California Department of Fish and Game 2008c).

Distribution and Life History. Bank swallows are typically found between April and September, primarily in riparian and other lowland habitats in the Central Valley. They nest colonially and inhabit isolated places where vertical bluffs or riverbanks with fine-textured soils in which to dig burrows are available. Bank swallows forage over open riparian areas, brushland, grassland, and cropland (Zeiner et al. 1990a).

The range of bank swallows in California is estimated to be have been reduced by 50 percent since 1900 (Zeiner et al. 1990a). Now, only 110 to 120 colonies remain within the state. Perhaps 75 percent of the current breeding population in California occurs along the banks of the Sacramento and Feather rivers in the northern Central Valley in areas where the rivers still meander in a mostly natural state. Other colonies persist along the central coast from Monterey to San Mateo counties and in northeastern California in Shasta, Siskiyou, Lassen, Plumas, and Modoc counties (Zeiner et al. 1990a).

Potential for Occurrence in the Project Area. Eroding banks that provide potentially suitable nesting habitat are present at CC 3.4L and SAC 136.9R. Burrows were not observed at either of the erosion sites. The height and length of available vertical face at each of the erosion sites is less than the average height and length (>10 feet, >100 feet) of burrows built by successful bank swallow colonies (Garrison 1999). Burrows in cliff faces less than 10 feet in height are more susceptible to predation. Additionally, the soils at each of the sites are compacted and primarily composed of clay and fine sand. Bank swallows tend to utilize banks with soils composed of sand and fine gravels (Garrison 1999).

The potential for bank swallows to use CC 3.4L and SAC 136.9R for nesting is considered to be low due to a lack of evidence of use, below average vertical face height and length, soil composition, and susceptibility to predation.

<u>*Western Red Bat*</u>

Status. The western red bat (*Lasiurus blossevillii*) is designated as a Species of Special Concern by DFG (California Department of Fish and Game 2008a).

Distribution and Life History. The western red bat roosts in mature trees of edge habitats, commonly within riparian zones in California. The species may inhabit elevations from sea level up to mixed coniferous forest (Zeiner et al. 1990b). Western red bats are mostly solitary, although females with pups may roost in small nursing colonies. Foraging begins 1 to 2 hours after sunset, with moths, crickets, beetles, and cicadas being important food items. This species may hibernate in colder portions of its range, but in northern California short migrations to western lowlands and the San Francisco Bay region have been observed in place of hibernation (Zeiner et al. 1990b).

Western red bats mate in August and September. Fertilization is delayed until March or April. After an 80- to 90-day gestation period, pups are born from late May through early July. Most litters have three pups, although twins are common, and litter size can range from one to five. Female may move young between roost sites (Zeiner et al. 1990b).

Potential for Occurrence in the Project Area. Suitable roosting habitat occurs in the riparian forests at sites SAC 26.0L, SAC 41.9R, SAC 71.3R, SAC 157.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, SAC 73.5L, SAC 78.8L, and SAC 157.7R.

Special-Status Plant Species

Bristly Sedge

Status. Bristly sedge (*Carex comosa*) is designated as a CNPS list 2 species. This species is threatened by marsh drainage and road maintenance (California Native Plant Society 2008).

Distribution and Life History. Bristly sedge is a large sedge in the Cyperaceae family. This species occurs along lake margins, swamps, and marshes in coastal prairie and valley and foothill grasslands at elevations between 0 and 2,063 feet. The blooming period is generally May through September (California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat for this species occurs at sites SAC 8.0L and SAC 10.8L. However, these erosion sites were surveyed for this species and it was not detected. Therefore, this species does not occur within any of the 25 erosion sites.

Silky Cryptantha

Status. Silky cryptantha (*Cryptantha crinita*) is designated as a CNPS list 1B species. This species is threatened by vehicles and gravel mining. It may also be threatened by grazing and non-native plants (California Native Plant Society 2008).

Distribution and Life History. Silky cryptantha is a small annual in the borage family (Boraginaceae). This species is known to occur on sand and gravel deposits associated with intermittent and, occasionally, perennial streams (Nakamura and Nelson 2001) in cismontane woodlands, lower montane coniferous forests, riparian scrub, riparian woodlands, and valley and foothill grasslands at elevations between 278 and 984 feet. Silky cryptantha's blooming period is generally from April to May (Nakamura and Nelson 2001; California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat for this species occurs along Deer Creek at site DC 0.9N. Suitable habitat does not occur within the proposed footprint of the setback levee.

Wooly Rose-Mallow

Status. Wooly rose-mallow (*Hibiscus lasiocarpus*) is designated as a CNPS list 2 species. This species is threatened by habitat destruction, development, agriculture, weed control, recreation, and channelization of the Sacramento River and its tributaries (California Native Plant Society 2008).

Distribution and Life History. Wooly rose-mallow is a large emergent plant in the Malvaceae family with showy white flowers. This species is known to occur in marshes and swamps in the Central Valley at elevations between 0 and 396 feet. The blooming period is generally between June and September (California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat for wooly rose-mallow occurs only at erosion site SBP 0.4E, and one CNDDB record for this species occurs just north of the site (California Department of Fish and Game 2008b). Wooly rose-mallow was not observed during field surveys; however, given the close proximity of a known population and the timing of field surveys (late in the season), additional surveys would be required to determine the status of this species within erosion site SBP 0.4E.

Delta Tule Pea

Status. Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) is a CNPS list 1B species. It is threatened by agriculture, water diversions, and bank erosion (California Native Plant Society 2008).

Distribution and Life History. Delta tule pea is a member of the legume (Fabaceae) family, and blooms from May through September. It is found in freshwater and brackish marshes and is associated with tules, rush, and California wild rose. Most of its distribution is restricted to the Delta at elevations of 0 to 13 feet (Hickman 1993; California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat for this species occurs only at erosion sites SAC 8.0L and SAC 10.8L. These sites were surveyed for this species and it was not detected. Therefore, this species does not occur within any of the 25 erosion sites.

Mason's Lilaeopsis

Status. Mason's lilaeopsis (*Lilaeopsis masonii*) is a state rare and a CNPS list 1B species. Threats include bank erosion, channel stabilization, flood control projects, recreation, agriculture, shading resulting from marsh succession, and competition with non-native plants (California Native Plant Society 2008).

Distribution and Life History. Mason's lilaeopsis is a member of the carrot (Apiaceae) family found in tidal freshwater and brackish marshes and riparian scrub with muddy or silty soil formed through river deposition or riverbank erosion. It is a semi-aquatic plant restricted to the water's edge (it is usually found from 4 to 28 inches above the low tide mark), where it is inundated by waves and tidal fluctuations. Endemic to California, Mason's lilaeopsis is known to occur in six counties. It grows at elevations ranging from 0 to 33 feet, and blooms from April through November (California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat for this species is present only at erosion sites SAC 8.0L and SAC 10.8L, and the species was detected within both erosion sites.

Delta Mudwort

Status. Delta mudwort (*Limosella subulata*) is a CNPS list 2 species. Threats to delta mudwort include habitat destruction, wave erosion, wave attenuation, and water quality degradation (California Native Plant Society 2008).

Distribution and Life History. Delta mudwort is a member of the figwort (Scrophulariaceae) family and blooms from May through August, at elevations between 0 and 13

feet. It is found on mud banks of the Delta in marshy or scrubby riparian associations, often with Mason's lilaeopsis.

Potential for Occurrence in the Project Area. Suitable habitat for this species is present only at erosion site SAC 10.8L, and the species was detected within this site.

Sanford's Arrowhead

Status. Sanford's arrowhead (*Sagittaria sanfordii*) is a CNPS list 1B species. It is threatened by grazing, development, and channel alteration (California Native Plant Society 2008).

Distribution and Life History. Sanford's arrowhead is a member of the water-plantain (Alismataceae) family and blooms from May to October. It is a rhizomatous, aquatic perennial herb with linear to three-angled emergent leaf blades and white-petaled flowers. This species occurs in shallow freshwater marshes, swamps, and low gradient streams at elevations less than 2,000 feet (California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat is present at SAC 8.0L, SAC 10.8L, and SBP 0.4E. These erosion sites were surveyed for this species and it was not detected. Therefore, this species does not occur within any of the 25 erosion sites.

Side-Flowering Skullcap

Status. Side-flowering skullcap (*Scutellaria lateriflora*) is a CNPS list 2 species.

Distribution and Life History. Side-flowering skullcap is a rhizomatous herb of the mint family (Lamiaceae), and blooms from July to September. It occurs on wet sites along meadows and seeps and in marshes and swamps at elevations between 0 and 1,650 feet (California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat is present at SAC 8.0L, SAC 10.8L, and SBP 0.4E. These erosion sites were surveyed for the presence of this species and it was not detected. Therefore, this species does not occur within any of the 25 erosion sites.

Suisun Marsh Aster

Status. Suisun Marsh aster (*Symphyotrichum lentum*) is a CNPS list 1B species. Threats to this plant include marsh habitat alteration and loss by bank erosion (California Native Plant Society 2008).

Distribution and Life History. Suisun Marsh aster is a member of the sunflower (Asteraceae) family and blooms from May through November. Endemic to the Delta, Suisun Marsh aster is most often seen along sloughs with reeds, bulrush (*Scirpus* spp.), blackberry, and cattails (*Typha* spp.) in brackish and freshwater marshes and swamps. This species occurs at elevations ranging from 0 to 10 feet (California Native Plant Society 2008).

Potential for Occurrence in the Project Area. Suitable habitat is present at SAC 8.0L and SAC 10.8L, and this species was detected at both of these sites.

3.5.2. Regulatory Setting

3.5.2.1. Federal Laws and Regulations

U. S. Army Corps of Engineers

Section 404, Clean Water Act

The objective of the Clean Water Act (CWA 1977, as amended) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands, is regulated by the Corps under Section 404 of the CWA (33 USC 1251-1376). Corps regulations implementing Section 404 define waters of the United States to include intrastate waters, including lakes, rivers, streams, wetlands, and natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce. Wetlands are defined for regulatory purposes as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3; 40 CFR 230.3). To comply with the Section 404 policy of no net-loss of wetlands, discharge into wetlands must be avoided and minimized to the extent practicable. For unavoidable impacts, compensatory mitigation is required to replace the loss of wetland functions.

U.S. Fish and Wildlife Service/National Oceanic and Atmospheric Administration

Federal Endangered Species Act

The Endangered Species Act (ESA) defines "take" (Section 9) and generally prohibits the "taking" of a species listed as endangered or threatened (16 USC. 1532, 50 CFR 17.3). Under the ESA, the "take" of a federally listed species is deemed to occur when an intentional or negligent act or omission causes the agent of the action "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The term "harm" includes acts that actually kill or injure wildlife. Such acts may include significant habitat modification or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Section 7 of the ESA requires federal agencies, in consultation with the Secretary of the Interior, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat for these species.

Critical Habitat

Critical habitat is defined in Section 3(5)(A) of the ESA as "(i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." Section 3(3) of the ESA defines "conservation" as "the use of all methods and procedures which are necessary to bring an endangered species or threatened species to the point at which the measures provided

pursuant to the ESA are no longer necessary" (i.e., the species is recovered and removed from the list of endangered and threatened species).

The designation of critical habitat directly affects only federal agencies by prohibiting actions they fund, authorize, or carry out from destroying or adversely modifying critical habitat. Individuals, businesses, and other non-federal entities are not affected by the designation of critical habitat so long as their actions do not require a permit, a license, funding, or other support from a federal agency.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act, originally passed in 1940, provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) and the golden eagle (*Aquila chrysaetos*) (as amended in 1962) by prohibiting the take; possession; sale; purchase; barter; offer to sell, purchase, or barter; transport; export; or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a); 50 CFR 22). "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb (16U.S.C. 688(c); 50 CFR 22.3). A violation of the Act can result in a fine, imprisonment, or both.

Migratory Bird Treaty Act

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR Part 10, including feathers or other parts, nests, eggs, or products except as allowed by implementing regulations (50 CFR 21). Most of the birds found in the study area are protected under the MBTA. Thus, project construction has the potential for direct take of nests, eggs, young, or individuals of protected species.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a federal fisheries management plan (FMP). The MSA requires federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agencies that may adversely affect EFH (MSA Section 305[b][2]). A component of this consultation process is the preparation and submittal of an Essential Fish Habitat Assessment (EFHA). The length of the EFHA will vary, based on project complexity and the magnitude of potential impacts on EFH, but all EFHAs must include the following information: (1) a description of the proposed action; (2) an analysis of the effects, including cumulative effects, of the proposed action on EFH, the managed species, and associated species, such as major prey species, including affected life history stages; (3) the federal agency's views regarding the effects of the proposed action on EFH; and (4) proposed mitigation, if applicable. In instances where MSA and ESA issues overlap, NMFS encourages an integrated approach to consultation.

The EFH mandate applies to all species managed under an FMP. For the Pacific coast (excluding Alaska), there are three FMPs covering groundfish, coastal pelagic species, and Pacific salmon.

Marine Mammal Protection Act

Congress passed the Marine Mammal Protection Act (MMPA) in 1972. The MMPA prohibits, with certain exceptions, the take of marine mammals in United States waters and by United States citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. Take is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal." Harassment is defined as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering."

3.5.2.2. State

California Department of Fish and Game

Streambed Alteration Agreement (Sections 1600 to 1616 of the California Fish and Game Code)

DFG has jurisdictional authority over fish and wildlife resources associated with rivers, streams, and lakes under California Fish and Game Code Sections 1600 to 1616. The DFG must be notified when any person, business, state or local government agency, or public utility proposes an activity that will divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake; use material from a streambed; or result in the disposal or deposition of debris, waste, or other material where it can pass into any river, stream, or lake. If DFG determines that the proposed project or activity could have substantial adverse effects on fish or wildlife, a Streambed Alteration Agreement is required. Because the SRBPP is a federal project, a Streambed Alteration Agreement is not required.

California Endangered Species Act

Under CESA, DFG is responsible for maintaining a list of endangered and threatened species (California Fish and Game Code 2070). The DFG also maintains a list of "candidate species," which are species that DFG has formally noticed as being under review for addition to the list of endangered or threatened species. The DFG also maintains lists of "species of special concern," which serve as species watch lists.

Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state listed endangered or threatened species may be present in the project area and determine whether the proposed project could have a significant impact on such species. In addition, DFG encourages informal consultation on any proposed project that may affect a candidate species.

Project-related impacts to species listed as threatened or endangered under CESA would be considered significant. State listed species are fully protected under the mandates of CESA. "Take" of protected species incidental to otherwise lawful management activities may be authorized under California Fish and Game Code Section 2081. Authorization from DFG would be in the form of an Incidental Take Permit.

Native Plant Protection Act

State listing of plant species began in 1977 with the passage of the Native Plant Protection Act (NPPA) (California Fish and Game Code Sections 1900-1913). The NPPA directed DFG to carry out the legislature's intent to "preserve, protect, and enhance endangered plants in this state." Under the NPPA, DFG has the authority to designate native plants as endangered or rare and to require permits for collecting, transporting, or selling such plants. CESA expanded upon the NPPA and enhanced legal protection for plants. CESA established threatened and endangered species categories, and grandfathered all rare animals – but not rare plants – in the Act as threatened species. Thus, there are three listing categories for plants in California: rare, threatened, and endangered.

Birds of Prey

Under Section 3503.5 of the California Fish and Game Code, it is unlawful to take, possess, or destroy any birds in the orders of Falconiformes (hawks, eagles, and falcons) or Strigiformes (owls) or to take, possess, or destroy the nest or eggs of any such bird, except as otherwise provided by the code.

Migratory Birds

The California Fish and Game Code Section 3513 states that it is unlawful to take or possess any migratory nongame bird as designated in the MBTA or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA. Under Section 3513, DFG may consider impacts similar to those described above under the MBTA a significant impact.

"Fully Protected" Species

California statutes also accord "fully protected" status to a number of specifically identified birds, mammals, reptiles, amphibians, and fish. These species cannot be "taken," even with an incidental take permit (California Fish and Game Code, Sections 3505, 3511, 4700, 5050, and 5515).

California Regional Water Quality Control Board

Section 401 Water Quality Certification

The Regional Water Quality Control Board (RWQCB) is responsible for enforcing and protecting water resources. The RWQCB regulates the discharge of wastes to surface waters through the National Pollutant Discharge Elimination System (NPDES) permit process. Waste discharge requirements are established in NPDES permits to protect beneficial uses. The RWQCB requires that a project proponent apply for and obtain a CWA Section 401 Water Quality Certification for any project that requires authorization under the CWA for discharge into waters of the United States.

3.5.2.3. Local

Colusa County General Plan

The Colusa County General Plan (Colusa County 1989) does not have specific policies that address special-status wildlife species; however, CO-20 and CO-21 address conflicts with agriculture and recreation management practices and the protection of Resource Conservation Areas will be resolved on a case-by-case basis. Resource Conservation Areas shall only be

regulated to the degree necessary to protect the resource allowing for low density single family residences, low intensity recreational uses, and agricultural uses to the extent that critical habitats are not disrupted (Colusa County 1989).

Sacramento County General Plan

Marsh and riparian areas are protected under policies CO-60 through CO-68 of the Sacramento General Plan (Sacramento County 1993). The policies applicable to the SRBPP are CO-62 and CO-65, which ensure there is a no net loss of marsh or riparian woodland acreage, values, or functions and that removal of riparian woodland or scrub is mitigated to minimize the unavoidable impacts to biological resources.

The American River Parkway and several areas along the Sacramento River are identified as critical natural areas in the General Plan. LAR 10.0L and LAR 10.6L are within the American River Parkway. The goals of the American River Parkway Plan include to "preserve, protect, interpret and improve" the ability of the parkway to support migratory and resident wildlife and diverse natural vegetation.

Policy 4.10 states, "flood control projects, including levee protection projects and vegetation removal for flood control purposes, shall be designed to avoid or minimize adverse impacts on the Parkway, including impacts to wildlife and wildlife corridors." When adverse impacts are found to be unavoidable, "appropriate feasible compensatory mitigation shall be part of the project." These mitigation measures are required to be close to the affected site, unless undesirable impacts are created through such a location.

All plantings in the parkway are required to be consistent with an approved list of native vegetation approved by the Recreation and Parks Commission. Activities such as brush clearing and mowing of natural vegetation are permitted where necessary "to protect the public's health, safety, or for the purpose of habitat restoration."

The Plan permits the removal of non-native trees and shrubs if any of the following criteria are met: they constitute a hazard, the removal is part of on-going normal maintenance practice, or the vegetation was approved for removal as part of a discretionary project.

The Sacramento County Tree Preservation and Protection Ordinance requires a permit for removal and pruning of public trees, which occur on any county owned lands and/or within certain right-of-way situations.

The Sacramento County General Plan addresses rare and endangered species by addressing habitat preservation. Sacramento County's goal is to increase the population of threatened and endangered species by preserving and increasing available habitat for these species. Policies relevant to the project that address threatened and endangered species habitat management include the following: use of native species and discouragement of non-native species for vegetation management on public lands (CO-141), control of human access to minimize impacts to threatened and endangered species (CO-143), protection of critical habitat from pesticides and other chemical residues (CO-144), use of mosquito abatement control measures in preserved wetlands that have the least effect on non-target species (CO-145), maintenance of riparian vegetation and topographic diversity during stream channel and bank

stabilization projects (Sec V, F, objective 4), and encouragement of the use of special-status plant species in re-vegetation plans (CO-127) (Sacramento County 1993).

The Sacramento County General Plan provides for meeting a goal of preserving and protecting native and non-native trees in both rural and urban environments. The County's objectives are to 1) manage trees to promote a 10 percent increase of oak regeneration in designated woodlands; 2) preserve native and landmark trees; 3) maintain "Tree County USA" status; 4) plant one million new trees within the urban areas; and 5) manage urban tree practices promoting trees as economic and environmental resources. Tree preservation policies applicable to the project include 1) preservation of non-oak native trees (excluding cottonwoods), landmark trees, and native oak trees 6 inches in dbh or greater (excluding zoned agriculture) (CO-130); 2) native trees will be replaced with in-kind species with the combined diameter of trees replaced equaling the combined diameter of trees removed (CO-131); if all trees cannot be replaced, a sum equivalent to the replacement cost shall be paid (CO-132); and no net canopy loss policy of native oaks through preservation of groves and providing a location for on-site mitigation (CO-133).

Sutter County General Plan

Preservation of areas of natural vegetation is encouraged through policy 4.D-1 of the General Plan. Policy 4.C-7 states that the County encourages the preservation of rare, threatened, or endangered animal species. Threatened, rare, and endangered plants are protected by General Plan policy 4.D-2 (Sutter County 1996).

Tehama County General Plan

Goal OS-3 of the Tehama County General Plan is to protect, preserve, and enhance fish and wildlife species by maintaining healthy ecosystems (Tehama County 2008). This goal will be reached by the implementation of several policies in the General Plan including: the designation of areas supporting habitat for sensitive animal and plant species as habitat resources and the designation of riparian habitats as resource lands under the Natural Resource Conservation Land Use Classifications; providing wildlife circulation around new developments; and working with state and federal agencies to control and eliminate invasive plants from the County. The General Plan has several goals and policies to encourage the protection and restoration of oak woodlands (Tehama County 2008).

The Tehama County General Plan does not specifically address rare, threatened, or endangered plants or animals. However, policy OS-3.1 states that the County will preserve and protect environmentally sensitive and significant lands and water valuable for their plant and wildlife habitat (Tehama County 2008).

Yolo County General Plan

Conservation policies identified by the Yolo County General Plan and pertaining to this project include the following: developing standards for development to prevent unnecessary disruption of terrain, vegetation, and significant resources and shall include mitigation of potential adverse environmental impacts (CON 7); establish a tree planting program and adopt a tree ordinance (CON 28); require specific mitigation for wildlife habitat in conjunction with other agencies to enhance and create wildlife preserves and to preserve and rehabilitate wildlife

habitat areas (CON 30); and conserve natural vegetation where possible (CON 33) (Yolo County 2009).

3.5.3. Environmental Consequences

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS;
- Adversely modify designated critical habitat for any federally listed species;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by DFG or USFWS;
- Have a substantial and adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Substantially diminish habitat for any wildlife species or any fish life stage, or result in displacement of spawning fish such that year-class strength is substantially reduced, or involve production and discharge of materials that pose a hazard to fish and wildlife species;
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.5.3.1. No-Action Alternative

Under the no-action alternative, no action would be taken to repair the existing erosion and protect the levee at the 25 erosion sites. Forces of erosion would persist, including wave wash, flood flows, and human disturbances. Continued erosion at the erosion sites would increase the risk of levee failure and possible flooding of surrounding areas. Potential impacts resulting from the no-action alternative are identified below.

Vegetation Communities

Several of the erosion sites support riparian forest, oak woodland, riparian scrub, and emergent aquatic vegetation. These vegetation communities provide structure, shade, shelter, foraging and breeding opportunities, and other significant resources for fish and wildlife species. Under the no-action alternative, the erosion would be allowed to continue, leading to the need for pre-failure emergency repairs, or levee failure and the need for post-failure emergency repairs. Either of these outcomes could result in potentially significant impacts to riparian vegetation communities and habitat for fish and wildlife species.

With pre-failure emergency repairs there is little to no opportunity to conduct studies of the existing vegetation communities and wildlife habitats, incorporate measures to retain and/or replace riparian vegetation, and minimize the potential for adverse impacts. Additionally, pre-failure emergency repairs would likely require a larger impact footprint than that required under the existing level of erosion.

Depending on severity, the failure of the levee could result in removal or burial of riparian and emergent vegetation communities and loss of habitat and other resources for fish and wildlife. Post-failure emergency repairs would be required and would likely be of a nature that limits the ability to properly implement Best Management Practices (BMPs), site-specific mitigation, and other measures that would minimize impacts to vegetation communities. Depending on the damage to the levee resulting from the failure, a significantly larger footprint could be required for the repair than that required under the existing level of erosion.

Special-Status Species

The no-action alternative would likely result in levee failure and post-failure emergency levee repair measures, and would include short-term construction-related effects and long-term effects on habitat. The potential adverse effects of the no-action alternative on special-status fish would in part be due to levee failures that could potentially transport fish out of the stream channel and into areas where they are likely to become stranded (e.g., agricultural fields). Additional adverse effects of such an event may also result from post-failure emergency repair measures in which BMPs and mitigation measures would be more difficult to implement. A limited ability to implement BMPs and mitigation measures could result in short-term adverse construction-related effects and long-term adverse effects on habitat for green sturgeon, delta smelt, river lamprey, hardhead, Central Valley steelhead, Central Valley spring-run Chinook salmon, winter-run Chinook salmon, Central Valley fall-/late fall-run Chinook salmon, Sacramento splittail, and longfin smelt. The post-failure emergency repair measures that could occur under the no-action alternative would likely include alteration of EFH for Chinook salmon (all ESUs); designated critical habitat for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and delta smelt; and proposed critical habitat for green sturgeon.

Short-term adverse effects of emergency levee repair could include increases in turbidity and suspended sediment that may disrupt feeding activities or result in temporary displacement of individuals from preferred habitats. Deposition of suspended sediment can also bury stream substrates that provide habitat for aquatic invertebrates, an important food source for many fish species, thereby reducing food availability and foraging success for these species.

Toxic substances used at construction sites, including gasoline, lubricants, and other petroleum-based products could enter the project reaches because of spills or leakage from machinery or storage containers. These substances can kill aquatic organisms through exposure to lethal concentrations. Exposure to non-lethal levels can cause physiological stress and increased susceptibility to other sources of mortality. Although unlikely, direct mortality of individual fish could also occur due to in-water construction activities such as placement of rock revetment.

Long-term adverse effects could include reduced nearshore habitat value for spawning and incubation by delta smelt and for spawning, rearing, and/or adult migration life stages of all special-status fishes. These effects would result from addition of rock revetment and removal or burial of riparian and emergent vegetation at emergency bank repair locations.

Because BMPs and mitigation measures may not be implemented for emergency bank repair actions that could occur under the no-action alternative, it may not be possible to avoid the short-term and long-term effects described above.

Potential impacts to special-status wildlife and plant species associated with the no-action alternative would result from the erosion becoming so severe that pre-failure emergency repairs are required; or the levee fails resulting in flooding, greatly accelerated erosion, and the need for post-failure emergency repairs. Either of these outcomes would likely result in potentially significant impacts to special-status species that may occur within and near the erosion sites.

When pre-failure emergency repairs are required, failure of the levee is imminent and there is little to no opportunity to properly conduct environmental studies, assess environmental impacts, and incorporate environmental protection and mitigation measures into the project design. Additionally, given that the no-action alternative would allow erosion to continue, a larger disturbance area would be required to repair the levee; resulting in a larger footprint of environmental impact than that required under the existing level of erosion.

The level of disturbance from levee failure and resultant flooding can range in severity from relatively minor to catastrophic depending on the conditions under which the levee failed, the integrity and materials of the levee, and the surrounding land uses. Under a less severe scenario, loss of suitable habitat and/or displacement of special-status species may be limited. However, post-failure emergency repairs would be required and would likely be of a nature that limits the ability to implement proper BMPs, site-specific mitigation, and other measures that would minimize impacts to special-status species.

Under a more severe scenario, levee failure and flooding could result in significant loss of suitable habitat and displacement of special-status species. Furthermore, extensive flooding during a levee failure would likely entrain toxic substances into the water, including gasoline, lubricants, insecticides, pesticides, and sewage that could enter the affected river systems. These substances can kill or otherwise adversely affect special-status species. The required post-failure emergency repairs could have a significantly large footprint and the urgent need to repair the levee immediately would preclude proper planning and environmental protection.

Non–Special Status Species

The potential adverse effects of the no-action alternative on non–special status species would be similar to those described for special-status species.

3.5.3.2. Alternative 1: Proposed Action

Four designs have been developed to address repairs necessary for the 25 erosion sites. Section 2.2 provides specific design descriptions and identifies the proposed design for each erosion site. Construction activities associated with the proposed action generally include removal of all herbaceous vegetation and removal of woody vegetation less than 4 inches in dbh; removal of IWM and other woody debris within the construction footprint; placement of quarry stone and soil-filled quarry stone on the levee slope to provide bank stabilization; creation of riparian benches; installation of IWM along the MSWL; and revegetation of the sites with native plant species. These activities have the potential to result in adverse impacts to biological resources.

Vegetation Communities

Several of the erosion sites support oak woodland, riparian forest, riparian scrub, orchard, pasture, ruderal, and emergent aquatic vegetation communities. These vegetation communities provide structure, shade, shelter, foraging and breeding opportunities, and other significant resources for fish and wildlife species. The proposed action includes a suite of three designs developed to provide the required repairs at each of the 25 erosion sites. Construction at each erosion site would involve clearing the understory vegetation within the limits of the repair. Several of the proposed designs also include the development of riparian benches, and placement of IWM along the shoreline. All of the proposed designs incorporate, to the greatest extent practicable, the retention of native trees with a dbh greater than 4 inches, and planting of native vegetation to replace vegetation lost due to project construction. However, tree trimming or tree removal may be necessary for access, equipment maneuverability, safety, or preservation of tree health. Several of the sites contain dense tree stands that may inhibit access to the erosion repair site. In these areas, some level of tree removal may be required. Tree removal may also be required if tree survival is compromised by the depth of the revetment placed or the tree presents a safety concern. By properly trimming trees, irreparable damage caused by heavy equipment can be avoided.

Currently, tree #142 at SAC 78.7L and tree #776 at FR 5.5L are anticipated to require removal because they overhang the bank. The length of site SAC 114.5R is approximately 1,500 feet. Because of this length, it is difficult for construction equipment to obtain adequate access to the bankline from either end of the erosion site. To accommodate equipment access, a 12-foot swath perpendicular to the levee would be cleared of all trees. Efforts would be made to place the swath where there are the fewest trees and where trees have the smallest diameters. Tree trimming is anticipated to be necessary at most erosion sites for revetment installation.

Wetland vegetation communities are present in the vegetated shallows at SAC 8.0L and SAC 10.8L. The proposed repairs at these sites are limited to the upper bank and direct impacts to the vegetated shallows are not anticipated. Emergent wetland vegetation is also present at SBP 0.4E along the shoreline of the existing levee. Some of this wetland vegetation would be disturbed during construction activities.

None of the 25 erosion sites occur within any designated conservation plan boundaries. Therefore, implementation of the proposed action alternative would not affect local policies or conservation plans protecting biological resources.

Special-Status Species

Special-Status Plants

Botanical surveys and habitat assessments were completed at all 25 erosion sites from August 2008 through February 2009. Based on these investigations, it was determined that the erosion sites provide suitable habitat for nine special-status plant species: bristly sedge, silky cryptantha, wooly rose-mallow, Delta tule pea, Mason's lilaeopsis, Delta mudwort, Sanford's arrowhead, side-flowering skullcap, and Suisun Marsh aster.

Mason's lilaeopsis and Suisun Marsh aster were detected at SAC 8.0L and SAC 10.8L, and Delta mudwort was detected at SAC 10.8L. However, bristly sedge, Delta tule pea, Sanford's arrowhead, and side-flowering skullcap were not detected at any of the erosion sites. Suitable habitat for silky cryptantha is present along Deer Creek at DC 0.9N (but not within the setback levee footprint), and suitable habitat for wooly rose-mallow is present at SBP 0.4E. However, the presence or absence of these species at DC 0.9N and SBP 0.4E could not be determined because the botanical surveys were conducted outside of their detectable periods.

Special-Status Fish Species

The proposed action includes implementation of in-water bank protection measures at 22 of the 25 erosion sites to prevent ongoing erosion and increase levee stability. This treatment does not apply to the three proposed setback levee sites (CC 2.8L, CC 3.4L, and DC 0.9N), which are discussed individually below. Proposed in-water bank protection measures include the following: (1) protecting the toe and upper slopes of the bank with riprap while restoring the 3:1 levee prism profile, (2) establishing a riparian bench at or near the elevation of the MSWL to provide aquatic habitat during higher river stages in winter and spring, (3) placing anchored IWM for aquatic habitat, and (4) planting pole and container plantings to stabilize the bank and provide riparian and shaded riverine aquatic habitat. Proposed repairs at two sites in the Delta, SAC 8.0L and 10.8L, would not include a riparian bench feature, but would include rock revetment capped with soil on the levee, riparian plantings, and IWM installation.

In-water work would be conducted between August 1 and November 30 in 2009 and 2010. The erosion repairs at these 22 sites have been designed to maximize the habitat values at the sites, providing for riparian and upland habitats in ratios appropriate for each site locale. Adverse impacts to special-status fish species and their habitat would be primarily short-term and occur during construction.

Landside construction of setback levees are proposed at three erosion sites: CC 2.8L, CC 3.4L, and DC 0.9N. Setback levees are proposed for these sites because of the following: (1) insufficient channel widths to accommodate in-water bank/levee repairs (e.g., Cache Creek), (2) protection of existing riparian vegetation and near-shore habitat (e.g., Deer Creek), and (3) cost-effectiveness as compared to implementation of in-water repair structures (e.g., Deer Creek). The setback levee design to be implemented at these sites would be constructed between 50 and 200 feet landward of the existing levee crest, thereby creating a floodplain area between the setback levee and the present-day streambanks. The setback levee crown would be constructed

with a 3:1 waterside facing slope. At CC 2.8L and 3.4L, the existing levee crowns would remain, but would be notched down to the floodplain elevation in several locations along their lengths in order to allow inundation of the reconnected floodplain area during high winter and spring flows. At DC 0.9N, the existing levee would be removed and the materials used to construct the setback levee. No adverse effects on special-status fish species and their habitat would be expected at these three sites, assuming existing riparian vegetation and near-shore areas are not modified or disturbed.

Activities occurring at the 22 sites having in-water construction would potentially affect green sturgeon, delta smelt, river lamprey, hardhead, Central Valley steelhead, Central Valley spring-run Chinook salmon, winter-run Chinook salmon, Central Valley fall-/late fall-run Chinook salmon, Sacramento splittail, and longfin smelt. Project effects would also include alteration of EFH for Chinook salmon (all ESUs); designated critical habitat of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and delta smelt; and proposed critical habitat for green sturgeon.

The qualitative evaluation of short-term effects on aquatic species takes into account the in-water work window schedule (August 1–November 30) relative to the species migration timing. If a species has the potential to be present in the channel during the scheduled in-water work, it is assumed that it would be directly affected. Potential effects to special-status fish species resulting from implementation of the proposed action at the 22 sites with waterside-repairs are identified below. Construction at the three setback levee sites is not anticipated to result in significant impacts to special-status fish species.

LAR 10.0L and LAR 10.6L are located in proximity to known, long-term steelhead spawning areas (Hannon and Healy 2002, 2003, 2004, 2005, and 2007). Based on bathymetric survey data provided by Kleinfelder and spawning depth criteria from the Bureau of Reclamation (USBR) redd surveys in the lower American River (Hannon and Healy 2002, 2003, 2004, 2005, and 2007), bank repairs at LAR 10.0L and LAR 10.6L could result in a loss of suitable spawning habitat. Preliminary estimates of suitable spawning area loss at LAR 10.0L and 10.6L are based on a partial habitat criteria assessment utilizing the depth criteria only and are 13,830 square feet (0.32 acre) at LAR 10.0L and 12,109 square feet (0.28 acre) at LAR 10.6L. Therefore, the total area of potentially suitable steelhead spawning habitat that would be lost within the footprint of the revetment structures at these two sites is estimated to be 25,939 square feet, or 0.60 acre. A summary of the methods used to estimate the area of potentially effected spawning habitat is presented in Appendix E.

Short-term and long-term effects to special-status salmonids related to nearshore habitat have been analyzed using the SAM model. Short-term effects are those resulting from habitat alterations caused by construction or other bank protection activities, and serve as the starting point for modeling long-term effects. Long-term effects may last months or years and generally involve physical alteration of the bank and riparian vegetation adjacent to the water's edge, with consequential impacts on SRA cover, as defined by the USFWS (Fris and DeHaven 1993). The SAM assesses long-term impacts by comparing special-status salmonid species responses to long-term differences in habitat under with- and without-project conditions (U.S. Army Corps of Engineers 2004, 2006a). In general, the effects are measured in terms of the area of bank and

channel bed disturbed by construction, and the quantity and quality of aquatic, bank, floodplain, and supporting riparian habitat.

Long-term species habitat attributes potentially affected by construction activities include spawning habitat area and quality, rearing habitat area and quality, migration habitat conditions, and predator habitat suitability. Altered bank characteristics could also cause changes to hydraulics, cover, and substrate conditions at the erosion sites and immediately downstream, potentially reducing habitat quantity and quality for rearing juveniles and other life stages. Specific nearshore cover types include IWM, riparian vegetation, and overhead SRA.

The SAM model was used to approximate the net change in habitat value for each season of the year and life stage of listed salmonid and delta smelt species. SAM modeling results for all listed fish species are presented in the SAM report (Appendix D). Results can be analyzed collectively by river region to better assess the potential impacts of the project as a whole. The four regions of the SRBPP action area, as defined in the Programmatic Biological Assessment of the remaining Phase II authority (U.S. Army Corps of Engineers 2007a), are defined as Region 1a (RM 0–20), Region 1b (RM 20–80), Region 2 (RM 80–143), and Region 3 (RM 143–194) of the Sacramento River and the various waterbodies that respectively enter the four regions of the mainstem channel. The model estimates potential effects for each year of the project evaluation period (50 years) and reports values based on the water year (WY) equivalent to Year 0, 1, 5, 15, 25, and 50 following construction activities. The WY is assumed to span fall, winter, spring, and summer. For the purposes of this assessment, rock and soil placement and IWM installation are assumed to occur during summer (WY 2009 or WY 2010) while revegetation activities are assumed to occur in fall (WY 2010 or WY 2011). Long-term effects of the proposed action on habitat for green sturgeon, river lamprey, hardhead, Sacramento splittail, and longfin smelt were not modeled by the SAM, but potential effects on these species resulting from the proposed action are expected to be generally similar to those described for the modeled species below.

Region 1a Modeled Species Effects. There are four sites (SAC 8.0L, SAC 10.8L, CC 2.8L, and CC 3.4L) located in Region 1a, which encompasses RM 0–20. Only SAC 8.0L and SAC 10.8L were modeled using the SAM. The setback levees proposed at CC 2.8L and CC 3.4L could not be appropriately modeled using the SAM because they would entail no nearshore habitat modifications. Furthermore, Cache Creek is not designated as critical habitat or EFH for the modeled fish species because this tributary regularly lacks hydrologic connectivity with the Sacramento River via the Yolo Bypass (Nagano pers. comm. 2003, National Marine Fisheries Service 2009). Because none of the special-status fish species typically occur in Cache Creek and no in-water work or bank modifications would occur under this alternative, the setback levees are expected to have no adverse effect on the modeled fish species or their habitat.

Project effects on critical habitat at SAC 8.0L and SAC 10.8L indicate habitat losses for all modeled seasons and salmonid life stages immediately following project implementation (Table 3-7). In winter and spring, full recovery to pre-project conditions is modeled to occur by WY 2012 for all salmonid life stages due to continued vegetation growth, thereby offering increased instream cover for the modeled salmonids. This recovery period amounts to two years (i.e., Year 2), after which the model indicates long-term gains in habitat. In summer and fall, all salmonid life stages would experience long-term habitat deficits chiefly due to the loss of cover

due to vegetation removal. Recovery to pre-project conditions would be driven by increasing overhanging shade cover, and would occur for adult salmonid habitat by WY 2021 (Year 11) and for juvenile and smolt habitat by WY 2024 (Year 14).

Table 3-7 Effects of the Proposed Action on Salmonid Species and Delta Smelt (Region 1a)

Season	Time to Recover Initial Habitat Losses from 2010	Long-Term Effects on Habitat Value
Salmonid Species		
Winter	2 years	Gains
Spring	2 years	Gains
Summer	Juveniles/Smolts: 14 years Adults: 11 years	Losses for juvenile salmonid life stages would not recover until WY 2024 (Year 14); losses for adult salmonid life stages would not recover until WY 2021 (Year 11)
Fall	Juveniles/Smolts: 14 years Adults: 11 years	
Delta Smelt		
Winter	1 year	Gains
Spring	1 year	Gains
Summer	1 year	Gains

Similar to the salmonid responses, long-term habitat gains would occur for all delta smelt life stages (spawning and incubation and juvenile rearing habitat) in winter and spring, and habitat values would continue to increase through the modeled time period (WY 2060) (Table 3.7). Unlike the salmonids, delta smelt of all life stages would experience long-term habitat gains in summer. No habitat responses are modeled in fall because the two modeled delta smelt life stages, spawning and incubation and juvenile rearing, are not present during fall, and adult delta smelt are not sensitive to changes in nearshore conditions during any season.

Region 1b Modeled Species Effects. Region 1b (RM 20–80) includes sites SAC 26.0L, 35.4L, 41.9R, 71.3R, 73.5L, and 78.8L; and LAR 10.0L and 10.6L. At sites in Region 1b, initial reductions in SRA would be offset by an immediate increase in the availability of shallow-water habitat and instream cover following construction due to placement of functioning IWM below the summer low-water line. Overall, winter and spring habitat quality for the salmonid species/life stages is projected to increase instantly after construction at most sites because of immediate gains in shallow water habitat availability, instream structure (IWM), and eventual recovery of riparian vegetation (Table 3-8). Despite placement of IWM below the summer waterline, all salmonid life stages would experience long-term habitat deficits in summer and fall due to the proposed action (Table 3-8). The summer and fall deficits are a consequence of the loss of shallow water habitat and nearshore vegetation and coarser bank substrate (exposed revetment) subsequent to construction. The summer and fall deficits for the juvenile/smolt life stage are projected to improve, yet remain negative during the modeled period, as planted

vegetation incrementally recovers to provide shade. Adult salmonid habitat deficits would be compensated by the increasing shade cover and would recover and exceed pre-project conditions by WY 2020 (Year 11 for 2009-built sites and Year 10 for 2010-built sites) at the latest.

Table 3-8 Effects of the Proposed Action on Salmonid Species and Delta Smelt (Region 1b)

Season	Time to Recover Initial Habitat Losses from 2009	Long-Term Effects on Habitat Value
Salmonid Species		
Winter	1 year	Gains
Spring	1 year	Gains
Summer	Juveniles/Smolts: >50 years Adults: 11 years	Losses for juvenile salmonid life stages would not recover by WY 2060 (Year 51); losses for adult Chinook salmon would recover by WY 2020 (WY 11); losses for adult steelhead would recover by WY 2016 (Year 7).
Fall	Juveniles: >50 years Adults: 11 years	
Delta Smelt		
Winter	1 year	Gains
Spring	1 year	Gains
Summer	>50 years	None

Winter and spring habitat for all delta smelt life stages increases immediately after initial losses due to construction (Table 3-8). Increases in shallow-water habitat and placement of IWM provide immediate gains in habitat during winter and spring. In contrast, summer habitat deficits for all delta smelt life stages would persist through WY 2060.

Region 2 Modeled Species Effects. Region 2 (RM 80–143) includes 11 proposed erosion repair sites: SAC 87.0L, 93.7L, 114.5R, 130.0L, 136.7R, and 136.9R; FR 1.0L, 3.7L, 5.5L, and 7.0L; and SBP 0.4E. Delta smelt do not occur in Region 2. Therefore, model results from the SAM include salmonids only. Immediate positive habitat responses are anticipated for all salmonid life stages during winter and spring within the first year following project construction and continuing through the modeled assessment period (WY 2060) (Table 3-9). These gains are driven by the increased instream cover on the riparian benches. In summer and fall, adult salmonid life stages would similarly experience immediate and lasting positive habitat benefits through WY 2060. However, juvenile and smolt salmonids would experience long-term habitat losses in the summer and fall that would not recover until WY 2051 at the latest. The summer and fall deficits follow a pattern similar to that exhibited at many sites within Region 1b, where improved SRA coverage provides incremental habitat gains through WY 2060, but does not completely mitigate for impacts to other instream cover features, such as aquatic vegetation.

Table 3-9 Effects of the Proposed Action on Salmonid Species (Region 2)

Season	Time to Recover Initial Habitat Losses from 2009	Long-Term Effects on Habitat Value
Salmonid Species		
Winter	1 year	Gains
Spring	1 year	Gains
Summer	Juveniles/Smolts: 37 years Adults: 1 year	Losses of juvenile rearing habitat would recover by WY 2032 (Year 23); losses of smolt outmigration habitat would recover by WY 2046 (Year 37)
Fall	Juveniles/Smolts: 42 years Adults: 1 year	Losses for juvenile rearing salmonid life stage would recover by WY 2032 (Year 23); losses for smolt outmigration salmonid life stage would recover by WY 2051 (Year 42)

Region 3 Modeled Species Effects. Region 3 encompasses RM 143–194 and includes SAC 157.7R and DC 0.9N. Delta smelt do not occur in Region 3; therefore, model results include salmonids only. A planted riparian bench with instream cover features is proposed to be built at SAC 157.7R and a setback levee would be constructed at DC 0.9N. No adverse effects on special-status fish species, which include spring- run Chinook salmon, fall-run Chinook salmon, and steelhead, at the DC 0.9N site are expected because there would be no streamside or in-water work associated with the setback levee.

At the SAC 157.7R site, winter and spring habitat for juvenile and smolt salmonid species/life stages are expected to recover quickly from initial habitat losses and to continue to experience long-term habitat gains through WY 2060 (Table 3-10). For adults, short-term losses would occur in winter and slightly longer-term losses would occur in spring, followed by recovery and continued positive habitat gains through WY 2060 with the increase in SRA cover. The low-magnitude losses are attributed to initial reductions in existing SRA cover despite the increased IWM cover. In summer and fall when the salmonid habitats are exposed to an un-vegetated, moderately sloped, and relatively coarse revetment, all salmonid life stages would experience low magnitude, long-term habitat losses. Adult salmonid responses would recover to pre-project conditions by WY 2033 due to the gradual increase of SRA cover; however, the long-term loss of aquatic vegetation drives the juvenile and smolt habitat losses through WY 2060, despite the relative increase in IWM.

Table 3-10 Effects of the Proposed Action on Salmonid Species (Region 3)

Season	Time to Recover Initial Habitat Losses from 2009	Long-Term Effects on Habitat Value
Salmonid Species		
Winter	Juveniles (all species/runs): 1 year Adult Chinook salmon: 5 years Adult steelhead: 3 years	Gains for juvenile salmonid life stages; losses for adult Chinook salmon with recovery by WY 2015 (Year 5); losses for adult steelhead with recovery by WY 2013 (Year 3)
Spring	Juveniles (all species/runs): 1 year Adult Chinook salmon: 8 years Adult steelhead: 5 years	Gains for juvenile salmonid life stages; losses for adult Chinook salmon with recovery by WY 2018 (Year 8); losses for adult steelhead with recovery by WY 2015 (Year 5)
Summer	Juveniles (all species/runs): >50 years Adults (all species/runs): 23 years	Losses for juvenile salmonid life stages would not recover by WY 2060 (Year 50); Losses for adult salmonid life stages would recover by WY 2033 (Year 23)
Fall	Juveniles (all species/runs): >50 years Adults (all species/runs): 23 years	

Discussion of Effects in All Regions. The cumulative results for all 22 modeled erosion repair sites indicate that the proposed action would result in a long-term increase in habitat values in winter and spring for all Chinook salmon and steelhead life stages. The modeled values for sites in all regions indicate that the proposed action would be immediately self-mitigating for salmonid juveniles and smolts in winter and spring and for salmonid in summer and fall within 1–11 years, with continued habitat gains through Year 50. Generally, the salmonid habitat deficits modeled in Regions 1a and 3 during winter and spring would be effectively offset by the positive habitat gains experienced in the adjacent Regions 1b and 2. Summer and fall habitat deficits for juveniles and smolts would not fully recover by Year 50, but the level of deficit recovery varies by life stage and season.

Rearing and emigrating Chinook salmon juveniles and smolts are likely to be present near the erosion sites during the fall, winter, and spring, but are not expected to occur in substantial numbers during the August 1–November 30 construction window. Therefore, the effects of construction activities on these life stages would be less than significant. However, adult salmonids could potentially experience short-term adverse effects as a result of the proposed action.

Construction activities would occur during the primary migration period for adult winter-run and spring-run Chinook salmon and for a large portion of the migration window for adult late fall-run Chinook salmon and steelhead. Therefore, these life stages would be subject to the potential stressors identified above. While injury or mortality of adult salmonids is unlikely because adults primarily use deep, mid-channel habitat during their upstream migration and placement of rock would be restricted to the channel edge, there is the potential for direct impact to these species.

The SAM results for Central Valley steelhead are similar to those for Chinook salmon, with some seasonal differences for the juvenile rearing and smolt outmigration life stages among the erosion sites. The differences in species response indices between steelhead and Chinook salmon reflect slight differences in life history timing and differences in the species' response relationships for individual habitat variables (U.S. Army Corps of Engineers 2004). The SAM results indicate positive responses by all steelhead life stages at most sites during winter and spring. The improved habitat qualities stem from increases in shallow water habitat availability and instream structure (i.e., IWM) on the riparian benches and vegetation and shade provided by existing and planted riparian vegetation.

Adult steelhead in the Sacramento River migrate upstream during most months of the year, beginning in July, peaking in September, and continuing through February or March. Adults use the river channel at the erosion sites as a migration pathway to upstream spawning habitat, and may use deep pools with instream cover as resting and holding habitat. Construction activities would affect adults because site construction activities would occur during the primary migration period.

Installation of anchored IWM at all sites is sufficient to provide immediate habitat gains for steelhead during the higher water stages that typically occur during winter and spring. During summer and fall, even though IWM would be inundated at all sites, cumulative SAM results across all sites show that recovery to pre-project conditions would not occur by Year 50, primarily due to steeper, coarser, and vegetation-free banks. Long-term changes in nearshore habitat are expected to have negligible effects on adult steelhead because they generally use deep, mid-channel habitat during migration.

At all of the project sites located in Regions 1a, 1b, 2, and 3, the proposed action treatments are likely to result in significant effects during summer and fall for all salmonid life stages. Through the purchase of off-site compensation credits or the construction of a suitable compensation site within the first few years of project implementation, the identified impacts to summer and fall habitat may be reduced to less-than significant levels.

Effects of the proposed action on delta smelt would potentially include short-term impacts at sites within Region 1a and 1b corresponding to the species' critical habitat (59 FR 65256). Direct adverse effects on delta smelt may include mortality or injury during a construction activity. Indirect effects may include the impairment of essential behavior patterns. Cumulative delta smelt habitat responses during winter and spring, as modeled by the SAM, exhibit positive values for all life stages by WY 2010 (Year 1 of 2009-built sites and Year 0 of 2010-built sites), followed by continued gains through WY 2060. Similar to the salmonid responses, inundation of the planted riparian benches (at all sites except SAC 8.0L and SAC

10.8L) during winter and spring would offer sufficient improvements to habitat quality for all life stages under with-project conditions, including increased shallow water habitat (i.e., more gradual bank slope) and increased IWM and aquatic vegetation bankline cover. Delta smelt habitat deficits in summer are a consequence of the loss of shallow water habitat along the revetment (i.e., steep face of the revetment during low water), coarse substrate, and loss of aquatic vegetation.

Long-term effects of the project on green sturgeon were not modeled, but aspects of the life history and distribution of the species are reasonably well known. Thus, general statements about long-term effects can be made. Although long-term adverse effects on green sturgeon are likely at some sites, the overall long-term effects of the proposed action on green sturgeon are expected to be positive and less-than significant. Larval and juvenile green sturgeon move downstream in the Sacramento River from February through late July (Emmett et al. 1991, as cited in Moyle 2002). Since this species is not expected to occur at the erosion sites during in-water work, no direct short-term impacts are anticipated to occur, despite the tendency of larval and juvenile green sturgeon to take refuge from predators in shallow, nearshore waters. In fact, addition of IWM at all sites is expected to increase rearing and foraging habitat for larval and juvenile green sturgeon during winter and spring, thereby providing some long-term benefits for these life stages despite possible short-term impacts due to construction. However, long-term reductions in summer and fall habitat for larvae and juveniles may occur at all sites because incremental increases in riparian shade are not sufficient to compensate for the loss of instream structure. Off-site mitigation would be required to compensate for these habitat losses.

The Sacramento River downstream of Knights Landing (RM 90) is not believed to have suitable spawning habitat for green sturgeon, although there may be spawning habitat in the Feather River (Fry 1979, as cited in HDR and SWRI 2007). Therefore, the proposed construction at sites below RM 90 will not affect spawning habitat. Since green sturgeon are believed to spawn in deeper and faster portions of the channel (70 FR 17386), streamside levee repair actions should have little effect on spawning habitat in the Feather River.

Adult green sturgeon are not expected to be affected by changes in nearshore habitat. However, if suitable deep habitat exists near eroding banks at the erosion sites (i.e., erosion scour holes) adverse effects on adult green sturgeon may occur if these areas are filled with rock. Given the rapid recovery of the near-bank habitat conditions and the relatively long life span of green sturgeon, these habitat losses are considered less than significant.

Adult Sacramento splittail would likely be present at the erosion sites during their upstream migration, which begins in November and continues through January. Given that the majority of this period does not coincide with in-water work, direct effects on adult Sacramento splittail are unlikely. Sacramento splittail would not experience any long-term effects on spawning or incubation habitat. Spawning typically takes place on inundated floodplains from February through June. Sacramento splittail and their eggs would not be affected because no floodplain habitat exists in the project area, and spawning occurs outside of the in-water work window.

Long-term effects on rearing habitat would, however, likely be similar to those described for salmonids above, and may be potentially significant at some sites. Long-term increases in

nearshore cover, provided by planted vegetation on constructed riparian benches, would maintain or enhance rearing habitat for juvenile Sacramento splittail at sites in Regions 1b, 2, and 3. Potential effects on Sacramento splittail would therefore be limited to the effects of summer and fall habitat loss for larval and juvenile life stages. Creation of offsite floodplain habitat would mitigate project effects.

Long-term effects of the project on longfin smelt were not modeled by the SAM, but the species has similar life history requirements as delta smelt. Thus, general statements about long-term effects can be made based on delta smelt modeling. Adult and juvenile longfin smelt reside mainly in the tidally influenced areas of the river, whereas spawning occurs primarily in freshwater habitat. The locations of primary spawning areas for longfin smelt are not well known, but for this analysis, it is assumed that spawning habitat for longfin smelt is generally similar to that of delta smelt. Therefore, potential long-term impacts to longfin smelt are anticipated to be as described for delta smelt. Although impacts to potential habitat use at upstream sites within Region 1b by longfin smelt are not anticipated, the general mitigation and avoidance measures described below for delta smelt should benefit longfin smelt as well.

Long-term effects of the project on river lamprey were not modeled by the SAM. This species life history requirements and distribution are similar to those for Chinook salmon as they are both anadromous and potentially occur at all erosion sites except CC 2.8L and CC 3.4L. Adult river lamprey would likely be present at the erosion sites during their upstream migration between July and October, which would subject this life stage to the potential stressors identified above for salmonids. Similar to the salmonid life stages present during this period, injury or mortality of adult river lamprey is unlikely because they use relatively deep, mid-channel habitat during migration and placement of rock would be restricted to the channel edge; however, there remains the potential for direct impact to these species.

Larval and juvenile river lamprey hold in low-velocity and edge-water areas during spring, which is outside of the August 1–November 30 construction window. Therefore, direct impacts from construction activities are not expected for this life stage. Juvenile river lamprey would potentially benefit from on-site mitigation features, such as IWM, fine soils, and aquatic vegetation, available on the constructed riparian benches when flooded during spring. Long-term alteration of summer/fall bank conditions would potentially diminish rearing habitat conditions for juvenile river lamprey as they prefer to burrow into and feed in fine, organic-rich sediments. Potential project-related effects on river lamprey would therefore be limited to the effects of summer and fall habitat loss for larval and juvenile life stages. Off-site mitigation measures applied to offset impacts to juvenile salmonids in summer and fall would similarly mitigate for the significant impacts to juvenile river lamprey.

The SAM was not used to evaluate long-term effects to hardhead. The life history requirements of adult hardhead are similar to those for green sturgeon where both species prefer to hold in deep, slow moving pools. Therefore, adult hardhead are not expected to be affected by changes in nearshore habitat except in the event that deep habitat areas near the eroding banks are filled with rock. Thus, there remains a potential for significant impacts to the adults as a result of the proposed action. Juvenile hardhead would be expected to rear in the shallow edge-water areas in the project areas during in-water work, which would potentially result in a

significant impact to this life stage. The availability of increased IWM and aquatic vegetation cover at all sites in winter and spring is expected to increase rearing and foraging habitat for larval and juvenile hardhead, thereby providing some long-term benefits for these life stages despite possible short-term impacts due to construction. Conversely, exposure to steeper, coarser, and vegetation-free nearshore conditions in summer and fall would result in a long-term impact to juvenile hardhead habitat. Off-site mitigation would be required to compensate for these habitat losses.

Summary of Effects to Special-Status Fish Species. In general, the proposed work is expected to result in long-term increases in the quality of winter and spring habitat available to special-status fish species, whereas long-term habitat losses would be expected in summer and fall due to the modification of existing nearshore conditions. Long-term effects of the project on the habitat of special-status fish species include alteration of river hydraulics, instream and overhead cover, and substrate conditions along the seasonal low- and high-flow shorelines of the project sites. Off-site mitigation would be needed in those situations where project features do not adequately restore modeled habitat deficiencies, such as summer and fall habitat.

Special-Status Wildlife

Implementation of the proposed action has the potential to result in impacts to the following special-status wildlife species: valley elderberry longhorn beetle, giant garter snake, western pond turtle, bank swallow, yellow warbler, yellow-breasted chat, white-tailed kite, Swainson's hawk, and western red bat.

Valley Elderberry Longhorn Beetle. Suitable habitat (i.e., elderberry shrubs) for the valley elderberry longhorn beetle occurs within 10 of the erosion sites: SAC 41.9R, FR 1.0L, FR 3.7L, FR 5.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC3.4L, SAC 73.5L, and SAC 157.7R. Additionally, elderberry shrubs occur within 100 feet of sites SAC 10.8L and SAC 130.0L.

Giant Garter Snake. Suitable habitat for the giant garter snake occurs at erosion site SBP 0.4E.

Western Pond Turtle. Western pond turtles were not detected on at any of the erosion sites. However, the Sacramento River, Feather River, American River, Cache Creek, Deer Creek, and Sutter Bypass provide suitable habitat for this species. Both upland and aquatic habitats may be used by western pond turtles.

Bank Swallow. Potentially suitable habitat for the bank swallow occurs on the eroding banks at sites SAC 136.9R and CC 3.4L. However, due to a lack of evidence of use by bank swallows, below average nest site suitability, and the potential for predation, it is unlikely that bank swallows would utilize the banks at these sites. If bank swallows do nest at sites SAC 136.9R and CC 3.4L, direct impacts may occur if construction activities coincide with their nesting period (i.e., early April to mid-July).

White-Tailed Kite. Suitable riparian nesting habitat for the white-tailed kite is present in riparian habitats at 14 of the erosion sites: SAC 41.9R, SAC 71.3R, SAC 130.0L, SAC 136.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, SBP 0.4E, SAC 73.5L, SAC 78.8L, SAC 114.5L, SAC 136.9R, and SAC 157.7R. In addition, a white-tailed kite was observed foraging at SAC 78.8L

during the field surveys. Thus, direct impacts may occur if construction activities at these sites coincides with the white-tailed kite nesting period (i.e., early March to mid-August).

Swainson's Hawk. Suitable nesting and/or foraging habitat for Swainson's hawk is present at all of the erosion sites except SAC 8.0L, SAC 10.8L, and DC 0.9N. Thus, direct impacts may occur if construction activities coincide with the Swainson's hawk nesting period (i.e., early March to mid-August).

Yellow Warbler and Yellow-Breasted Chat. Suitable nesting habitat for yellow warbler and yellow-breasted chat within the erosion sites is limited to the riparian corridor along Deer Creek at erosion site DC 0.9N. Thus, impacts to nesting yellow warblers and yellow-breasted chats may occur if construction activities at site DC 0.9N coincide with the yellow warbler and yellow-breasted chat nesting period (i.e., early April to mid-July).

Western Red Bat. The riparian corridors at 12 of the erosion sites provide suitable roosting habitat for the western red bat: SAC 26.0L, SAC 41.9R, SAC 71.3R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, SAC 73.5L, SAC 78.8L, and SAC 157.7R. Thus, impacts to western red bats could occur if the species is present during construction activities.

Non–Special Status Fish and Wildlife Species

Proposed construction at the 25 erosion sites would affect aquatic resources and vegetation communities that provide habitat for non–special status fish and wildlife species. Direct impacts to migratory birds, raptors (birds of prey), marine mammals, and other fish and wildlife species may also occur because of implementation of the proposed action.

Impact BIO1: Impacts to Orchard and Pasture Vegetation Communities

Proposed activities at sites DC 0.9N, CC 2.8L, and CC 3.4L involve the construction of setback levees. Setback levees would be constructed approximately 125 to 150 feet away from the existing levees. Vegetation communities that would be affected by the construction of the setback levees include orchard and pasture. Direct impacts would include the removal of approximately 8 acres of orchard at CC 2.8L and CC 3.4L and 2 acres of pasture at DC 0.9N.

Because these vegetation types are not considered to be sensitive and are abundant in the area surrounding the erosion repairs, impacts to vegetation communities at DC 0.9N, CC 2.8L, CC3.4L would be considered less than significant and no mitigation is required.

Impact BIO2: Impacts to Native Tree Resources

Native trees would be preserved to the greatest extent possible at each of the erosion sites. However, tree trimming and limited tree removal may be necessary for access, equipment maneuverability, safety, or preservation of tree health. Unnecessary tree removal, improper trimming, and inadequate tree protection prior to placement of revetment would result in direct effects on tree resources, which would be considered significant. Implementation of Mitigation Measure BIO1 would reduce impacts to a less-than-significant level.

Grade changes due to placement of revetment may result in indirect impacts on tree resources (e.g., changes in drainage patterns, air exchange, or soil compaction). Placement of revetment on the levee slope is necessary to provide protection against continuing erosion and levee failure. Grade changes and placement of revetment within the dripline of trees may result in tree stress, reduced tree longevity, and a general decline in tree health and condition. However, healthy trees do have considerable capacity to adapt to altered environmental conditions. Levee repairs completed within the last 3 years have used similar designs and substantial indirect tree decline/loss has not been observed. Additionally, the proposed designs include revegetation of the erosion sites with native plant species including native trees. For many erosion sites (i.e., those with limited to no existing tree cover), this would result in the long-term increase in native tree resources. Therefore, indirect impacts to tree resources would be considered less than significant and no mitigation is required.

Impact BIO3: Impacts to Riparian Vegetation Communities

Proposed activities at the erosion sites have the potential to result in direct and indirect impacts to riparian vegetation communities. Direct impacts include the removal of existing riparian understory vegetation during site grubbing. Indirect impacts include the potential introduction and/or spread of invasive plant species, such as giant reed (*Arundo donax*), tamarisk (*Tamarix* sp.), or yellow star-thistle. Invasive plants disrupt natural processes by altering physical processes, displacing native plants, and degrading wildlife habitat. Indirect impacts also include the temporal loss of riparian vegetation cover and corresponding habitat value while replacement vegetation matures.

Riparian vegetation would be removed at the 22 erosion sites where waterside repairs are proposed. To compensate for the loss of riparian vegetation, the sites would be revegetated with native riparian species in accordance with the revegetation plans prepared for the proposed action (Appendix F). Revegetation would occur as soon as practicable after completion of construction to minimize the potential for establishment of invasive plants. Monitoring and maintenance would be implemented for a minimum of 3 years to ensure the successful establishment of the replacement vegetation.

Invasive plant species (e.g., black locust, fig, giant reed grass, or tamarisk) located within the construction easement would be removed during construction activities, including aerial portions of the plants, rootballs, rhizomes, and other propagules as indicated in the technical specifications. All invasive plant materials removed from the site would be contained (i.e., not allowed to enter the water or left in adjacent areas) and transported to appropriate disposal facilities. Invasive plants would be allowed to remain only in the event that the Corps/CVFPB determines that there are overriding habitat considerations associated with the plants (e.g., black locust along the shoreline providing shaded riverine habitat).

With implementation of site revegetation, invasive plant removal, and monitoring and maintenance of revegetated areas, the proposed action would have a less-than-significant impact on riparian vegetation communities, and no mitigation is required.

Impact BIO4: Impacts to Ruderal Vegetation Communities
Construction activities at the erosion sites would involve the loss of ruderal vegetation communities. Ruderal vegetation communities within the erosion sites are dominated by non-native grasses and forbs adapted to regular disturbance (e.g., plowing, mowing, and herbicidal spraying). Re-vegetation of the erosion sites upon completion of construction activities would replace existing ruderal vegetation communities with native plant species. Impacts to ruderal vegetation communities would be considered less than significant and no mitigation is required.

Impact BIO5: Impacts to Emergent Wetland Vegetation Communities
Emergent wetland vegetation communities are present along the shoreline at erosion sites SAC 8.0L, SAC 10.8L, and SBP 0.4E. A portion of the emergent vegetation at SBP 0.4E would be removed during construction of the riparian bench. Given that the riparian bench would be planted with native riparian species, the impacts to emergent vegetation would be less than significant. The proposed action would not result in the removal of emergent wetland vegetation at SAC 8.0L and SAC 10.8L as construction is limited to repairs on the upper bank, and the wetland bench supporting the emergent wetlands would be preserved. However, impacts could occur due to release of sediments or pollutants into the waterbody. Implementation of Mitigation Measures WQ1 and WQ2 (see section 3.6, Water Quality and Hydrology) would reduce potential impacts to a less-than-significant level.

Impact BIO6: Impacts to Special-Status Plant Species
Project construction activities at erosion sites SAC 8.0L, SAC 10.8L, DC 0.9N, and SBP 0.4E have the potential to result in direct and indirect impacts to special-status plants. Direct impacts may include removal of plant populations, trampling, and other direct disturbance of individual plants. Indirect impacts may include changes in habitat conditions (such as shade or hydrologic conditions), introduction or spread of invasive non-native species, and degradation of habitat from erosion of disturbed soils and introduction of pollutants associated with construction activities and equipment. Impacts to special-status plants would be considered significant.

The proposed repairs at sites SAC 8.0L and SAC 10.8L are limited to the upper slope of the levees and do not include the placement of revetment below the MSWL. The populations of Mason's lilaeopsis, Suisun Marsh aster, and Delta mudwort present at these sites occur below the MSWL. Therefore, direct impacts to these species are not anticipated to occur due to the placement of revetment. However, given the proximity of populations of these species to proposed construction activities, mitigation measures are necessary to avoid the potential for inadvertent direct disturbance.

Suitable habitat for silky cryptantha is present within the gravelly areas along the Deer Creek corridor at site DC 0.9N. The proposed repairs at this site include the construction of a setback levee. Construction of the setback levee would not involve direct impacts to suitable habitat for silky cryptantha. However, given the proximity of suitable habitat for this species to proposed construction activities, mitigation measures are necessary to avoid the potential for inadvertent direct disturbance.

Suitable habitat for wooly rose-mallow is present in the shallow portions of the channel at SBP 0.4E. Additional surveys during the blooming period (i.e., June to September) would be required to determine presence or absence of this species. If this species is present within the erosion site, activities in the active channel (e.g., placement of revetment and IWM) could result in direct impacts.

Indirect impacts to populations of special-status plants or suitable habitat for special-status plants could occur if construction activities result in the degradation of habitat conditions through erosion and sedimentation, release of pollutants, or other means.

Implementation of Mitigation Measure BIO2 would reduce the potential for direct impacts to special-status plants to a less-than-significant level. Implementation of Mitigation Measures WQ1 and WQ2 (see section 3.6, Water Quality and Hydrology) would reduce the potential for indirect impacts to special-status plants to a less-than-significant level.

Impact BIO7: Direct Disturbance to Fish from Construction-Related Activities
Construction activities have the potential to result in short-term direct impacts to special-status fish species. The potential for direct impacts is dependent on the likelihood of occurrence of special-status fish species relative to the location, magnitude, timing, frequency, and duration of project activities. When special-status fish are present during the in-water work window, the presence of overhead equipment and the sound generated by construction activities could temporarily disrupt essential behavior patterns (e.g., feeding, escape from predators, migration) of adult and juvenile fish at the erosion sites and the surrounding areas. Placement of toe rock may also potentially injure or kill any fish migrating though the area of the construction sites during the initial phase of construction. Direct impacts to special-status fish would be considered significant. Implementation of Mitigation Measure BIO3 would reduce potential impacts to a less-than-significant level.

Impact BIO8: Impacts to Fish from Increase in Turbidity and Suspended Sediment
Construction activities are expected to result in short-term increases in turbidity and suspended sediment that could disrupt feeding activities of fish and result in temporary disturbance of or displacement from preferred habitats at the erosion sites and downstream. Deposition of suspended sediment can temporarily bury stream substrates that provide habitat for aquatic invertebrates, an important food source for juvenile fish species, thereby reducing prey availability and foraging success. Implementation of Mitigation Measure WQ1 (see section 3.6, Water Quality and Hydrology) would reduce potential impacts to a less-than-significant level.

Impact BIO9: Impacts to Fish from Release of Toxic Substances
Toxic substances used at construction sites, including gasoline, lubricants, and other petroleum-based products, could enter the waterways adjacent to the erosion sites due to spills or leakage from machinery or storage containers. Release of toxic substances into the waterways could result in significant impacts to special-status fish species. Implementation of Mitigation Measure WQ2 (see section 3.6, Water Quality and Hydrology), would reduce potential impacts to a less-than-significant level.

Impact BIO10: Impacts to Fish from Loss of Existing Riparian Vegetation
Existing riparian vegetation in the form of herbaceous, scrub/shrub, and/or tree cover, would be affected by the proposed action, which in turn would potentially result in a significant impact to special-status fish species. Streamside vegetation provides several benefits to fish habitat. Floating, submerged, and emergent aquatic vegetation serve as hiding cover and an invertebrate food production base for all aquatic species. Overhanging shade provided by trees and large, woody scrub/shrub vegetation benefits aquatic habitat by providing hiding cover and food for fish species. Each erosion site supports varying proportions of both aquatic vegetation and shade trees, with few exceptions (e.g., SAC 35.4L, SAC 93.7L). Construction activities would entail removal of existing vegetation from the banks of the sites.

To compensate for the loss of riparian vegetation, the sites would be revegetated with native riparian species in accordance with the revegetation plans prepared for the proposed action (Appendix F). Monitoring and maintenance would be implemented for a minimum of 3 years to ensure the successful establishment of the replacement vegetation. With implementation of site revegetation and monitoring and maintenance of revegetated areas, the proposed action would have a less-than-significant impact on fish from loss of existing riparian vegetation, and no mitigation is required.

Impact BIO11: Impacts to Fish from Loss of Existing Instream Woody Material
All existing woody materials, both on the banks and in the water, would be initially removed from the sites during construction activities. Instream wood offers several habitat benefits for aquatic species, including special-status-fish, by providing hiding and resting cover, in addition to affecting invertebrate food production. Because most sites currently posses some proportion of IWM cover, the loss of IWM could result in a significant impact to special-status fish species.

To reduce the effects related to the loss of existing IWM, the proposed construction activities include installation of IWM at the 22 erosion sites with waterside repairs, which would substantially increase short-term IWM loading levels from current levels (Table 3-13). IWM would installed in accordance with the installation designs shown in the revegetation plans (Appendix F). The proposed construction would generally install proportions of IWM cover at the erosion sites comparable to or greater than currently exist, recruitment from off-site sources would potentially provide replacement or increased cover amounts, and planted riparian tree species would eventually serve as an onsite IWM source. The proposed action is therefore considered to have a less-than significant impact on fish from loss of existing IWM, and no mitigation is required.

Impact BIO12: Loss of Suitable Steelhead Spawning Habitat at LAR 10.0L and 10.6L
Implementation of the proposed action at sites LAR 10.0L and LAR 10.6L is anticipated to result in the loss of approximately 25,939 square feet (0.60 acre) of suitable spawning habitat for steelhead. This loss would represent a significant impact to steelhead spawning in this reach of the lower American River. Implementation of Mitigation Measure BIO4 would reduce impacts to a less-than-significant level.

Impact BIO13: Impacts to Salmonid and Delta Smelt Summer/Fall Habitat

The proposed action would result in both temporary and long-term significant impacts to aquatic habitat for special-status fish species in summer and fall, particularly for salmonids and delta smelt as modeled by the SAM. The short- and long-term impacts would potentially occur due to modification of the nearshore habitat areas. Specifically, the construction of a riparian bench surface above, rather than below, the summer/fall median water levels would expose special-status fish species to relatively steeper, coarser, and vegetation-free conditions along the waterside slope below the bench surface. Similarly, the revetted bank slopes of the two near-Delta sites (SAC 8.0L and 10.8L), which would not have riparian benches, would still potentially expose special-status fish species to short-term impacts as a result of temporary losses of existing vegetation cover. Overall, the addition of increased IWM cover at most sites would partially mitigate for initial reductions in vegetation cover; however, the long-term reduction in shallow water habitat availability, coarsening of bank substrate size, and complete loss of existing aquatic vegetation at many sites during summer and fall together would contribute to the long-term losses of juvenile salmonid and delta smelt habitat as a result of the proposed action. Long-term effects of the proposed action on habitat for green sturgeon, river lamprey, hardhead, Sacramento splittail, and longfin smelt were not modeled by the SAM, but potentially significant impacts to these species from the proposed action are expected to be generally similar to those modeled for salmonids and delta smelt during summer and fall conditions.

Off-site habitat mitigation measures would be required to compensate for these significant project-related impacts to special-status fish species in summer and fall as the use of on-site mitigation measures, such as IWM installation and revegetation, at most sites would be inadequate, as evaluated with the SAM. Based on the cumulative results for all 22 sites modeled in the four regions, salmonids rearing as juveniles and emigrating as smolts would be the limiting salmonid life stage in summer and fall, with expected maximum habitat losses of up to 1,380 linear feet (bank-line) and 271,363 square feet (wetted area) in WY 2015 (Year 6 for 2009-built sites and Year 5 for 2010-built sites). Therefore, off-site mitigation measures would be required to compensate completely for these impacts to juveniles as well as other salmonid life stages, even though model results indicate that juveniles would potentially experience the greatest habitat losses. The long-term habitat losses for delta smelt life stages were modeled up to 1,014 linear feet and 181,455 square feet in WY 2011 (Year 2 for 2009-built sites and Year 1 for 2010-built sites). Although the project-related impacts are not expected to be significant due to the typical restricted downstream distribution of delta smelt, the SAM results indicate that off-site mitigation would be required to offset potentially significant long-term impacts on spawning and incubation and juvenile rearing habitat.

Impacts to salmonids, delta smelt, and other special-status fish species due to project implementation would be significant. Implementation of Mitigation Measure BIO5 would reduce impacts to a less-than-significant level.

Impact BIO14: Impacts to the Valley Elderberry Longhorn Beetle

Project construction activities at erosion sites SAC 41.9R, FR 1.0L, FR 3.7L, FR 5.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC3.4L, SAC 73.5L, SAC 130.L, and SAC 157.7R have the potential to result in impacts to the valley elderberry longhorn beetle. Direct impacts involve the loss or damage of occupied or suitable elderberry shrubs (i.e., stems with basal diameter >1 inch) due to construction activities associated with levee repair. Direct impacts could also occur if suitable elderberry shrubs are removed and transplanted to another site. The removal of elderberry shrubs may result in mortality of individuals. Further, reproduction and foraging may be impaired because valley elderberry longhorn beetles rely on elderberry foliage for food and lay their eggs on elderberry stems.

Temporal loss of habitat would also occur with removal or transplanting of shrubs. Although mitigation generally provides creation or restoration of habitat, it generally takes more than 5 years for a shrub to become large enough to support beetles and 25 years for riparian habitats to reach their full value. Temporal loss of habitat would reduce the amount of habitat available for beetles, may fragment suitable habitat, and isolate subpopulations.

In addition, levee repair construction could result in impacts to the species due to application of herbicides, ground disturbance, and petroleum and chemical spills that may affect the viability of elderberry shrubs. Per USFWS guidelines (1999), complete avoidance may be assumed when a 100-foot buffer is established and maintained around elderberry shrubs.

All elderberry shrubs within sites SAC 41.9R, SAC 73.5L, SAC 157.7R, FR 1.0L, FR 3.7L, and FR 5.5L would be removed and relocated to an offsite mitigation area. Cumulatively, 33 elderberry clumps/shrubs totaling 147 stems (>1 inch basal diameter) would be directly impacted within these sites.

Elderberry shrubs at sites LAR 10.0L and LAR 10.6L would be preserved within the construction footprint by building temporary plywood enclosures protecting them from revetment placement and damage from heavy equipment. However, these shrubs may be impacted if roots or limbs are disturbed. Cumulatively, 42 elderberry clumps/shrubs totaling 215 stems (> 1 inch basal diameter) within the lower American River sites may be affected.

Elderberries at sites SAC 10.8L, SAC 130.0L, CC 2.8L, and CC 3.4L would be completely avoided. The elderberry shrubs at SAC 10.8L and SAC 130.0L are not located within the construction easement and would not be disturbed by construction activities. The elderberry shrubs at CC 2.8L and CC 3.4L are located on the waterside of the existing levee and would not be disturbed by construction of the setback levees.

Impacts to the valley elderberry longhorn beetle from project implementation would be significant. Implementation of Mitigation Measure BIO6 would reduce impacts to this species to a less-than-significant level.

Impact BIO15: Impacts to the Giant Garter Snake
Project construction activities at erosion site SBP 0.4E have the potential to result in impacts to the giant garter snake. Direct impacts may include mortality or injury of individuals during clearing of the site or placement of quarry stone, removal of emergent wetland vegetation that provides escape cover and foraging opportunities, and removal of upland habitat for basking, cover, and retreat sites. Loss of these habitats may cause individuals to move into areas where they are exposed to a greater risk of predation. In addition, construction disturbance, such as noise or vibration, may result in a temporary reduction in prey items or impacts on water quality. Potential impacts to the giant garter snake would be considered significant. Implementation of Mitigation Measure BIO7 would reduce these impacts to a less-than-significant level.

Impact BIO16: Impacts to the Western Pond Turtle
Construction activities at all erosion sites have the potential to result in impacts to western pond turtles. Direct impacts would occur if construction activities (such as earth moving, grubbing, and IWM and revetment placement) resulted in direct mortality of individuals occupying upland or aquatic habitat. Removal of suitable refugia and basking sites (such as emergent vegetation, IWM, or rocks) may also contribute to direct impacts by exposing individuals to predation and limiting the availability of basking sites. Additionally, impacts may occur if water quality is compromised by petroleum or chemical spills or turbidity and sedimentation. Reduction in water quality could injure individual turtles and result in a reduction of aquatic organisms that serve as a food source. Impacts to the western pond turtle may be considered significant. Implementation of Mitigation Measure BIO8 would reduce impacts to this species to a less-than-significant level.

Impact BIO17: Impacts to the Bank Swallow
Proposed construction activities at erosion sites SAC 136.9R and CC3.4L have the potential to result in direct impacts to bank swallows. The proposed erosion repair at site SAC 136.9R would cover the eroding bank with soil and rock revetment. A setback levee is proposed for site CC 3.4L, but the vertical eroding bank would not be disturbed.

Direct impacts to bank swallows may include disturbance of breeding activities and mortality or injury of individuals if active nest colonies are present at site SAC 136.9R during construction. Impacts may also occur due to the loss of suitable habitat resulting from placement of revetment over the eroding banks.

These impacts to bank swallow would be considered significant. Implementation of Mitigation Measure BIO9 would reduce impacts to this species to a less-than-significant level.

Impact BIO18: Impacts to the White-Tailed Kite
Construction activities at erosion sites SAC 41.9R, SAC 71.3R, SAC 130.0L, SAC 136.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, SBP 0.4E, SAC 73.5L, SAC 78.8L, SAC 114.5L, SAC 136.9R, and SAC 157.7R have the potential to result in direct impacts to white-tailed kites. Potential direct impacts include the removal of trees containing active nests and the incidental loss of fertile eggs or nestlings due to construction disturbance

(i.e., noise, vibration, etc. that leads to adult abandonment of a nest) during the breeding season.

Impacts to white-trailed kites would be considered significant. Implementation of Mitigation Measure BIO10 would reduce impacts to this species to a less-than-significant level.

Impact BIO19: Impacts to the Swainson's Hawk
Construction activities at the erosion sites have the potential to result in direct impacts to the Swainson's hawk, such as the removal of trees containing active nests. In addition, construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to the abandonment of nests. Proposed staging areas occur in suitable foraging habitat (i.e., disced grasslands adjacent to tomato fields) at SAC 87.0L. Thus, some foraging habitat would be temporarily affected while the staging area is in use. However, abundant foraging habitat is available in the tomato fields adjacent to the erosion site.

Impacts to Swainson's hawk would be considered significant. Implementation of Mitigation Measure BIO11 would reduce impacts to this species to a less-than-significant level.

Impact BIO20: Impacts to the Yellow Warbler and Yellow-Breasted Chat
Proposed activities at erosion site DC 0.9N involve the construction of a setback levee, but the riparian corridor along Deer Creek would not be disturbed. Therefore, construction activities would not result in loss of habitat for the yellow warbler and yellow-breasted chat. However, noise, vibration, and activities associated with construction have the potential to result in impacts to these species, including nest abandonment resulting in the loss of fertile eggs or nestlings.

Impacts to the yellow warbler and yellow-breasted chat may be considered significant. Implementation of Mitigation Measure BIO12 would reduce impacts to these species to a less-than-significant level.

Impact BIO21: Impacts to the Western Red Bat
Because this species roosts and breeds solitarily, direct impacts to individuals may occur if roost trees are removed. Additionally, the presence of construction activity and noise may deter the bats from roosting or result in relocation (including young) from the construction area. However, construction activities are restricted to a localized area and tree removal would be avoided or minimized at all erosion repair sites.

Localized construction areas, limited or no tree removal, solitary roosting, and the ability for bats to move their young reduce the likelihood of impacts to western red bats. Therefore, potential impacts to this species would be less than significant and no mitigation is required.

Impact BIO22: Impacts to Non–Special Status Fish Species
Impacts to non–special status fish species would be similar to those for special-status fish species. Potential impacts include direct disturbance from construction activities, increase in turbidity and suspended sediment, release of toxic materials, reduced aquatic vegetation cover, reduced overhead shade cover from loss of riparian vegetation, and loss of IWM. Impacts to non–special status fish species are typically considered less than significant because populations of these species are generally large and resilient, and the potential population-level effects would therefore be minor. However, effects on non–special status fish species would be considered significant if implementation of the proposed action would substantially diminish habitat for any fish life stage or result in displacement of spawning fish such that year-class strength is substantially reduced.

Implementation of Mitigation Measures WQ1 and WQ2 (see section 3.6, Water Quality and Hydrology), Mitigation Measures BIO3, and site revegetation and IWM installation as specified in the revegetation plans (Appendix F) would reduce potential impacts to a less-than-significant level.

Impact BIO23: Impacts to Nesting Raptors and Migratory Birds
Disturbance from construction activities may impact nesting raptors and migratory birds. Stick nests were observed at LAR 10.0L (tree no. 531) and just north of the erosion site at FR 1.0L. Tree and vegetation removal may cause direct impacts to nesting birds if nests are present. Construction noise (e.g., generators, heavy equipment, vehicles, and river barges) has the potential to affect these species by causing nest abandonment or premature fledging resulting in a potentially significant impact. Implementation of Mitigation Measures BIO10 and BIO13 would reduce potential impacts to a less-than-significant level.

Impact BIO24: Impacts to Marine Mammals
The California sea lion, a marine mammal, is known to use the lower reaches of the American, Sacramento, Mokelumne, and San Joaquin rivers. Occasionally, California sea lions have been observed using the upper reaches of the Sacramento River and have been recorded as far north as Colusa and as far south as the confluence of the Mokelumne and San Joaquin rivers. California sea lions were observed at SAC 87.0L during the field visits.

Marine mammals may be directly or indirectly affected by construction activities if present during construction. Direct impacts may occur if barges, heavy equipment, or placement of material in the river result in direct mortality or injury of individuals that may occupy the river during periods of construction. Additionally, impacts could occur if water quality is compromised by petroleum or chemical spills or turbidity and sedimentation. Reduction in water quality could harm individual marine mammals and result in a reduction of aquatic organisms that serve as a food source.

Because California sea lions and other marine mammals are protected under the Marine Mammal Protection Act (MMPA), impacts on marine mammals would be considered significant. Implementation of Mitigation Measure BIO14 would reduce impacts to a less-than-significant level.

Impact BIO25: Impacts to Other Non–Special Status Wildlife
Common wildlife species present within the erosion sites may be directly or indirectly affected by the implementation of the proposed action. Direct impacts may include mortality or injury to individuals present within the erosion sites due to vegetation removal, movement of heavy equipment, construction noise, or placement of revetment. Indirect impacts may include altered habitat conditions after the completion of the repairs. Populations of common wildlife species are abundant throughout the region and in the immediate vicinity of the erosion sites. Additionally, many species are adaptable to a variety of habitats. Thus, impacts to non–special status wildlife species would be considered less than significant and no mitigation is required.

3.5.3.3. Alternative 2: Thin Rock Armor

Under the thin rock armor alternative (alternative 2), vegetation would be cleared from the levee and a thin layer of rock revetment would be placed on the existing slope of the levee. This alternative would likely limit or altogether prevent implementation of beneficial actions, including planting native riparian vegetation, installation of IWM, and development of riparian and wetland benches. Placement of a thin layer of rock would protect the bank from erosion, but would not address stability issues. The erosion repair would leave the sites generally barren of vegetation, and mitigation for lost habitat values would be arranged at an offsite location.

Vegetation Communities
Implementation of alternative 2 would result in the removal of oak woodland, riparian forest, riparian scrub, ruderal, emergent wetland, and other vegetation communities present within the erosion sites. Measures to replace existing vegetation communities and create gradients suitable for emergent and riparian vegetation communities may be limited or absent from the erosion repair efforts. Placement of the thin rock armor would likely inhibit the post-construction establishment of native vegetation communities and result in colonization of the erosion sites by non-native, weedy plant species.

Special-Status Plants
The potential adverse effects of alternative 2 on special-status fish due to short-term construction-related activities would be substantially similar to those discussed for the proposed action. Overall, this alternative would result in a loss of habitat and adverse effects on special-status fish species similar to the proposed action.

Potential short-term effects would include localized disturbance or displacement of adult and juvenile fish because of noise, suspended sediment, and turbidity generated during in-water construction activities. Sediment and turbidity effects may occur at the erosion sites and downstream of the sites. Noise effects may occur at the erosion sites, and upstream and downstream of the sites. Removal of riparian vegetation and IWM from the streambank may result in the short-term loss of overhead and instream cover, reducing habitat quality and quantity for adult and juvenile fish. The potential also exists for injury or mortality of fish that may be unable to move away from channel or nearshore areas directly affected by construction activities (e.g., placement of rock revetment). In addition, mortality or physiological impairment may be caused by toxic substances (e.g., gasoline, lubricants, and oil) entering the water.

Long-term adverse effects could include reduced near-shore habitat value for spawning and incubation by delta smelt, and for rearing and adult migration life stages of all special-status fishes. These effects would result from addition of rock revetment and removal or burial of riparian and emergent vegetation at bank repair locations. Alternative 2 does not address slope stability issues and, because bank slopes would not be reduced, mid-term (i.e., approximately 25 years) levee failures are possible. Levee failure could potentially transport fish out of the Sacramento River into areas where they are likely to become stranded, and could result in post-failure emergency repair measures during which BMPs and mitigation measures would be more difficult to implement. A limited ability to implement BMPs and mitigation measures would result in a greater potential to affect special-status wildlife and plants. These effects could result in significant impacts to special-status fish species.

Implementation of alternative 2 may directly or indirectly impact special-status plants that are known to occur or have the potential to occur. Direct impacts include removal of individuals or populations during vegetation removal activities. Altering the bank with thin rock placement may indirectly impact special-status plant species by altering the physical habitat (i.e., grade, hydrology, or soil density) that would otherwise support these species. Implementation of this alternative may limit or prevent beneficial actions that would provide replacement habitat at equal or greater values. Direct and indirect impacts could occur to Mason's lilaeopsis (SAC 8.0L, SAC 10.8L), Suisun Marsh aster (SAC 8.0L, SAC 10.8L), Delta mudwort (SAC 10.8L), silky cryptantha (DC 0.9N), and wooly rose-mallow (SBP 0.4E), which are known to occur or may occur at the indicated erosion sites.

Impacts to special-status wildlife species resulting from implementation of alternative 2 would be greater than those described for the proposed action. Removal of vegetation and trees that provide foraging and breeding habitat for special-status wildlife species would likely result in significant impacts to special-status wildlife species that may use the erosion sites for foraging, breeding, and other activities. Given that replacement of riparian vegetation and specific habitat components (e.g., IWM) would be limited or absent in erosion repair efforts, this alternative would likely result in a permanent loss of habitat value and displacement of special-status wildlife species from the erosion sites.

Non–Special Status Fish and Wildlife Species

The potential adverse effects of Alternative 2 on non–special status fish would be due to short-term construction-related activities including localized disturbance or displacement of adult and juvenile fish because of noise, suspended sediment, and turbidity generated during in-water construction activities. Sediment and turbidity effects may occur at the erosion sites and downstream of the sites. Noise effects may occur at the project sites and upstream and downstream of the sites.

Removal of riparian vegetation and IWM from the streambank may result in the short-term loss of overhead and instream cover, reducing habitat quality and quantity for adult and juvenile fish. The potential also exists for injury or mortality of fish that may be unable to move away from channel or nearshore areas directly affected by construction activities (e.g., placement of rock revetment). In addition, mortality or physiological impairment may be caused by toxic substances (e.g., gasoline, lubricants, and oil) entering the water.

Long-term adverse effects could include reduced near-shore habitat value for spawning and incubation, and for rearing and adult migration life stages of all non–special status fish. These effects would result from addition of rock revetment and removal or burial of riparian and emergent vegetation at bank repair locations. Alternative 2 does not address slope stability issues and, because bank slopes would not be reduced, mid-term (i.e., approximately 25 years) levee failures are possible. Levee failure could potentially transport fish out of the river into areas where they are likely to become stranded, and could result in post-failure emergency repair measures during which BMPs and mitigation measures would be more difficult to implement.

Implementation of alternative 2 would directly impact non–special status wildlife occurring within the erosion sites. The removal of all vegetation would result in a significant loss of habitat value and result in the long-term displacement of wildlife species currently utilizing the erosion sites. The removal of vegetation may also result in the fragmentation of existing riparian corridors and disturb the movement of wildlife species along the affected waterbodies.

3.5.4. Mitigation

The following mitigation measures would be incorporated into the proposed action to avoid the potential for significant impacts to biological resources.

Mitigation Measure BIO1: Impacts to Native Trees

a. All native trees within the construction easement that are greater than 4 inches dbh shall be retained to the greatest extent practicable. Tree removal shall be limited to situations where access, required equipment maneuverability, worker/public safety, and levee integrity are not reasonably possible without removal of trees. Any tree removal that is not specifically identified as authorized in the construction plans shall require individual authorization by the Corps and/or CVFPB. This specification shall be identified in the construction contract.

b. All trees that are to be retained and that occur within the footprint of the repairs shall be trimmed of any branches that would interfere with installation of protective materials (e.g., burlap or plywood boxes) or be covered with revetment. All trimming of trees shall be completed by an International Society of Arboriculture certified arborist or other qualified personnel that are knowledgeable about tree biology and appropriate trimming procedures.

c. All trees that are to be retained and that occur within the footprint of the repairs shall be protected by constructing plywood boxes around the trunks or wrapping the trunks with protective materials (e.g., burlap) prior to placement of revetment. Tree protection measures shall be clearly illustrated in the construction plans. Where construction of plywood boxes around tree trunks is appropriate (e.g., on upper slopes with limited height of revetment), the box shall be constructed as far as practicable away from the trunk.

d. Construction staging and operation of vehicles/heavy equipment within the dripline of native trees shall be avoided to the greatest extent practicable.

Mitigation Measure BIO2: Impacts to Special-Status Plants

a. Direct disturbance to populations of Mason's lilaeopsis, Suisun Marsh aster, and Delta mudwort at erosion sites SAC 8.0L and SAC 10.8L shall be avoided. The locations of the populations of these species shall be clearly identified on construction plans, and these locations shall be clearly identified as avoidance areas.

b. Prior to initiation of construction activities, exclusionary fencing (i.e., 4-foot tall plastic orange mesh) and signage shall be erected around the populations of special-status plant species within the construction easement. Fencing shall be placed as far as practicable away from the plant populations. No fencing shall be placed within inundated areas of the Sacramento River. Fencing shall be erected under the supervision of a qualified biologist. No construction disturbance shall be allowed within the fenced areas. Signage prohibiting entrance shall be placed at a minimum of every 50 feet along the exclusionary fencing. The signs shall be clearly readable from a distance of 20 feet. All fencing and signage shall be maintained for the duration of all construction activities.

c. Prior to initiation of construction activities, worker environmental awareness training shall be conducted by a qualified biologist. The training shall inform workers of the sensitivity of the avoidance areas and their responsibilities to ensure that the populations of special-status plant species are not disturbed.

d. Prior to initiation of construction activities at erosion site SBP 0.4E, a qualified biologist shall conduct surveys for wooly rose-mallow within 100 feet upstream and downstream of the construction easement footprint. Surveys shall be conducted during the identifiable period for this species. If wooly rose-mallow is not present within the survey area, no additional measures are required. If wooly rose-mallow is present within the survey area, the following measures shall be implemented:

    - Direct impacts to populations shall be avoided to the greatest extent practicable. This may include, but is not limited to, installation of exclusionary fencing, signage, and implementation of worker environmental awareness training.

    - If direct impacts cannot be avoided, the plants (including their root balls/rhizomes) shall be transplanted to an appropriate location under the supervision of a qualified biologist. The qualified biologist shall coordinate with DFG regarding transplantation techniques and locations prior to implementation of transplantation efforts.

- If transplantation of plants is required, a monitoring program (with performance requirements) shall be implemented to evaluate the success of the transplantation effort. The monitoring program shall be developed by a qualified biologist in coordination with DFG. The monitoring program shall be implemented for a minimum of 3 years. If transplantation efforts are determined to be unsuccessful during the monitoring period, remedial actions shall be identified and implemented in coordination with DFG. Remedial actions may include, but are not limited to, providing replacement plantings and continued monitoring with plants obtained from a local native plant nursery, participating in the improvement of habitat conditions at off-site locations known to support the species, and implementing or providing financial support to conservation efforts in the watershed that would benefit regionally occurring special-status plant species.

Mitigation Measure BIO3: Direct Impacts to Fish from Construction Activities

a. In-water work activities shall be limited to August 1 through November 30.

b. During construction operations, stockpiling of construction materials, portable equipment, vehicles, and supplies shall be restricted to the designated construction staging areas. A qualified biologist shall provide worker environmental awareness training to contractors and construction crews regarding all special-status fish species known to occur near the erosion sites.

c. A representative (on-site monitor) shall be appointed by the Corps to be the point of contact for any worker that observes a dead, injured, or entrapped special-status fish. Dead or injured fish shall be photographed and the photographs provided to the Corps, NMFS, and the USFWS. If a live specimen is captured in good condition, and a positive identification cannot be made in the field because of size or lack of other distinguishing characteristics, the fish shall be immediately returned to the river downstream of the project area.

Mitigation Measure BIO4: Steelhead Spawning Habitat at LAR 10.0L and 10.6L

a. A compensatory replacement program shall be implemented for the estimated loss of 25,939 square feet (0.60 acre) of potentially suitable steelhead spawning habitat at erosion sites LAR 10.0L and LAR 10.6L. The compensatory replacement program shall result in addition of spawning-size gravel in an amount suitable to account for replacement of the spawning habitat lost by the project. The augmentation of spawning-size gravel shall account for both the actual area lost to each revetment structure footprint and the loss of the steelhead spawning that would potentially occur in the season(s) that the revetments are built. A 2:1 replacement ratio shall be required to compensate adequately for the potential spatial and temporal loss of potential spawning habitat. Applying the 2:1 ratio, the estimated required spawning habitat mitigation area is 51,878 square feet (1.19 acres).

b. The location and volume for mitigation gravel shall be selected in close coordination with qualified fishery biologists who are familiar with the location and habits of steelhead in the lower American River. Furthermore, selection of the mitigation site(s) shall be selected in coordination with a qualified geomorphologist familiar with gravel augmentation and its attendant caveats. The mitigation shall be implemented either: (1) as part of the project design in the form of onsite and/or nearby placement of spawning-sized gravels, or (2) through a provision of funds toward ongoing or future gravel augmentation projects in the lower American River. For the latter approach, funding could potentially be put toward the ongoing U.S. Bureau of Reclamation (USBR) gravel augmentation efforts in the project reach. The appropriate gravel augmentation approach shall be chosen by the Corps, CVFCB, and NMFS prior to construction.

c. The mitigation gravel shall have a thickness that is greater than the typical redd thickness, or height, constructed by lower American River steelhead to insure adequate habitat for spawning and incubation of eggs and alevin. The initial gravel volume shall also be thick enough to provide an adequate supply of spawnable gravel subsequent to possible redistribution of the emplaced mitigation gravel that may occur after sediment transporting flows. The mitigation gravel shall be placed in a location adjacent to the project sites that is accessible to spawning steelhead and where key habitat parameters (e.g., water velocity, depth, and temperature) are suitable for steelhead spawning.

d. Prior to implementation of the compensatory replacement program, the location of augmentation sites, volume of gravels required, and method and timing for gravel placement shall be approved by NMFS.

e. Through coordination with the Corps, CVFPB, and NMFS, an ongoing monitoring program shall be developed to document the success of gravel augmentation in the project reach. Specifically, field surveys shall document steelhead use of the added gravels, track the movement and dispersal (i.e., loss) of the added gravels over time, and identify losses or additions of suitable spawning areas elsewhere in the project reach due to changes in hydraulic conditions as a result of the project. Information obtained from ongoing redd surveys conducted by the USBR in the project reach may be used to complement the monitoring activities. The monitoring studies shall have an approximate time limit of 3 to 5 years following the initiation of construction. The final study duration shall be determined through an agreement with NMFS.

Mitigation Measure BIO5: Impacts to Salmonid and Delta Smelt Summer/Fall Habitat

a. Prior to implementation of the proposed action, formal consultation under Section 7 of the ESA shall be completed with NMFS and the USFWS. All terms and condition of the Biological Opinions shall be implemented.

b. On-site mitigation shall include the creation of three riparian bench types, including a riparian bench with a 10:1 bank slope (13 Corps-built sites), and undulating riparian bench with 2-foot transverse berms and 10:1 bank slope (4 DWR-built sites), and a sloping riparian bench with a 6:1 bank slope (3 Corps-built sites on the Feather River). The riparian benches shall be seasonally inundated during winter and spring high flows. In Reach 1a, where no riparian benches will be constructed, bank slope repairs shall be planted with riparian vegetation.

c. IWM and fascines shall be installed at all of the erosion sites (except the three setback levee sites) to retain and enhance the structural habitat and hydraulic complexity of the nearshore zones relative to existing conditions. The key objective is to provide essential SRA habitat and velocity refuge opportunities for rearing juveniles. Woody materials shall be installed at the 22 sites in accordance with the installation designs shown in the revegetation plans Appendix F. All installed IWM shall consist of hardwood tree species (e.g., English walnut and almond) that span approximately 15 to 20 feet in length and retain an extensive branch and root structure. IWM shall be securely anchored under rock revetment at the front edge of the riparian bench or bank toe (e.g., SAC 8.0L and 10.8L) for both high water winter and spring habitat and for low water summer and fall aquatic habitat. The required specifications for installation of IWM and planting of riparian trees shall be clearly identified in final construction drawings and construction contracts.

d. To compensate for salmonid habitat losses identified by the SAM, the Corps and the CVFPB shall purchase or develop aquatic habitat with equivalent values (within the SAM) to provide 1,390 linear feet and 271,363 square feet (6.2 acres) of habitat for juvenile Chinook salmon in fall within Regions 1a, 1b, 2, and 3 by WY 2015 (Year 6 for 2009-built sites and Year 5 for 2010-built sites). These values shall be used to compensate for effects on juveniles as well as other salmonid life stages, even though model results indicate that juveniles would potentially experience the greatest habitat losses. A suitable mitigation site shall be situated within 50 miles of the project sites and approved by NMFS. The expected project-related impacts to other juvenile special-status fish species (i.e., green sturgeon, Sacramento splittail, river lamprey, and hardhead) would be similarly mitigated to less-than significant levels with the creation of aquatic habitat by this salmonid-targeted mitigation measure.

e. To compensate for delta smelt habitat losses identified by the SAM, the Corps and CVFPB shall purchase or develop aquatic habitat with equivalent values (within the SAM) to provide 1,014 linear feet and 181,455 square feet (4.2 acres) of habitat for the affected delta smelt life stages (spawning, incubation, and rearing) in summer within Regions 1a and 1b. Compensation in these amounts shall be applied no later than 2011 to ensure habitat recovery within the 2-year recovery period recommended by the SAM (U.S. Army Corps of Engineers 2004). Off-site mitigation credits shall be withdrawn from the Cache

Slough/Yolo Bypass Mitigation Area. Prior to 2007, the Cache Slough mitigation site offered 12,000 feet and 138 acres (6,011,280 square feet) of potential habitat compensation. Considering both the current SAM-modeled deficits (1,014 linear feet and 4.2 acres) and previous compensation of 2,531 linear feet and 21.9 acres from 29 previously constructed Corps sites (U.S. Army Corps of Engineers 2008a) and 816 linear feet and 3.8 acres from 13 planned Corps sites in 2008–2009 (U.S. Army Corps of Engineers 2008b) withdrawn from this mitigation site, this would leave a balance of 7,639 feet and 108.1 acres (4,708,836 square feet for future delta smelt compensation needs.

Mitigation Measure BIO6: Impacts to Valley Elderberry Longhorn Beetle

a. The locations of elderberry shrubs to be preserved and elderberry shrubs to be transplanted shall be clearly identified on construction plans.

b. Prior to any vegetation clearing, plywood boxes (or other protective measures approved by the USFWS) shall be constructed around all elderberry shrubs proposed to be preserved within the footprint of the levee repairs. The plywood boxes shall be constructed as far as feasible outside the dripline of the elderberry shrubs. A biological monitor shall be present during construction of the plywood boxes to ensure that all elderberry shrubs intended to be preserved are identified and adequately protected prior to vegetation clearing.

c. Prior to any construction activities, exclusionary fencing (e.g., 4-foot tall plastic orange mesh) shall be erected around all elderberry shrubs located outside of the footprint of the repairs, but within the construction easement. Fencing shall be placed as far as practicable outside of the dripline of the elderberry shrubs. Fencing shall be erected under the supervision of a qualified biologist. No construction disturbance within the fenced areas shall be allowed. Signage shall be placed a minimum of every 50 feet along the exclusionary fencing with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the ESA of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs shall be clearly readable from a distance of 20 feet. All fencing and signage shall be maintained for the duration of all construction activities.

d. Prior to the initiation of construction activities on all sites containing elderberry shrubs to be preserved, worker environmental awareness training shall be conducted by a qualified biologist. The training shall instruct crews about the status of the valley elderberry longhorn beetle, its relationship with its host plant, the need to avoid damaging elderberry shrubs, and the possible penalties for not complying with these requirements.

e. Following completion of the levee repairs at all sites containing elderberry shrubs, a post-construction evaluation shall be conducted by a qualified biologist to determine whether any elderberry shrubs intended to be preserved were

damaged by construction activities. If damage is identified, the USFWS shall be immediately consulted to determine appropriate compensatory measures. Measures to compensate for unanticipated impacts to elderberry shrubs shall (at a minimum) conform to the 1999 USFWS *Conservation Guidelines for the Elderberry Longhorn Beetle*.

f. All elderberry shrubs proposed to be removed from the footprint of the levee repairs shall be transplanted to an off-site location approved by the USFWS. Timing, transplant techniques, and ratios for plantings of additional elderberry shrubs and associated native plant species shall be approved by the USFWS. A qualified biologist shall monitor the transplanting of all elderberry shrubs to ensure that all requirements of the USFWS are fulfilled.

Mitigation Measure BIO7: Impacts to Giant Garter Snake

a. Unless otherwise approved by the USFWS, construction activities at erosion site SBP 0.4E shall be initiated only during the giant garter snake active period (May 1 to October 1), when individuals are active on the surface and able to move away from disturbance.

b. Prior to initiation of construction activities at site SBP 0.4E, workers shall participate in USFWS-approved worker environmental awareness training provided by a qualified biologist. The training shall instruct workers on how to identify the snake and its habitats, what to do if a snake is encountered during construction activities, and how to contact the designated biological monitor.

c. Within 24 hours prior to commencement of construction activities, the site shall be inspected by a qualified biologist approved by the USFWS. The biologist shall provide the USFWS with a field report documenting the monitoring effort that occurred within 24 hours of commencement of construction activities. The biologist shall be available during construction. If a giant garter snake is encountered, the monitoring biologist and the USFWS shall be immediately notified and all construction activities with the potential to disturb the snake shall be immediately stopped. The snake shall be monitored and allowed to leave the area on its own. The biologist shall remain in the area for the remainder of the workday to ensure that the snake is not harmed. If a snake does not leave on its own within one working day, further consultation with the USFWS shall be conducted.

d. Movement of heavy equipment to and from the construction site shall be restricted to established roadways and designated construction areas. Stockpiling of construction materials shall be restricted to designated staging areas.

e. Giant garter snake habitat that can be avoided shall be clearly identified on construction plans, and these locations shall be clearly identified as avoidance areas. Exclusionary fencing and signage shall be erected to delineate avoidance areas. No construction disturbance shall be allowed with the avoided areas.

f. Erosion control measures (BMPs) that minimize soil or sediment from entering the river shall be implemented. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations.

g. Litter, debris, unused materials, equipment, and supplies from areas below the ordinary high water line shall be removed daily. Such materials or waste shall be deposited at an appropriate disposal or storage site.

h. No plastic, monofilament, jute, or similar erosion control matting that could entangle snakes shall be placed in the construction area when working within 200 feet of giant garter snake habitat. Possible substitutions include coconut coir matting, tactified hydroseeding compounds, or other material approved by the USFWS.

i. Upon completion of construction activities, any temporary fill and/or construction debris shall be removed from the site. If the material is located near undisturbed giant garter snake habitat and shall be removed between October 1 and April 30, it shall be inspected by a qualified biologist to ensure that snakes are not using it as a hibernaculum.

Mitigation Measure BIO8: Impacts to Western Pond Turtle

a. Pre-construction surveys for western pond turtles shall be conducted by a qualified biologist the morning of initiation of construction activities. Any turtles observed shall be allowed to move out of the construction area before construction activities are initiated.

b. Prior to initiation of construction activities at all erosion sites, workers shall participate in a worker environmental awareness training provided by a qualified biologist. The training shall instruct workers regarding how to identify the turtle, the habitats used by the turtle, the potential for turtle egg clutches (i.e., nest sites) to be discovered during vegetation clearing, what to do if a turtle or suspected egg clutch is encountered during construction activities, and how to contact the monitoring biologist. The monitoring biologist shall be contacted immediately in the event that a turtle or eggs are encountered.

c. Any dead or injured turtles shall be immediately reported to DFG. The treatment of any injured or dead turtles shall be coordinated with DFG.

Mitigation Measure BIO9: Impacts to Bank Swallow

a. To the extent practicable, construction activities at erosion sites SAC 136.9R and CC 3.4L during the bank swallow nesting season shall be avoided. The bank swallow nesting season is early April to mid-July.

b. If construction activities at sites SAC 136.9R and CC 3.4L are to occur during the bank swallow nesting season, a qualified biologist shall conduct a pre-

construction survey within the construction easement to determine the presence/absence of nesting bank swallows. At least one survey shall be conducted no more than one week prior to the onset of any construction activity. If no active nests are located, no further mitigation is necessary.

c. If active bank swallow nests (nests containing eggs or young) are present within the construction easement, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with DFG. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate.

d. A qualified biologist shall monitor any active nests that are located within the construction easement. The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and nest failure is possible, DFG shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with DFG and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to DFG within 2 weeks of termination of monitoring activities.

Mitigation Measure BIO10: Impacts to Nesting Raptors

a. To the extent practicable, construction activities at the erosion sites during the nesting season for white-tailed kites and other raptor species shall be avoided. The nesting season for raptor species is March through August.

b. If construction activities are to occur during the nesting season, a qualified biologist shall conduct pre-construction surveys of the construction easement and accessible areas within a 500-foot radius prior to initiation of construction activities. At least one survey shall be conducted no more than one week prior to the initiation of construction activities. If no active nests are located, no further measures to avoid impacts to active raptor nests are warranted.

c. If an active raptor nest is identified within 500 feet of the construction easement, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with DFG. Determination of the required width of the buffer zone shall consider the distance of the nest site from construction activities, the line of sight from the nest site to construction activities, the existing level of disturbance, and other factors established with DFG on a case-by-case basis.

d. A qualified biologist shall monitor any active nests that are located within 500 feet of construction activities (assuming DFG approves a buffer width of greater than or equal to 500 feet). The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and nest failure is possible, DFG shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with DFG and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to DFG within 2 weeks of termination of monitoring activities.

Mitigation Measure BIO 11: Impacts to Swainson's Hawk

a. At all erosion sites (other than SAC 8.0L, SAC 10.8L, and DC 0.9N), construction activities during the Swainson's hawk nesting season shall be avoided to the extent practicable. The Swainson's hawk nesting season is March 1 to August 15.

b. If construction activities are to occur during the Swainson's hawk nesting season, a qualified biologist shall conduct a pre-construction survey of accessible areas within a 0.5-mile radius of the construction easement, the required survey radius may be reduced (on a case-by-case basis) if approved in advance by DFG, but in no case shall be less than 500 feet. At least one survey shall be conducted no more than one week prior to the initiation of construction activities. If no active nests are located, no further measures to avoid impacts to active Swainson's hawk nests are necessary.

c. If an active Swainson's hawk nest is identified within the required survey radius, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with DFG. Determination of the required width of the buffer zone shall consider the distance of the nest site from construction activities, the line of sight from the nest site to construction activities, the existing level of disturbance, and other factors established with DFG on a case-by-case basis.

d. A qualified biologist shall monitor any active nests that are located within 500 feet of construction activities (assuming DFG approves a buffer width of greater than or equal to 500 feet). The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and nest failure is possible, DFG shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with DFG and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to DFG within 2 weeks of termination of monitoring activities.

e. If direct impacts to an active Swainson's hawk nest site cannot be avoided, or the required no-disturbance buffer determined in coordination with DFG cannot be maintained, a CESA 2081 incidental take permit shall be obtained prior to initiation of construction activities. All conditions of the 2081 permit shall be implemented. Permit conditions may include, but are not limited to, implementing restoration/replacement of woody riparian habitat, acquisition/preservation of existing habitat, and purchase of credits from an authorized mitigation bank or payment of in-lieu fees.

f. Suitable foraging habitat for Swainson's hawk occurs at site SAC 87.0L. This habitat shall be avoided to the extent practicable. Any suitable foraging habitat that is temporarily disturbed due to construction activities (e.g., staging or ground disturbance) shall be restored to pre-construction conditions or better after completion of construction activities. If construction activities result in a permanent loss of suitable foraging habitat, compensation for loss of foraging habitat shall be provided in accordance with the *Staff report regarding mitigation for impacts to Swainson's hawks (Buteo swainsoni) in the Central Valley of California* (California Department of Fish and Game 1994b) or by other measures as approved by DFG.

Mitigation Measure BIO12: Impacts to Yellow Warbler and Yellow-Breasted Chat

a. To the extent practicable, construction activities at erosion site DC 0.9N during the nesting season for the yellow warbler and yellow-breasted chat shall be avoided. The nesting season for these species is from early April to mid-July. If construction activities avoid the nesting season, no further mitigation is required.

b. If construction activities are to occur during the nesting season, pre-construction surveys of all suitable habitats within 250 feet of proposed construction activities shall be conducted by a qualified biologist. A minimum of one survey shall be conducted no more than one week prior to the onset of any construction activity. If no active nests are located, no further mitigation is necessary.

c. If active nests (nests containing eggs or young) are present within the survey area, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with DFG. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate.

Mitigation Measure BIO13: Impacts to Migratory Birds

a. Vegetation removal during the peak nesting season for migratory birds shall be avoided. The peak nesting season is April 1 to July 15.

b. If vegetation removal is to occur during the peak nesting season, a qualified biologist shall conduct a pre-construction survey within the construction easement to determine the presence/absence of nesting birds. At least one survey event shall be conducted no more than one week prior to the onset of any construction activity. If no active nests are located, no further mitigation is necessary.

c. If active nests (nests containing eggs or young) are identified within the survey area, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the USFWS. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate.

Mitigation Measure BIO14: Impacts to Marine Mammals

a. All aquatic habitat within the construction area shall be inspected for the presence of marine mammals within 2 hours and 30 minutes prior to the initiation of construction and during construction activities.

b. If a marine mammal is encountered, all construction activities shall cease and NMFS and the monitoring biologist shall be contacted for further instructions. Construction activities shall not be initiated or resumed until the marine mammal has completely left the area at its own volition.

c. If any dead or injured marine mammals are discovered, all construction activities shall cease and NMFS and the monitoring biologist shall be immediately contacted. Construction activities shall not resume until authorized by NMFS. The treatment of any injured or dead marine mammals shall be coordinated with NMFS.

3.6. Hydrology and Water Quality

3.6.1. Environmental Setting

The 25 proposed erosion repair sites are located in the drainage basin of the Sacramento River system in the northern part of California's Central Valley along the Sacramento River, Feather River, American River, Cache Creek, Deer Creek, and Sutter Bypass, as described in Chapter 1. The 25 sites are generally located along the Sacramento River valley floor from south of Rio Vista in Solano County to northeast of Corning in Tehama County (see Figure 1-1).

The Sacramento River drainage area covers approximately 27,000 square miles, including the Feather River drainage basin, which totals approximately 5,500 square miles, and the American River drainage basin, which totals approximately 2,100 square miles. The

watershed consists of the entire area drained by the Sacramento River, including the Sacramento Valley, the Coast Ranges to the west, the Klamath and Cascade ranges to the north, and the Sierra Nevada to the east. Water from the Trinity River drainage basin has also been conveyed to the Sacramento River near Redding since the 1960s. The average annual flow of the Sacramento River is 19,000 cubic feet per second (cfs) (Sacramento Valley Water Quality Coalition 2004), and, on average, over 22 million acre feet of water flows through the 327-mile-long river annually.

The Feather River, which is the largest tributary to the lower Sacramento River, originates in the Sierra Nevada and Cascade Mountains; the combined flows of the Feather River and its tributaries (including the Yuba River) enter the Sacramento River near the community of Verona in Sutter County. The three forks of the American River originate in the Sierra Nevada and converge east of the city of Sacramento; the lower American River joins the Sacramento River in Sacramento. Cache Creek, a large stream that has been modified by dams and diversions, flows from Clear Lake across Yolo County into a settling basin in the Yolo Bypass just west of the river and north of Woodland. The Sutter Bypass, like the Yolo Bypass, is part of an engineered flood management system; water flows into the Sutter Bypass from the Butte Creek drainage system and from the Sacramento River at flood stage via the Tisdale Weir. Deer Creek, where the northernmost erosion site is located, is in Tehama County and drains west to the Sacramento River east of the city of Corning.

3.6.1.1. Hydrology

Total annual precipitation in the Sacramento River watershed falls as both rain and snow. Annual and daily precipitation varies widely throughout the watershed, which generally results in highly variable annual and monthly runoff patterns. Much of the snowmelt from the surrounding mountains is held in reservoirs and released in response to water needs and flood control (Domagalski et al. 2000). Flood management facilities, including levees and weirs, are common along the rivers and tributaries; water diversions, used to transfer water to water purveyors and other users, are also common throughout the watershed.

In the Sacramento, American, and Feather rivers, river stage—the height of the surface of a river within a channel above an arbitrary zero point—is largely the consequence of upstream dam releases. Flows on the Sacramento River are controlled mainly by Shasta Dam and, to a lesser extent, by dams on the Feather and American rivers and their tributaries. Runoff from winter rains and snowmelt is released into the watershed's river system during the normally dry summer months. Winter flow is dependent on a number of factors, including stormwater runoff, reservoir releases, and diversions to bypass flood control channels (Sacramento Valley Water Quality Coalition 2004).

Table 3-11 summarizes the seasonal median water flows, including 2-year recurrence interval approximations for each erosion site based on the nearest available monitoring data.

Table 3-11 Median Water Flows

Erosion Site	Median Flows (cfs)				
	2-year Recurrence Interval	Season			
		Winter	Spring	Summer	Fall
CC 2.8L	Information unavailable	—	—	—	—
CC 3.4L	Information unavailable	—	—	—	—
DC 0.9N	5,600	170	270	80	70
FR 1.0L	62,200	5,000	5,800	5,600	3,500
FR 3.7L	62,200	5,000	5,800	5,600	3,500
FR 5.5L	62,200	5,000	5,800	5,600	3,500
FR 7.0L	62,200	5,000	5,800	5,600	3,500
LAR 10.0L	Information unavailable	3,364	4,149	3,108	1,725
LAR 10.6L	Information unavailable	3,364	4,149	3,108	1,725
SAC 8.0L	67,000	21,000	17,900	13,400	10,900
SAC 10.8L	67,000	21,000	17,900	13,400	10,900
SAC 26.0L	30,500	11,200	9,900	8,000	6,900
SAC 35.4L	77,000	25,000	21,500	16,400	13,600
SAC 41.9R	77,000	25,000	21,500	16,400	13,600
SAC 71.3R	63,400	21,800	17,700	13,900	11,600
SAC 73.5L	63,400	21,800	17,700	13,900	11,600
SAC 78.8L	63,400	21,800	17,700	13,900	11,600
SAC 87.0L	29,200	13,100	11,000	8,400	7,100
SAC 93.7L	26,700	12,400	10,500	7,900	6,500
SAC 114.5R	26,700	12,400	10,500	7,900	6,500
SAC 130.0L	39,700	12,100	10,600	9,200	6,400
SAC 136.7R	39,700	12,100	10,600	9,200	6,400
SAC 136.9R	39,700	12,100	10,600	9,200	6,400
SAC 157.7R	78,100	12,100	11,100	9,600	6,800
SBP 0.4E	47,900	n/a*	n/a*	n/a*	n/a*

**Stages based on analysis of gage stage data. No analysis of flows was conducted.*
Source: Adams pers. comm.

Water Quality

The Sacramento River and its tributaries are generally characterized as having good overall water quality, supporting a variety of beneficial uses, including drinking water supplies, recreation, irrigation supplies, and protection of fish and other aquatic life. The good water quality is commonly attributed to the purity of the snowmelt, which serves as the primary water

source for the river system. As water flows downstream through the watershed, it accumulates various pollutants and constituents associated with human activities, and water quality typically decreases. Major sources of added constituents include eroded soils, agricultural return flows, runoff from urban areas, and discharges from municipal wastewater treatment facilities. These inputs can increase total suspended solids (TSS), organic and inorganic solid materials that are suspended in the waters.

Contaminants known to affect the water quality of the Sacramento River include acidic mine drainage, agricultural runoff, dioxin (from paper mills), mercury, organophosphate pesticides, and municipal non-point source pollution. Mercury, a contaminant of particular concern, has been detected at elevated levels in the American, Feather, and Sacramento rivers by the California State Toxic Substance Monitoring Program (California State Water Resources Control Board 2006). Further contaminants enter the system as a result of runoff from orchards, rice fields, and pastures, and effluent from treatment plants and municipal sources (U.S. Geological Survey 2008).

Several reaches of the Sacramento River and its tributaries have been classified as *impaired* by the DWR (California Department of Water Resources 2006). The State's 2006 *List of Impaired Waterbodies* prepared under Section 303(d) of the CWA includes approximately 40 surface water bodies (including lakes and streams) throughout the Sacramento River watershed impaired by 45 different pollutants or stressors. This designation is given to streams for which a standard of water quality for beneficial uses (such as drinking water and water for recreation) has not been met. The Sacramento River system is classified as impaired for organophosphate pesticides and mercury (California State Water Resources Control Board 2006). Stormwater runoff conveying non-point source pollution has a significant influence on water quality in the Sacramento River (Domagalski et al. 2000).

The Sacramento Regional County Sanitation District, the County of Sacramento Water Resources Division, and the City of Sacramento jointly established the Sacramento Coordinated Water Quality Monitoring Program (CMP) for ongoing and future Sacramento-area water quality monitoring programs on the Sacramento and American rivers. Together, these three public entities are responsible for the management of all municipal wastewater and most stormwater in portions of the Sacramento urban area within Sacramento County (Grovhoug and Suverkropp 1997). Researchers from the CMP collect water samples six to eight times per year at three locations on the Sacramento River and two locations on the American River. This monitoring satisfies permit requirements for both the wastewater and stormwater programs for the state (Larry Walker Associates 2009).

Additional monitoring programs that have been conducted or are ongoing in the Sacramento River watershed include regional monitoring activities by the Sacramento River Watershed Program (SRWP), the Central Valley RWQCB, U.S. Geological Survey (USGS), CVFPB, and DFG. The SRWP maintains a compendium of major water quality monitoring programs occurring in the Sacramento River watershed (Sacramento River Watershed Program 2008).

Water quality parameters routinely measured in the Sacramento River watershed include trace metals (arsenic, cadmium, chromium, copper, iron, lead, mercury, methyl mercury,

molybdenum, nickel, silver, and zinc), conventional parameters (hardness, pH, dissolved oxygen, temperature, conductivity, total organic carbon, dissolved organic carbon, chloride, total dissolved solids, and total suspended solids), organophosphate and carbamate pesticides, coliform bacteria, cyanide, ultraviolet absorbance (UVA 254) (a measurement of organic matter concentrations in water), nutrients (nitrogen and phosphorus species) and selected trace organic compounds (herbicides, polycyclic aromatic hydrocarbons (PAH), semi-volatile organics, and methyl tert-butyl ether (MTBE)).

Water quality data presented in the CMP's 2007–2008 Annual Report were compared to the lowest relevant water quality objectives (WQO) from the California Toxics Rule (CTR) and the Water Quality Control Plan (Basin Plan) for the Sacramento River watershed, along with the Sacramento area NPDES Stormwater Permit (No. CAS082597, Order R5-2002-0206) criteria for diazinon and chlorpyrifos. The majority of the constituents measured in 2007–2008 indicated compliance with existing water quality objectives (Camp Dresser & McKee Inc. et al. 2008).

Mercury concentrations in the American River and the Sacramento River for 2007–2008 were all below the CTR human health criterion (50 mg/L total mercury), as were the majority of concentrations of the trace metals. However, 13 total aluminum results, five total iron results, and one dissolved copper result from sites on both the Sacramento and American rivers exceeded the Title 22 secondary maximum contaminant level (MCL) criterion. The majority of pesticides (orthophosphate and carbamate) and trace organics were not detected above their respective reporting limits. (Camp Dresser & McKee Inc. et al. 2008). During the 2007–2008 sampling period, bacteria levels (*Escherichia coli* and fecal coliform) twice exceeded Basin Plan objectives on both the American and Sacramento rivers. These occurrences were detected in samples collected during a wet weather event under wet weather conditions (based on the river's flow) (Camp Dresser & McKee Inc. et al. 2008).

The upper reaches of the Sacramento River generally have excellent mineral and nutrient quality, with typical total suspended solids (TSS) concentrations ranging from 1 to 5 milligrams per liter (mg/L) during summer and fall months to 50 to 100 mg/L during winter and spring (U.S. Army Corps of Engineers 2006b). Seasonal and storm-event variability in TSS is due to the intermittent hydrology of the region, with increasing and decreasing TSS concentrations, respectively, as stream flow rises and falls during storms.

Baseline water quality information was provided in a report prepared for previous erosion repair projects on the Sacramento River (U.S. Army Corps of Engineers 2006b). Because the sites assessed in the prior report are located within the range of the sites being assessed herein, the information that it contains concerning water quality in the Sacramento River is relevant to the 25 Sacramento River sites in this document. Analysis of these data determined that levels of TSS are highest in the Sacramento River from December though March, peaking at 139 mg/L in December at RM 72.2R and at 153.9 mg/L in January at RM 34.5R. The lowest TSS levels occurred in July at RM 77.2R (33 mg/L) and in October at RM 34.5R (19.4 mg/L).

Turbidity is determined by the cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye. Turbidity directly affects water temperature by absorbing light, which in turn warms the water and lessens the water's ability to hold oxygen. Less light, warmer water, and less oxygen make it impossible for

some forms of life to exist. Elevated levels of suspended solids can also suffocate fish and their eggs, as well as adversely affect the microhabitats of aquatic insects.

Mean monthly TSS concentrations may be considered equivalent to turbidity, with an approximate conversion of 1 to 1.5 nephelometric turbidity units (NTU) per mg/L TSS, depending on the parent geology of the suspended materials (American Public Health Association et al. 2006). Generally, TSS concentration is related to stream discharge; TSS concentration increases as stream flow increases. The proportion between the amount of suspended sediment and water volume (TSS concentration) is not consistent and can vary greatly throughout different portions of a fluvial system. Caution should be applied when using historical data to make assumptions about the turbidity of the water using TSS concentration data.

Historical monthly TSS and stream flow data (water years 1996 to 1998) (Domagalski et al. 2000) from two gages on the Sacramento River, Sacramento River above Bend Bridge near Red Bluff and Sacramento River at Freeport, were used to provide an approximate range of TSS concentrations and transported TSS mass across the project area. The two representative gages display the typical seasonal pattern common to upper Sierra Nevada watersheds, where TSS levels are highest during winter (December through February) and lowest during summer (June through August) and fall (September through November).

At the Bend Bridge gage, the Sacramento River had a maximum measured TSS concentration of 355 mg/L at a stream flow of 2,446.85 cubic meters per second (m^3/sec) in February 1995, which is approximately equivalent to 868.65 kilograms (kg) of suspended sediment transported downstream every second. Additionally, the gage had a minimum TSS concentration of 3mg/L at a stream flow of 178.42 m^3/sec in April 1998, which is approximately equivalent to 0.54 kg of suspended sediment transported downstream per second. Downstream, at the Freeport gage, the Sacramento River had a maximum measured TSS concentration of 368 mg/L at a stream flow of 1,755.84 m^3/sec, or 646 kg of suspended sediment transported downstream per second in January 1998. In April 1998 at the Freeport gage, the Sacramento River had a minimum TSS concentration of 12 mg/L at a stream flow of 280 m^3/sec, which is approximately equivalent to 3.36 kg of suspended sediment transported downstream every second.

3.6.2. Regulatory Setting

3.6.2.1. Federal and State Laws and Regulations

Clean Water Act

The Clean Water Act (CWA) of 1972 is the primary federal law aimed at providing protection to the nation's surface waters by prohibiting unauthorized discharges. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of surface waters. Section 301 prohibits the discharge of any unpermitted pollutant and Section 402 establishes the permit program.

The CWA requires that states maintain a listing of impaired water bodies that do not meet water quality standards and are not supporting beneficial uses. These waters are placed on the

Section 303(d) *List of Impaired Waterbodies*. Inclusion on this list triggers development of a pollution control plan based on a determination of the Total Maximum Daily Load (TMDL) of pollutants detected in the state's waterways and to make sure that the water does not exceed TMDL limits established by the CWA.

The Corps regulates "waters of the United States," which are defined by the CWA as inter- and intrastate waters and wetlands, and their tributaries. Section 404 of the CWA regulates activities that result in the discharge of dredged or fill material into waters of the United States. The CWA requires that an applicant for a Section 404 permit (used to authorize the discharge of dredged or fill material into waters of the United States) obtain certification from the appropriate state agency stating that the proposed fill is consistent with the state's water quality standards and criteria. A Section 404 permit is not valid until certification is obtained. In California, the authority to grant certification is delegated by the State Water Resources Control Board to nine RWQCBs. The regional board has the authority to veto or add conditions to the Corps permit. An application for water quality certification is included in Appendix G and a CWA Section 404(b)(1) evaluation for the proposed action is included as Appendix H.

States are required under Section 303 of the CWA to adopt water quality standards for all surface waters of the United States. Where multiple beneficial uses exist, water quality standards must protect the most restrictive beneficial use. The SWRCB and the RWQCB are responsible for ensuring that a proposed action complies with the CWA. The RWQCB regulates all water bodies within its scope, but has special responsibility for riparian areas and wetlands that have a high resource value, are vulnerable to filling, and are not systematically protected by other programs. The proposed action is within the jurisdiction of the Central Valley RWQCB, which is charged with the protection of the Sacramento and San Joaquin Rivers and their tributaries.

The CWA also authorizes the U.S. Environmental Protection Agency (EPA) to regulate issues of construction-related soil erosion for the purpose of water quality protection. Section 402(p) establishes a framework for regulating stormwater discharges into surface water by issuance of an NPDES permit, which establishes pretreatment standards for discharged water.

The RWQCB implements NPDES permits at the state level, but EPA may retain jurisdiction at its discretion. In accordance with NPDES regulations, the state requires that any construction activity affecting 1 acre or more be authorized under a General Construction Activity Stormwater Permit (General Permit), which is intended to minimize the potential effects of construction site water runoff on receiving water quality. Permit applicants are also required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) that specifies erosion and sediment control BMPs to reduce or eliminate construction-related impacts on receiving water quality.

The SWPPP must identify all potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharges from the construction site; describes practices to be used to reduce pollutants in stormwater discharges from the construction site; and assure compliance with the terms and conditions of the permit. All dischargers must certify annually that construction activities are in compliance with the General Permit.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act of 1969 is enforced by the SWRCB and the RWQCB. It defines "waters of the state" as water bodies with boundaries in the state, including any surface or groundwater, whether fresh or saline. The intent of the Act is to provide a comprehensive program for the protection of water quality and beneficial uses of water through the regulation of waste discharges. Waste discharges may include such substances as wastewater effluent and discharges of fill and dredged material into waters of the state.

California Fish and Game Code

Under Sections 1600–1616 of the California Fish and Game Code, DFG regulates activities that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed. In practice, DFG marks its jurisdictional limit at the top of the stream or lake bank, or the outer edge of the riparian vegetation, where present, and sometimes extends its jurisdiction to the edge of the 100-year floodplain.

Any activity within a stream zone (which includes the riparian vegetation associated with perennial, intermittent, and ephemeral streams) or lake that might substantially divert, obstruct, or change the natural flow, or alter the bed or bank requires that a notification package and fee payment be on file with DFG before project activities begin. The use of material from streams and lakes, in addition to the deposition or disposal of debris in locations where it could eventually end up in a lake or stream, are also regulated under Section 1602 of the code.

California Code of Regulations Section 3831(k)

Title 23 of the California Code of Regulations (CCR) Section 3831(k) requires that an applicant obtain a federal license or permit to conduct an activity that may result in discharge into navigable waters and obtain certification from the state that any such discharge will comply with the applicable provisions of CWA sections 301, 302, 303, 306, and 307.

California Wetlands Conservation Policy

The California Wetlands Conservation Policy is a compilation of strategies intended to ensure a long-term net gain in quantity and quality of wetland acreage in the state. The policy establishes a framework to reduce procedural complexity in the administration of state and federal wetlands conservation programs. In addition, the policy encourages a partnership between landowners and state and federal agencies through incentive programs focused on wetland conservation and restoration.

3.6.2.2. Local Laws and Regulations

American River Parkway Plan

Water policies contained in the American River Parkway Plan state that water quality shall be maintained to provide for beneficial uses of the river (Sacramento County 2006). The plan defers to the local, regional, state, and federal agencies having jurisdiction over water quality in the American River to manage and monitor discharges and enforce existing water quality regulations.

Colusa County General Plan

The Conservation Element of the Colusa County General Plan (Colusa County 1989) contains several policies concerning water quality and availability. It dictates that sedimentation and erosion shall be minimized by control of grading, quarrying, logging, vegetation removal, placement of roads and bridges, use of off-road vehicles, and agricultural practices. The water needs of the County are to be secured through a cooperative effort with state and federal agencies responsible for water projects (Colusa County 1989).

Sacramento County General Plan

Water resources policies contained in the Conservation Element of the Sacramento County General Plan are intended to promote a healthy aquatic environment that is safe for public use and enjoyment (Sacramento County 1993). Although the General Plan focuses primarily on urban development, its water quality protection policies, including erosion control and contaminants monitoring, ensure that the County will be able to provide an adequate supply of quality water for its residents while maintaining healthy natural systems.

Sutter County General Plan

"To preserve and protect the water resources of the County" is the primary goal of the water section of the Conservation/Open Space – Natural Resources Element of the Sutter County General Plan. To achieve this goal, the General Plan has set the following policies: required development setbacks from all watercourses, protection of ground water resources, encouragement of water conservation practices, and monitoring of agricultural water runoff (Sutter County 1996).

Tehama County General Plan

Ensuring that water supplies of sufficient quality and quantity will be available to serve the needs of Tehama County now and into the future is the stated goal pertaining to water and water quality in the Open Space and Conservation Element of the Tehama County General Plan (Tehama County 2008). Included in this element are a number of policies to achieve this goal, including maintaining local water ordinances; adhering to state and federal regulations; protecting surface and ground water from major sources of pollution; establishing and requiring the use of BMPs to protect receiving waters from the adverse effects of construction activities, sediment, and urban runoff; and using Natural Resource Lands (and their land use subcategories) to indicate areas essential to the recharge of groundwater and to afford protection from streambank erosion (Tehama County 2008).

Yolo County General Plan

The Conservation and Open Space Element of the Yolo County General Plan establishes a goal of ensuring an abundant, safe, and sustainable water supply to support the needs of existing and future generations residing in Yolo County (Yolo County 2009). Water resources conservation policies included in the General Plan include managing supplies to avoid long-term overdraft, water quality degradation, land subsidence, and other potential problems; improving and protecting water quality for municipal, agricultural, and environmental uses; and supporting mercury regulations that are based on good science and reflect an appropriate balancing of sometimes competing public values, including health, food chain, reclamation and restoration of

Cache Creek, sustainable and economically viable Delta agriculture, necessary mineral extraction, flood control, erosion control, water quality, and habitat restoration.

3.6.3. Environmental Effects

Effects on water quality that could result from implementation of the proposed action are evaluated on the basis of construction designs and practices, construction materials, the location and duration of activities, and the potential for degradation of water quality or beneficial uses. Operational effects on surface hydrology and water quality are determined by assessing the potential for surface runoff patterns to be significantly altered and for additional sources of pollution to be generated at each erosion site as a result of implementation of the proposed action.

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- Substantially alter the existing drainage pattern of the site or area in a manner which would result in increased flood risk or substantial erosion or siltation;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Substantially degrade water quality;
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows; or
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

3.6.3.1. No-Action Alternative

Under the no-action alternative, no action would be taken to halt erosion and protect the levees at the 25 erosion sites. Forces of erosion would persist, including wave wash, flood flows, and human disturbances. Continued erosion of the levee system would increase the risk of levee failure and possible flooding of surrounding areas.

Should levee failure result from the no-action alternative, resultant emergency measures would likely be of a nature that limits the ability of the Corps to properly implement BMPs, site-specific mitigation, and other measures that would minimize impacts on hydrology and water quality.

Potential effects on water quality from this alternative include increases in total suspended solids and turbidity, both chronically (as levees continue to erode) and acutely (in the event of a levee failure). Water quality impacts from a levee failure in which water floods urban, suburban, and agricultural areas have a potential to be wide-ranging and severe. Of particular concern would be those water quality impacts affecting public health, such as the spread of bacteria and viruses that cause disease. Less immediately threatening, but nevertheless adverse, would be water quality degradation from chemical pollution such as oil and grease, pesticides, heavy metals, and nutrients.

3.6.3.2. Alternative 1: Proposed Action

Potential impacts to hydrology and water quality resulting from implementation of the proposed action include the restriction of floodway and channel capacity, short-term temporary increases in turbidity and sedimentation levels during construction, and inadvertent release of petroleum products and other hazardous materials associated with construction equipment.

Impact WQ1: Temporary Increases in Turbidity
Temporary increases in particulates and turbidity are anticipated during construction. Placement of rock in the active channel could generate a short-term increase in turbidity in the immediate vicinity of the repair site under construction. Loose soil entrained in stormwater runoff over disturbed areas or dislodged by wave action generated during boat and barge operations at construction sites might also be temporary sources of turbidity and particulate matter. Ground disturbance could temporarily increase the potential for localized erosion and sedimentation. It is anticipated that turbidity would increase by 5 to 10 NTUs (approximately 5 to 10 percent) above ambient levels during construction activities (U.S. Army Corps of Engineers 2008c). However, no permanent increases would occur in suspended particulates and turbidity levels resulting from the proposed action; rather, erosive processes would be significantly minimized for the long-term. Although temporary, the impact to water quality is considered to be significant. Implementation of Mitigation Measure WQ1 would reduce this impact to a less-than-significant level.

Impact WQ2: Accidental Release of Hazardous Materials
Construction equipment would require the use of petrochemicals and other potentially hazardous materials (e.g., fuel, engine oil, hydraulic line oil). There is a potential for these substances to be released in accidental spills, thus impairing water quality. This would be a significant impact. Implementation of Mitigation Measure WQ2 would reduce this impact to a less-than-significant level.

3.6.3.3. Alternative 2: Thin Rock Armor

Under this alternative, a thin layer of rock slope protection would be placed over the existing levee slope. The rock would protect the bank from erosion, but would not address stability issues. Placement of the rock would result in moderate ground disturbance and, when placed below the MSWL, minor temporary alterations in drainage patterns. During construction, the placement of rock could temporarily increase turbidity in the immediate vicinity of each erosion site. Temporary increases in turbidity may also be generated as loose soil is initially carried from the construction site by stormwater runoff or by wave attenuation created by boat and barge operations at those sites subject to waterside construction.

As under alternative 1, ground disturbance activities would increase the potential for localized erosion and sedimentation.

3.6.4. Mitigation

Standard water pollution prevention measures, including erosion and sediment control measures, proper maintenance of equipment and storage of materials, proper control of non-stormwater discharges, and hazardous spill prevention and response measures would be implemented as part of the proposed action. Implementation of the following mitigation measures would reduce the potential impacts to a less-than-significant level.

Mitigation Measure WQ1: Temporary Increases in Turbidity

a. The contractor shall prepare a Storm Water Pollution Prevention Plan (SWPPP) and implement the SWPPP during and after construction to minimize turbidity-generating activities. The SWPPP shall include an erosion control plan, a water quality monitoring plan, a hazardous materials management plan, and BMPs for construction activities, including the use of a floating turbidity curtain, as appropriate. The BMPs shall be maintained until terrestrial areas disturbed during construction have been adequately revegetated and stabilized.

b. Water quality monitoring, as detailed in the SWPPP, shall contain specific directives for establishing sampling locations and for acceptable levels of turbidity and settleable solids. Sampling shall be conducted at an upstream location in the vicinity of each construction site once daily to establish background levels. Water samples for determining down-current turbidity and settleable solids levels shall be collected 5 feet from the shoreline and 300 feet down-current of any floating turbidity curtain.

c. Benchmark levels for turbidity under the Central Valley RWQCB Basin Plan shall not exceed 1 NTU above ambient conditions (where natural turbidity levels range from 0–5 NTU); 20 percent (where natural turbidity levels range from 5–50 NTU); 10 NTU (where natural turbidity levels range from 50–100 NTU); or 10 percent (where natural turbidity levels are >100 NTU). In determining compliance with these turbidity limits averaging periods may be applied, provided that beneficial uses remain fully protected.

d. Settleable solids shall be determined by the American Public Health Association (1998) Method 2540F. During working hours, the construction activity shall not cause the settleable solids down-current from each construction site to exceed 0.1 ml/L after one hour settling.

e. Prior to placement of any material within the ordinary high water mark of the waterbody, a Section 401 Water Quality Certification shall be obtained from the RWQCB. All conditions of the Water Quality Certification shall be met.

f. Project construction contractors shall obtain and comply with the conditions of a State General Construction Activity Stormwater Permit adopted by the California State Water Resources Control Board.

Mitigation Measure WQ2: Accidental Release of Hazardous Materials

a. The contractor shall develop and implement a hazardous materials management plan prior to initiation of construction. The plan shall include BMPs that would reduce the potential for spills of toxic chemicals and other hazardous materials during construction. The plan shall include a specific protocol for the proper handling and disposal of materials and contingency procedures to follow in the event of a hazardous materials spill. The plan shall also describe the specific protocol for the proper handling and disposal of potentially hazardous materials that could be encountered during construction. Any spills of hazardous materials to the river shall be cleaned up immediately and immediately reported to the Central Valley RWQCB, NMFS, and USFWS.

3.7. Geomorphology

Geomorphology is the scientific study of land forms. Particularly important for the proposed action is fluvial geomorphology, the study of landforms modified by river dynamics, including river channels and adjacent floodplains. Geomorphic information is used extensively in land use planning, engineering, archaeology, and other disciplines. Geomorphic processes include channel bed and bank erosion, channel migration, sediment storage and recruitment, and IWM storage and recruitment. One major factor in channel development is stream power, defined by water discharge and river slope. The shape and layout, or contour, of a river channel as viewed from above is called the channel planform.

3.7.1. Existing Conditions

The Sacramento Valley is the northern portion of the Great Valley Basin of California. The basin is an elongated synclinal trough, which is bounded by the Sierra Nevada plutonic complex to the east and the Coast Ranges to the west. The Sacramento Valley is underlain by marine sedimentary rocks overlain by recent alluvial deposits and, to a lesser extent, some volcanic rocks. The levees and river sediments associated with the erosion repair sites are composed of Quaternary alluvium deposits that consist of loose to medium-dense, unweathered gravel, sand, silt, and clay. These sediments are estimated to have been deposited 200 to 10,000

years before present in naturally formed riverbanks and floodplains along the Sacramento River (Helley and Harwood 1985).

In geologic history, the Sacramento River migrated frequently and freely within its meander belt, which typically exceeded several thousand feet in width (Buer 1984). Prior to Euro-American settlement, the mainstem Sacramento River and tributaries along the valley floor would naturally overtop its banks at regular cycles and flood the adjacent lands, replenishing wetlands and depositing sediments. Despite overbank sediment deposition, these flood basins have maintained a low topographic profile, which suggests that the flood basins are subsiding at a rate equal to or greater than overbank deposition (Gilbert 1917, Water Engineering and Technology 1989). These floodplains have historically provided crucial fluvial geomorphic roles for the Sacramento River and Feather River, as the flow loss to the flood basins causes the Sacramento River to downsize in the downstream direction in the lower reaches (Water Engineering and Technology 1990).

Beginning in the late 1800s, the Sacramento River's channel morphology and sediment transport regime have been progressively altered by human activities, including the clearing of riparian vegetation and the construction of levees and upstream dams for flood control and water supply. Bank armoring of the levees has resulted in lower sinuosity, fewer overbank flows, and an altered pattern of channel migration and meander cutoff (Brice 1977; Larsen et al. 1997, 2004; Larsen and Greco 2002). The present-day Sacramento River is a single-thread channel, which transitions from a coarse gravel bed upstream into a sand-bedded channel (by about RM 128), with occasional outcrops of cemented alluvial deposits (such as the Modesto Terrace formation) that historically provided natural constraints to lateral migration. The morphology of the Sacramento River is further described below, using the following reach designations:

- Reach 1: from Collinsville to Isleton (RM 0–80)
  - Reach 1a: from Collinsville to Isleton (RM 0–20)
  - Reach 1b: from Isleton to Verona (RM 20–80)
- Reach 2: from Verona to Colusa (RM 80–143)
- Reach 3: from Colusa to Chico Landing (RM 143–194)

3.7.1.1. Reach 1

In Reach 1, the Sacramento River is narrowly confined (except in the lowermost few miles) at the channel margin by large levees, which largely block the river's access to historical tidal wetlands and seasonally inundated floodplains. Downstream from the Feather River confluence (RM 80), the river is mildly sinuous (average sinuosity about 1.3), and the channel has a uniform width and does not migrate. The channel is typically narrower and deeper than in upstream reaches (Brice 1977). Historically, deposition of fine sediment that graded from sand to silt in the downstream direction formed extensive natural levees along the river, from 5 to 20 feet above the floodplain for as far as 10 miles from the channel (Thompson 1961). The present-day channel is flanked by fine-grained cohesive banks that frequently erode due to both mass failures and fluvial erosion (e.g., wave-wash).

In the lowermost portion of Reach 1, low velocities predominate as flow is distributed in a network of delta channels and sloughs bordered by relatively low levees consisting of both natural bank materials and rock revetment (U.S. Army Corps of Engineers 1987). Tidal influence extends up the Sacramento River for 80 miles to Verona, with greater tidal variations occurring at the downstream end during low river stages. The major tidal sloughs included in this reach are Threemile, Steamboat, Sutter, Miner, Georgiana, Elk, and Cache sloughs.

In Reach 1, the frequency of bank revetment is high; 59 percent of the channel shoreline is armored from RM 0–20, and 75 percent is armored from RM 20–80 (Table 3-12). This high level of bank protection indicates limited potential for bank erosion or channel migration within the reach. The two tributaries in Reach 1 containing proposed erosion repair sites have relatively less revetment than the mainstem Sacramento River throughout this reach: Cache Creek (26 percent) and the lower American River (23 percent). The proportion of revetment coverage decreases in the upper reaches of both the lower American River and Cache Creek, thereby placing these sites adjacent to primarily non-revetted banks. The five Sacramento River sites between RM 5 and 68 are surrounded by reaches that are extensively armored on both sides of the channel. Upstream, in the vicinity of sites SAC 71.3R, SAC 73.5L, and SAC 78.8L, the surrounding areas have less extensive revetment, but the majority of potentially erosive outer banks at meander bends are armored.

Table 3-12 Existing Physical Bank Conditions by Water Body within the SRBPP Action Area

Water Body	Shoreline Length (ft)	Revetment Length (ft) (% Shoreline)	Instream Woody Material (ft [linear distance of shoreline]) (% shoreline)
Reach 1a (Sacramento RM 0-20)			
Sacramento River (RM 0-20)	200,525	119,059 (59%)	19,398 (10%)
Cache Creek	120,622	31,064 (26%)	0 (0%)
Reach 1b (Sacramento RM 20–80)			
Sacramento River (RM 20-80)	654,060	493,815 (75%)	103,471 (16%)
American River (RM 0–13)	142,864	32,265 (23%)	21,540 (15%)
Reach 2 (Sacramento RM 80–143)			
Sacramento River (RM 80-143)	662,562	398,330 (60%)	108,599 (16%)
Feather River (RM 0-61)	670,097	58,347 (9%)	144,277 (22%)
Sutter Bypass	318,284	60,628 (19%)	16,522 (5%)
Reach 3 Sacramento River (RM 143-194)			
Sacramento River (RM 143-194)	577,478	94,536 (16%)	97,848 (17%)
Deer Creek	14,174	9,629 (68%)	662 (5%)

Data from Corps revetment database (U.S. Army Corps of Engineers 2007).

The bank composition of the proposed erosion repair sites within Reach 1 is either revetment (e.g., concrete, rubble, large or medium rock/cobble) or natural material (e.g., silts and sands). The Sacramento River sites composed of mostly natural materials (26.0L, 41.9R, 71.3R, 73.5R, and 78.8L) are directly upstream or downstream of an existing armored bank (Table 3-13); the repair is essentially an extension of the existing revetment. A similar condition exists at site LAR 10.0L. The amount and degree of revetment at the currently armored sites vary, as some of the sites have extensive revetment (SAC 35.4L), while other sites only have revetment either along a portion of the site length (SAC 26.0L, SAC 78.8L, and LAR 10.0L) and/or on the upper levee slopes away from the low water active channel (SAC 8.0L, SAC 10.8L).

Table 3-13 Existing Bank and IWM Conditions at the 25 Erosion Sites

Waterbody	Site (River Mile)	Approx. Site Length (feet) [1]	Planform Location	Existing Bank Material Along Shoreline [2]			Existing IWM Structure (% shoreline)[3]
				Revetment vs. Natural	% Revetment	Average D_{50} (in)	
Sacramento River	8.0L	1,550	outer bend	revetment [4]	100%	4	49%
	10.8L	550	straight reach	revetment [4]	36%	6	73%
	26.0L	2,005	outer bend	natural [5]	29%	4.2	43%
	35.4L	1,070	inner bend	revetment	100%	16	0%
	41.9R	1,515	straight reach	natural [5]	11%	0.25	64%
	71.3R	515	outer bend	natural [5]	6%	0.25	24%
	73.5L	1,050	straight reach	natural [5]	1%	0.25	32%
	78.8L	250	outer bend	natural [5]	20%	4	40%
	87.0L	750	straight reach	revetment [4]	55%	6	2%
	93.7L	1,050	outer bend	natural [5]	10%	2	0%
	114.5R	1,500	straight reach	natural [5]	8%	1	30%
	130.0L	470	outer bend	revetment [4]	88%	13	3%
	136.7R	300	straight reach	natural [5]	0%	0.25	1%
	136.9R	900	outer bend	natural [5]	0%	0.25	4%
	157.7R	1,005	inner bend	natural	0%	0.25	26%
Feather River	1.0L	990	inner bend	natural [5]	0%	0.25	13%
	3.7L	2,300	straight reach	natural	0%	0.25	32%
	5.5L	832	straight reach	natural [5]	8%	2	28%
	7.0L	520	outer bend	natural [5]	8%	2	2%

Table 3-13 Existing Bank and IWM Conditions at the 25 Erosion Sites

Waterbody	Site (River Mile)	Approx. Site Length (feet) [1]	Planform Location	Existing Bank Material Along Shoreline [2]			Existing IWM Structure (% shoreline)[3]
				Revetment vs. Natural	% Revetment	Average D_{50} (in)	
Lower American River	10.0L	740	straight reach	natural [5]	25%	1	9%
	10.6L	670	straight reach	natural	0%	0.25	28%
Cache Creek	2.8L	1,300	outer bend	natural	0%	0.25	0%
	3.4L	900	straight reach	natural	0%	0.25	0%
Deer Creek	0.9N	800	outer bend / inner bend	natural (cobbles)	100% [6]	4	18%
Sutter Bypass	0.4E	365	straight reach	natural	0%	0.25	8%
Total		**23,897**					

[1]*Lengths for the 25 sites provided by Kleinfelder and DWR. Lengths were calculated along the levee crest between the upstream and downstream ends of each site, which slightly differ from the site lengths measured along the seasonal shorelines that factor channel curvature, bank topography, and seasonal water surface elevations.*

[2]*Data based on 2008 field inventories by North State Resources and Stillwater Sciences and supplemented with data from the Corps revetment database (U.S. Army Corps of Engineers 2007b).*

[3]*Data based on 2008 field inventories by North State Resources and Stillwater Sciences.*

[4]*Site has natural bank material along portions of the total length and/or at low-flow elevations, but is armored with revetment along the upper berm/levee faces and is therefore considered primarily resistant to bank erosion and channel migration.*

[5]*Site was identified as mostly or all natural bank conditions during field inventories, but the Corps revetment database (U.S. Army Corps of Engineers 2007b) indicates extensive bank revetment immediately upstream and/or downstream of the site.*

[6]*Site was identified as possessing 100 percent bank revetment (medium cobble) according to the Corps revetment database (U.S. Army Corps of Engineers 2007b). However, field observations made in 2008 reveal that the streambank at the site and in the vicinity is composed of coarse-grained alluvial deposits and not installed revetment.*

IWM loading in the Sacramento River along the channel shoreline is estimated at 10 percent of the shoreline from RM 0–20 and 16 percent from RM 20–80, which is similar to other reaches on the Sacramento River (Table 3-12). At seven of the eight proposed Sacramento River erosion repair sites within Reach 1, IWM coverage is greater than the reach average, and a few of these sites, such as SAC 10.8L and SAC 41.9R, possess substantially greater coverage: 73 percent and 64 percent, respectively (Table 3-13). Only site SAC 35.4L at 0 percent contains less than the reach average. The IWM coverage averages for the lower American River and Cache Creek within the SRBPP area are 15 percent and 0 percent, respectively. Site LAR 10.0L contains slightly less (9 percent) than the lower American River reach average, while site LAR 10.6L contains nearly twice (28 percent) the reach average. Both Cache Creek sites possess no IWM coverage, which is typical of the reach average for Cache Creek (0 percent).

3.7.1.2. Reach 2

The middle reach of the Sacramento River where the erosion repairs would occur (RM 80–143) lies between the Feather River confluence (RM 80) and the Colusa Weir (RM 146.5).

Reach 2 is predominately a sinuous single-thread channel with relatively uniform width, an average sinuosity of about 1.8 (Brice 1977), and an average slope of 0.00003 to 0.0001 (one-tenth to one-half the slope of Reach 3). The lack of channel form diversity in this reach is due in large part to adjacent levees and revetment on both sides of the channel. Levees along this portion of the Sacramento River and Feather River are generally constructed near the riverbank, except at a few locations where they are set back to provide overflow across major meander bends or within flood bypasses (U.S. Army Corps of Engineers 1987). Site SBP 0.4E is located within the expansive and occasionally inundated Sutter Bypass; however, the site does not possess any overflow or adjacent floodplain area as it is situated directly against the eastern levee bordering the bypass. A narrow berm of natural bank material inside of the levees occurs in some portions of Reach 2 on the Sacramento River and Feather River, providing some erodible substrate; however, erosion and deposition are probably greatly diminished from reference conditions (U.S. Fish and Wildlife Service 2001).

In Reach 2, 60 percent of Sacramento River channel shoreline has revetment, and the IWM loading is estimated at 16 percent of the channel shoreline (Table 3-12). In contrast, the Feather River banks have lower levels of revetments (9 percent) as do the margins of the Sutter Bypass (19 percent). The IWM loading along the Feather River (22 percent) is comparable to Reach 2 of the Sacramento River, while the loading along the Sutter Bypass is less (5 percent) due to the lower potential for recruitment from the relatively narrow corridor of riparian tree species bordering the east toe-drain channel in the bypass (i.e., lower density of riparian trees). Four of the six sites on the Sacramento River (SAC 93.7L, SAC 114.5R, SAC 136.7R, and SAC 136.9R), all four sites on the Feather River, and the Sutter Bypass site mostly or wholly consist of fine, natural bank materials with minimal to no rock revetment (Table 3-13). Four of these sites are located on outer banks at meander bends that have high erosion potential (SAC 93.7L, SAC 130.0L, SAC 136.9R, and FR 7.0L). The two sites on the Sacramento River with existing bank revetment (SAC 87.0L and SAC 130.0L) only have revetment either along a portion of the site length and/or on the upper levee slopes away from the low water active channel. IWM loading at the Sacramento River erosion repair sites is lower than the reach average (16 percent), except for site SAC 114.5R, which contains nearly twice the reach average (30 percent). This site also contains a relatively dense stand of riparian trees, which may account for the relatively high IWM recruitment. The Feather River and Sutter Bypass sites possess IWM coverage proportions comparable to the reach averages (22 percent and 5 percent), with the exception of FR 7.0L (2 percent).

3.7.1.3. Reach 3

In the uppermost reach above Colusa (RM 143–194), the Sacramento River migrates through alluvial deposits between widely spaced project levees. Although levees have not been constructed in much of the uppermost reach, riverbank migration is constrained by revetment and other structures along one-third to one-half of the reach length (U.S. Army Corps of Engineers 1987). Reach 3 is predominately a meandering single-thread channel, with an average sinuosity of about 1.4 to 1.5 (Brice 1977); average energy grade slopes from the Corps HEC-RAS model ranged from 0.0002 to 0.0003 (U.S. Army Corps of Engineers 2004). The channel is flanked by relatively coarser grained floodplain sediments with a median bed material size (D_{50}) of approximately 15 millimeters (mm) (Water Engineering and Technology 1989) that generally

provide a non-cohesive sand or gravel toe to the banks. Upstream of RM 140, exposures of the finer, cohesive Modesto and Riverbank formations are present intermittently along the riverbanks, which are relatively resistant to lateral erosion (Water Engineering and Technology 1990, Fischer 1994).

The percent of channel shoreline with revetment is 16 percent from RM 143–194, which is a notable decrease in the frequency of bank revetment compared to Sacramento River reaches farther downstream (Table 3-12). The majority of revetment within this reach is placed on the outer bank of meander bends where erosion potential is high. Despite the relatively higher frequency of channel migration and, therefore, the potentially high IWM recruitment, IWM loading along this reach (17 percent) is comparable to the two lower reaches along the Sacramento River. This low level of IWM recruitment is attributable to the conversion of riparian forests to agriculture over the last 100 years (Katibah 1984). The bank material at the one proposed repair site on the Sacramento River within Reach 3 (SAC 157.7R) is un-revetted and composed of cohesive silt and clay near the low-flow water elevation (Table 3-13). In the vicinity of this site, the banks in straight reaches are generally un-revetted, while most outer bank areas are revetted; therefore, the river is not free to laterally migrate at historical rates. IWM loading estimated at this site (26 percent) is greater than the Reach 3 average for the Sacramento River (17 percent).

Reach 3 also contains a site on lower Deer Creek—a relatively unregulated stream draining the high-relief southern Cascades. Prior to levee construction along the lower reach, the creek historically flowed and migrated across an alluvial fan with multiple overflow channels (Deer Creek Watershed Council 1998). The creek has retained an active single-thread channel with ample energy to erode streambanks and to transport a wide distribution of sediment, ranging in size from silt to cobbles (Tompkins and Kondolf 2007). The lower reach is bordered by low-lying (<3 feet high) levees that are slightly set back from the channel margins in some areas and are constructed of locally derived silt to cobble-sized sediments that are similar in composition to the surrounding streambanks. The Corps revetment database indicates that the frequency of bank revetment is high (68 percent) (Table 3-12); however, the database indicates that the majority of this revetment (88 percent) is composed of medium (6-10 inches) to small (<6 inches) cobble.

Based on the relatively small size of the material and observations made during a field visit in 2008, a significant portion of this material is likely coarse-grained alluvial deposits and not installed revetment, similar to the natural, coarse-grained alluvial banks found at the proposed bank repair site (DC 0.9N) in this reach (Table 3-13). The site is bordered by a low-relief levee setback about 20 feet from the channel margin. Recently installed revetment composed of large rock covers a bank segment at the outer bend immediately upstream of the site, which effectively prevents further migration of this channel segment into the levee and the road paralleling the channel. IWM loading in lower Deer Creek within the SRBPP area is relatively low (5 percent) compared to the average for the Sacramento River (17 percent) in Reach 3 (Table 3-12). However, IWM loading at the proposed repair site (18 percent) is comparable to the reach average along the Sacramento River (17 percent) (Table 3-13).

3.7.2. Regulatory Setting

3.7.2.1. Federal and State Laws and Regulations

Clean Water Act (33 USC Section 1251 et seq.)

The proposed action alternative at 22 of the 25 proposed erosion repair sites (i.e., non-setback levee sites) requires placing materials (rock revetment) in the waters of the United States. Temporary resuspension of sediments in the nearby area is likely. Water quality certification under Section 401 of the CWA addressing these activities is included in Appendix G, and a CWA Section 404(b)(1) evaluation for the proposed action is included as Appendix H. The Section 404(b)(1) guidelines for evaluation of discharges of dredged or fill materials provide specific guidance in Subpart C for evaluating significant impacts to the substrate of the aquatic ecosystem, turbidity, current patterns and water circulation, and normal water fluctuations in a natural aquatic system consisting of daily, seasonal, and annual tidal and flood fluctuations in water level. These include factors that cause "significant degradation of the Waters of the United States," with emphasis on the persistence and permanence of effects.

DFG Streambed Alteration Agreement

Under sections 1600–1616 of the California Fish and Game Code, DFG regulates activities that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed. In practice, DFG marks its jurisdictional limit at the top of bank, or the outer edge of the riparian vegetation, where present, and sometimes extends its jurisdiction to the edge of the 100-year floodplain. However, since the proposed action is a federal project, obtaining a Streambed Alteration Agreement from DFG is not necessary.

3.7.3. Environmental Effects

Effects on geomorphic processes that could result from construction activities were evaluated on the basis of construction designs, hydraulic modeling, materials planned for use in construction, location, and the duration of the activities. Operational effects on geomorphic processes were evaluated on the basis of the proposed action's potential to significantly alter channel bed and bank erosion, sediment storage and recruitment, channel migration, and IWM storage and recruitment.

Thresholds of significance for impacts to geomorphic processes from implementation of erosion repair at the bank protection sites are in part based on applicable environmental laws and on interpretation of the general physical context of the changes in channel morphology, sediment regime, and IWM processes. The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Impacts are considered significant under CEQA if the project would result in:

- Alteration in channel erosion and migration processes,
- Changes in the local hydraulics,
- Loss of sediment supply, or
- Loss of IWM loading and recruitment.

3.7.3.1. No-Action Alternative

Under the no-action alternative, no activities would be conducted to halt erosion and protect the levees at the 25 erosion repair sites. The banks would continue to erode, increasing the risk of levee failure and subsequent flooding in the surrounding areas. Eventually, emergency repair measures would likely need to be implemented to protect the levee system from failing. Levee repairs under these circumstances would likely involve the placement of bare rock revetment without the advantages of contouring riparian benches with IWM embedded in the rock, minimal protection and replanting of the riparian forest, and rock being placed without the advantage of hydraulic model results to design and guide the installation in a manner that minimizes velocity and water surface elevation differentials between pre- and post-project scenarios. Impacts associated with the no-action alternative would include cessation of bank erosion, elimination of IWM stored at the site, compromising the riparian forest in a manner that would likely eliminate hillslope IWM recruitment in the short and long term, and a much higher likelihood than the proposed action of channel bed and bank erosion associated with changes in velocity.

3.7.3.2. Alternative 1: Proposed Action

The proposed action includes the implementation of bank (levee and waterside slope) protection measures at 22 of the 25 erosion sites to prevent ongoing erosion and increase levee stability. Setback levees would be constructed at the three other sites (CC 2.8L, CC 3.4L, and DC 0.9N), as discussed below. Proposed bank protection measures at the 22 erosion sites include: (1) protecting the toe and upper slopes of the bank with riprap while restoring the 3:1 levee prism profile; (2) establishing a bench around the MSWL to provide aquatic habitat during higher river stages in winter and spring; (3) placing anchored IWM for aquatic habitat; and (4) planting pole and container plantings to stabilize the bank and provide riparian and shaded riverine aquatic habitat. Proposed repairs at SAC 8.0L and 10.8L would not include a riparian bench feature, but would include rock revetment capped with soil on the levee slope and riparian plantings and IWM installation. The potential geomorphic impacts at these two sites are considered to be similar to those expected at the other 20 sites having the bench feature because all sites would receive rock revetment with onsite mitigation features on the waterside of the levee.

Landside construction of setback levees is proposed at three erosion sites: CC 2.8L, CC 3.4L, and DC 0.9N. Setback levees are proposed for these sites due to the following: (1) insufficient channel widths to accommodate in-water bank/levee repairs (e.g., Cache Creek); (2) protection of existing riparian vegetation and habitat (e.g., Deer Creek); and (3) cost-effectiveness as compared to implementation of in-water repair structures (e.g., Deer Creek). The setback levee design to be implemented at these sites would be constructed between 50 and 200 feet landward from the existing levee crest, thereby creating a floodplain area between the setback levee and the present-day streambanks. The setback levee crown would be constructed with a 3:1 waterside facing slope. At CC 2.8L and 3.4L, the existing levee crowns would remain, but would be notched down to the floodplain elevation in several locations along their lengths in order to allow inundation of the reconnected floodplain area during high winter and

spring flows. At DC 0.9N, the existing levee road would be removed, and the materials would be used to construct the setback levee.

In terms of restoring geomorphic function to a river segment, a setback levee provides several benefits. The existing bank and levee erosion adjacent to the stream channel is allowed to continue at present rates, thereby providing for sediment and IWM recruitment. Bank erosion at DC 0.9N would provide a source for spawning gravel for anadromous fish species, while the fine bank materials eroded at the Cache Creek sites would not; however, lower Cache Creek does not support spawning habitat for any special-status fish species (see section 3.5). Setback levees also create a floodplain area capable of storing flood waters during high winter and spring flows. Riparian vegetation recruitment and overbank deposition of fine sediment would also be expected on the floodplain (Bozkurt et al. 2000). Floodplain trees would eventually serve as an IWM source as the stream continued its gradual migration into the floodplain. The local hydraulics and shear stresses would not be expected to increase but, rather, may potentially decrease as the channel width increases through the continued erosion of the existing bank and levee (Larsen and Greco 2002, U.S. Army Corps of Engineers 2004 Appendix G). Finally, the absence of in-water construction would avoid potential construction-related erosion and sedimentation effects, assuming that BMPs are adequately implemented on the landside during construction of the setback levee and notching of the existing levee. Overall, construction of the setback levees is not anticipated to result in significant geomorphic impacts.

Potential geomorphic impacts resulting from implementation of the proposed action are identified below.

Impact GEO1: Arrest of Bank Erosion and Change in Sediment Recruitment
The proposed action would result in placing rock revetment on approximately 20,897 feet of combined channel length for 22 of the 25 sites, with two-thirds of that revetment work occurring on the Sacramento River. Assuming the bank repairs are successful for the project design life, bank erosion would be arrested on about 4 miles of channel for 50 years.

While the arrest of bank erosion at the repair sites is one of the intended consequences of the proposed work, the results would have geomorphic implications. The new bank revetment would contribute to fixing the channel planform position by limiting lateral channel migration at the erosion repair sites; the rivers are already similarly constrained by levees and revetment in other locations. The proposed bank repairs would not alter the overall geomorphic trajectory of the reaches affected by the proposed action. Within Reaches 1 and 2 along the lower Sacramento River (RM 0–143), where approximately 192 miles of bank revetment are documented (U.S. Army Corps of Engineers 2007b), the planform position of the Sacramento River is essentially fixed in place, with limited opportunity for lateral migration or sediment recruitment from channel banks irrespective of the proposed action. Overall, impacts related to arrest of bank erosion are considered to be less than significant. No mitigation is required.

Additionally, potential sediment recruitment would be reduced. Sediment recruitment from these sites represents a small fraction of the overall Sacramento River basin sediment budget. Although the Sacramento River is gravel-dominated upstream of

Colusa at RM 144 (Water Engineering and Technology 1990), the bank materials of the proposed erosion repair site at SAC 157.7R are composed of cohesive silt and clay deposits. The potential sediment along the riverbanks of the project sites would likely be sand or finer, and would not be expected to contribute to the loss of spawning-sized material (i.e., gravel) for anadromous fish species. Overall, impacts related to sediment recruitment are considered to be less than significant. No mitigation is required.

Impact GEO2: Changes in IWM Recruitment

The proposed construction-related activities would result in loss and replacement of the riparian vegetation communities at the erosion repair sites. The effects to the riparian vegetation would likely persist for 5 to 10 years before newly planted vegetation reaches sufficient height to provide shaded riverine and riparian habitat.

IWM recruitment to the rivers would be affected during the reestablishment of the woody vegetation. Bank stabilization would result in the arrest of bank erosion and channel migration; thus, the primary mechanisms for natural IWM recruitment in the future would be wind-throw and tree mortality. Recruitment from newly planted trees would not occur until trees reach maturity and begin to senesce, which would likely occur about 25 to 50 years after planting.

To reduce the effects related to the loss of existing IWM during construction and tree reestablishment, the proposed construction activities include installation of IWM at the majority of the sites, which would substantially increase short-term IWM loading levels from current levels (Table 3-13). At least half of the shoreline would be covered with IWM under the planned designs, compared with existing IWM loads that average 20 percent and range from 0 to 73 percent. The designs specifically call for 60 percent shoreline coverage at the three near-Delta sites (SAC 8.0L, 10.8L, and 26.0L), as these three sites presently contain relatively high IWM coverage proportions of 49 percent, 73 percent, 43 percent, respectively. All other sites would receive between 40 percent and 50 percent shoreline cover of IWM, except for SBP 0.4E. The Sutter Bypass site would receive only 25 percent shoreline cover—an increase of 13 percent shoreline cover from the existing 8 percent cover—in order to preserve giant garter snake habitat.

IWM and riparian trees will be installed at the 22 sites in accordance with the installation designs shown in the revegetation plans (Appendix F). All installed IWM would consist of hardwood tree species such as English walnut (*Juglans regia*) or almond (*Prunus dulcis*), that span approximately 15 to 20 feet in length and retain an extensive branch and root structure. IWM will be securely anchored under rock revetment at the front edge of the riparian bench, or bank toe (e.g., SAC 8.0L and 10.8L), for both high-water winter and spring habitat and for low-water summer and fall aquatic habitat. The upper half of each tree would extend out of the front of the riparian bench quarry rock at approximately the elevation of the MSWL. This anchoring method would ensure that all installed IWM would remain onsite for approximately 1 to 10 years. The required specifications for installation of IWM and planting of riparian trees will be clearly identified in final construction drawings and construction contracts.

The success of IWM replacement largely depends on the lifespan and residence time of the IWM installed during project implementation, which is not fully predictable on a site-by-site basis. However, post-construction surveys at 29 Corps sites repaired within the past 6 years report 100 percent retention of installed IWM, indicating at least a high level of retention in the short term (U.S. Army Corps of Engineers 2008d). In the long term, the buried IWM is expected to degrade and decrease in volume over time due to fluvial abrasion caused by shear stress from flow, downriver transport of sediment and IWM, and organic decomposition. IWM pieces that are continually submerged in water would have slower rates of decomposition due to less oxygen available for decomposing organisms, while also having higher exposure to fluvial abrasion.

The buried IWM would not likely persist in abundant quantities over the entire time needed for the planted riparian forest to reach maturity (i.e., > 25 years) and begin to provide streamside IWM recruitment at the sites. However, the installed IWM would also likely increase the local trap efficiency for IWM that is fluvially transported downriver, and may replace degraded IWM and/or increase the IWM loading beyond the approximately 50 percent shoreline coverage under the current design. Post-construction surveys at previously repaired erosion sites noted fluvial IWM recruitment at more than one-third of those 29 sites (U.S. Army Corps of Engineers 2008d). This observation suggests that the potential exists for fluvial IWM recruitment from upstream sources at the 22 proposed repair sites with waterside repairs within 1 to 5 years following project implementation.

The surveys also indicated that none of the 29 previously repaired sites generated new IWM from onsite sources, such as existing mature trees on the upper banks, which suggests that this condition would likely exist at the subject 25 proposed repair sites as well. Thus, the loss of future IWM recruitment at the erosion repair sites from onsite sources could potentially persist at an estimated 5 to 25 years following project implementation. However, the installation of about 50 percent IWM coverage along a site's total length is expected to provide significantly greater IWM benefits than under existing conditions. The intermediate-term loss of IWM recruitment is therefore considered to be less-than-significant.

The proposed construction would generally install proportions of IWM cover at the erosion sites comparable to or greater than currently exist, recruitment from off-site sources would potentially provide replacement or increased cover amounts, and planted riparian tree species would eventually serve as an onsite IWM source. The proposed action is therefore considered to have a less-than significant impact on future IWM recruitment, and no mitigation is required.

Impact GEO3: Changes in Local Hydraulics and Shear Stress

The proposed erosion site repairs would change the channel geometry at the erosion sites and alter the local hydraulics (i.e., flow velocity fields and water surface elevations). The erosion site repairs include placing additional revetment onto the waterside of the existing levees, which would build out the levee prism and reduce the channel cross-sectional area. The physical response to a reduction in cross-sectional area for a given discharge is

for flow velocity to increase and/or water stage to rise. Both effects increase boundary shear stress, and an alluvial river channel would typically respond by laterally eroding and/or vertically incising to a new quasi-equilibrium channel that would transport the same amount of sediment at a given discharge as the original channel.

For many of the proposed repair sites, however, limited opportunity exists for the channel to laterally adjust due to extensive revetment in the vicinity of the sites, which would imply that vertical erosion may result due to the proposed activities. All proposed designs have been evaluated with hydraulic models that compute either steady state 1-dimensional (HEC-RAS) or 2-dimensional flow (SMS/RMA2) analysis for the 100-year flow rate for each bank repair site (Kleinfelder 2008, 2009; Wheeldon, pers. comm. 2009). Design specifications have been developed based on model results that minimize changes in pre- and post-project implementation velocity fields and water surface elevations. The maximum allowable tolerance for change in water surface elevation for a 100-year flood event is a 0.1 foot difference between pre-and post project model scenarios. Velocity differentials between pre- and post-project scenarios are not allowed to exceed levels that would cause bank erosion (evaluated based on the composition of nearby banks). Designs are also adjusted to limit bed scour.

Model results indicate some zones of velocity reduction, typically directly over the new bank protection or immediately downstream on the same bank. Velocity reductions, particularly at inner bend sites (e.g., SAC 35.4L), may induce fine sediment deposition, as has been observed at a recently repaired site at Sacramento River RM 99.3R where sandy sediments measuring up to several feet in depth have been deposited on the bench and lower bank portions of the repair structure (U.S. Army Corps of Engineers 2008d). Areas of maximum velocity increase and potential accelerated erosion vary with the channel planform position of the bank protection sites. Bank protection sites on inner bends tend to produce maximum velocity increases on the opposite, outer bank, whereas straight reaches tend to increase in velocity toward the channel centerline directly adjacent to the bank protection. Outer bend protection sites are modeled as having maximum velocity increases in close proximity to the new revetment, either immediately downstream or near the toe of the bank protection.

Based on model results, minimal erosion or additional flooding is expected to occur from project implementation. However, fluvial sediment transport and erosion processes are complex, and numerical hydraulic models involve assumptions and associated levels of uncertainty. Due to these inherent uncertainties coupled with zones of model-based predictions of velocity increases, the potential for erosion cannot be eliminated as an impact. Localized erosion potential is likely higher along the deformable sand-dominated channel bed as compared to the channel banks that are often armored with revetment or composed of cohesive silts and clays.

Because potential erosion impacts from changes in river hydraulics would likely be localized and not reach-wide gradient or channel width adjustments, the impacts associated with changes in local hydraulics and shear stress are considered to be less than significant. Further, the Corps has undertaken a SRBPP-wide evaluation of sediment

transport dynamics and bank stability to assess the long-term effects of changes to the channel cross-sectional area as a result of the contemporary levee repair actions. The study will specifically assess the potential for increased scour or deposition in the channel in order to inform future repair projects through adaptive management. No mitigation is required.

Impact GEO4: Construction-Related Accelerated Erosion and Sedimentation
Site clearing, ground disturbance and grading, and placement of rock beneath the water line during construction would result in minor alterations to local drainage patterns in the vicinity of all erosion repair sites. Ground-disturbing activities could increase the potential for localized erosion and sedimentation in the Sacramento River, Feather River, lower American River, and Sutter Bypass at the 22 proposed erosion repair sites considered under this treatment of the proposed action. This could potentially increase local turbidity levels to significant levels during construction activities and for a limited time immediately thereafter. Given the revegetation plans, which include mixes of fast-growing, native plant species, the proposed action is not expected to produce chronic surface erosion areas or result in rill and gullying.

Short-term increases in erosion and sedimentation resulting in increased turbidity levels would be a significant impact. Implementation of Mitigation Measure WQ1 (see section 3.6, Water Quality and Hydrology) would reduce potential impacts to a less-than-significant level.

3.7.3.3. Alternative 2: Thin Rock Armor

This alternative would place a thin layer of rock over the existing, eroded levee slope. The result would protect the bank from erosion, but would not address slope stability issues. When placed on a slope of 2:1 (horizontal to vertical) or greater, the design life of this type of repair is estimated at approximately 25 years, which is half the design life of the proposed action.

The thin rock armor alternative would likely limit or altogether prevent implementation of on-site mitigation such as riparian plantings and IWM placement, which would reduce IWM over time due to the lack of IWM recruitment from the bank slope. The thin rock layer would continue to limit bank erosion, channel migration, and sediment and IWM recruitment.

This alternative also has a higher likelihood of causing channel erosion than the proposed action due to the steeper 2:1 profile of the new revetment that would protrude further out into the channel and be composed of coarser substrate than the existing bank profile. Additionally, the shorter design life of this alternative could lead to emergency levee repair work in the future that could be implemented with minimal hydraulic design consideration.

3.7.4. Mitigation

Short-term increases in erosion and sedimentation resulting in increased turbidity levels are considered a significant impact. Implementation of Mitigation Measure WQ1 (see section 3.6, Water Quality and Hydrology) would reduce potential impacts to less-than-significant

levels. No other significant effects related to geomorphology were identified; therefore, no other mitigation measures are required.

3.8. Air Quality

This section includes a discussion of applicable air quality plans and standards, and the potential to contribute substantially to an existing air quality violation, result in a cumulatively considerable net increase of any criteria pollutant, or expose sensitive receptors to substantial pollutant concentrations.

3.8.1. Environmental Setting

Construction at the 25 erosion sites would occur within the Sacramento Valley Air Basin. The air basin is bounded by the Coast Ranges to the west and the Sierra Nevada to the east. The Carquinez Strait, a sea-level gap in the Coast Ranges, is located 50 miles southwest of the city of Sacramento, and the intervening terrain is very flat. The prevailing wind direction in the Sacramento Valley is southwesterly, resulting from marine breezes through the Carquinez Strait. During winter, when the sea breeze diminishes, northerly winds occur more frequently, but southerly winds still predominate.

A relatively stable high-pressure weather system positioned off the coast diverts storms to the north away from California during the spring, summer, and early fall. The dry, warm, subsiding air of this system produces an atmospheric condition known as a subsidence inversion, where warm air overlies cooler air. Subsidence inversions may be several thousand feet deep and, together with strong sunlight, can produce worst-case conditions for smog, of which ozone is the largest single component. In conjunction with this high-pressure zone, a thermal trough (a low-pressure zone caused by intense surface heating) is normally positioned over the Central Valley. The relative positions of these pressure zones serve to increase the movement of cooler ocean air through the Carquinez Strait to the Sacramento Valley. This helps cool the region, but it also carries pollutants from upwind urban sources.

During the late fall, winter, and early spring, the position of the summertime high-pressure zone shifts to the south, allowing numerous storm fronts to sweep through the region. Generally, over 30 of these winter storms can be expected per year, accounting for virtually all of the precipitation the city of Sacramento receives in a typical year (about 18 inches in an average year). Periods of stagnation between storms are characterized by very light winds. Surface inversions, which can form under these conditions, are most often observed in the morning from October to February.

Existing conditions for air quality in the proposed action area can be described with summary statistics for critical air pollutants. Air quality data for the Sacramento Valley Air Basin from 2005 to 2007 are summarized (Table 3-14).

Table 3-14 Summary Statistics for Air Quality Data in the Sacramento Valley Air Basin

Year	Pollutant (averaging time)	Maximum Concentration	No. of Days Exceeding Federal Standards	No. of Days Exceeding State Standards
2005	Ozone (1 hour)	0.134 ppm	3	33
	Ozone (8 hour)	0.117 ppm	45	62
	CO (8 hour)	4.19 ppm	0	0
	PM_{10} (daily)	109 $\mu g/m^3$	0	25
2006	Ozone (1 hour)	0.143 ppm	7	44
	Ozone (8 hour)	0.115 ppm	68	88
	CO (8 hour)	4.19 ppm	0	0
	PM_{10} (daily)	111 $\mu g/m^3$	1	11
2007	Ozone (1 hour)	0.138 ppm	1	15
	Ozone (8 hour)	0.123 ppm	34	61
	CO (8 hour)	5.58 ppm	0	0
	PM_{10} (daily)	119 $\mu g/m^3$	0	6

ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

Source: California Air Resources Board 2009; California Air Resources Board website – http://www.arb.ca.gov/adam (accessed 1/23/09).

The Sacramento Valley Air Basin does not consistently meet several applicable state air quality standards (California Air Resources Board 1996). Depending on the pollutant, the boundaries of the attainment areas vary. Between 2005 and 2007, measures of ozone frequently exceeded both federal and state standards, whereas concentrations of suspended particulate matter (PM_{10}) rarely exceeded federal standards (Table 3-15). Concentrations of PM_{10} did, however, frequently exceed state standards. Concentrations of carbon monoxide (CO) did not exceed state or federal standards during 2005 to 2007.

The Sacramento Valley Air Basin, including all of Butte, Colusa, Glenn, Sacramento, Shasta, Sutter, Tehama, Yolo, and Yuba counties and portions of Placer and Solano counties, is designated as a non-attainment area for the federal and state ozone standards. Sacramento, Sutter, Solano, Yolo, Tehama, and Colusa counties have varying classifications of non-attainment. Sacramento, Yolo, and Solano counties are designated as serious non-attainment areas according to federal 8-hour and state 1-hour ozone standards. Sutter County classifications vary, depending on location, ranging from moderate (North Sutter) to serious (South Sutter) non-attainment according to state 1-hour standards, and from unclassified (North Sutter) to serious

(South Sutter) non-attainment according to federal standards. Tehama and Colusa counties are unclassified with regards to federal standards, but classified as moderate non-attainment according to state 1-hour standards. Sacramento, Sutter, Solano, Yolo, and Tehama counties are all classified as non-attainment based on state 8-hour standards. Colusa County is classified as non-attainment/transitional with respect to state 8-hour standards.

For CO, the Sacramento urbanized area (i.e., Sacramento, Placer, and Yolo counties) was reclassified from non-attainment to attainment of the federal and state standards in 1998; therefore, a large portion of the proposed action area is considered to be a maintenance area for CO. The rest of the proposed action area is designated as either attainment or unclassified with respect to federal and state standards for CO.

For the federal PM_{10} standards, only Sacramento County has been designated a non-attainment area (moderate); however, redesignation to attainment has been requested by the Sacramento Metropolitan Air Quality Management District (SMAQMD). For the state PM_{10} standards, the entire air basin is considered a non-attainment area.

3.8.2. Regulatory Setting

3.8.2.1. Federal and State Laws and Regulations

Air quality in the air basin is regulated by federal, state, and regional agencies. At the federal level, the U.S. Environmental Protection Agency (EPA) is responsible for overseeing implementation of the 1990 Federal Clean Air Act (42 U.S.C. 7401 et seq.). The Air Resources Board is the state agency that regulates mobile sources and oversees implementation of state air quality laws, including the 1988 California Clean Air Act (Health & Safety Code Section 42300 et seq.).

Pursuant to the federal Clean Air Act, the EPA has established national ambient air quality standards for criteria pollutants, including ozone, CO, $PM_{10,}$ and particulate matter of respirable size ($PM_{2.5}$). California's ambient air quality standards are generally more stringent than the federal standards. The federal and state standards for ozone, CO, and PM_{10} are summarized in Table 3-15.

Table 3-15 Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]	Federal Standards[2]	
			Primary[3]	Secondary[4]
Ozone (O_3)	8 hour	0.070 ppm	0.075 ppm	0.075 ppm
	1 hour	0.09 ppm	--	--
Carbon monoxide (CO)	8 hour	9.0 ppm	9 ppm	--
	1 hour	20 ppm	35 ppm	--
PM_{10}	Annual arithmetic mean	20 $\mu g/m^3$	--	--
	24 hour	50 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$

Table 3-15 Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]	Federal Standards[2]	
			Primary[3]	Secondary[4]
$PM_{2.5}$	Annual arithmetic mean	12 μg/m^3	15.0 μg/m^3	15.0 μg/m^3
	24 hour	--	35 μg/m^3	35 μg/m^3

[1]California standards for ozone, carbon monoxide, and suspended particulate matter (PM_{10}) are values that are not to be exceeded.

[2]National standards, other than ozone and those based on annual averages or annual arithmetic mean, are not to be exceeded more than once a year. The ozone standard is attained when the 4th highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard.

[3]National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[4]National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

ppm = parts per million; μg/m^3 = micrograms/per cubic meter.

Source: California Air Resources Board 2008

In January 2008, Assembly Bill 32, the Global Warming Solutions Act of 2006, went into effect. This bill charged CARB to develop regulations on how the state would address global climate change (GCC) due to greenhouse gas (GHG) emissions. There are currently no thresholds or recommended methodologies for determining the significance of a project's potential cumulative contribution to GCC in CEQA documents.

3.8.2.2. Local Laws and Regulations

The primary agency that regulates air quality on a regional level in the proposed action area is the SMAQMD. Regional planning and attainment of air quality goals also involves the local air quality agencies, the Feather River Air Quality Management District (FRAQMD), Colusa County Air Pollution Control District (CCAPCD), Tehama County Air Pollution Control District (TCAPCD), and Yolo-Solano Air Quality Management District (YSAQMD), in addition to the neighboring local air quality agencies, El Dorado County Air Pollution Control District and Placer County Air Pollution Control District. SMAQMD and these local agencies have permit authority over stationary sources, act as the primary reviewing agencies for environmental documents, and develop regulations that must be consistent with, or more stringent than, federal and state air quality policies.

3.8.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Violate applicable air quality standards (see Table 3-14 for federal and state standards, and section 3.8.4.2 for established significance thresholds per air quality management district).
- Contribute substantially to an existing or projected air quality violation.

- Expose sensitive receptors to substantial pollutant concentrations.

3.8.3.1. No-Action Alternative

The no-action alternative would likely result in a continuation of the current air quality standard violations, similar to the trend shown in Table 3-14. This alternative is associated with the greatest possibility of levee failure. Subsequent emissions associated with repair would be as described for Alternatives 1 and 2 below.

3.8.3.2. Alternative 1: Proposed Action

This section describes the potential air quality effects of the proposed action, including exhaust emissions from construction equipment and worker commute and delivery vehicles, fugitive dust generated by construction activities, and vehicle travel over unpaved roads. To complete the analysis, information was collected on projected construction activities, duration, and timing and on equipment use and activities for each construction year.

Emissions associated with vehicle exhaust for employee commute vehicles and delivery trucks were estimated using SMAQMD Road Construction Emission Model Version 6.3, which includes the on-road Emission Factor Model (EMFAC2007) and an off-road source emission model (OFFROAD2007); Version 6.3 is the latest version of this California Air Resources Board model (Sacramento Metropolitan Air Quality Management District 2008a) (Appendix I, "Air Quality Modeling Data"). These emissions were based on assumptions described in Table 3-16. Emissions associated with the operation of construction equipment were estimated using the SMAQMD's "Guide to Air Quality Assessment in Sacramento County" (Sacramento Metropolitan Air Quality Management District 2004). Construction equipment usage from similar projects under the SRBPP was used to estimate daily and annual exhaust emissions for construction equipment.

Fugitive dust emissions from vehicle travel over unpaved roads and construction activities were estimated using data and emission factors from SMAQMD Road Construction Emission Model Version 6.3 and its emission factors (using models CARB2007 and OFFROAD2007) (Sacramento Metropolitan Air Quality Management District 2008a).

The model simulation input data and assumptions regarding construction activities used to estimate construction emissions are summarized in Table 3-16. The projected cubic yards of material to be imported, the projected number of employee commute trips, the anticipated number of delivery and haul truck trips, and the construction equipment projected to be used are also listed in Table 3-16.

Table 3-16 Emission Sources and Assumptions Used to Determine Air Emissions

Emission Source	Bank Erosion Sites
Material placed	87,000 cubic yards of revetment, sand, and soil by barge 407,000 cubic yards of revetment, sand, and soil by truck

Table 3-16 Emission Sources and Assumptions Used to Determine Air Emissions

Emission Source	Bank Erosion Sites
Employee commute trips	5 employee trips/day, 20 miles each way (per site)
Delivery truck trips/ debris haul truck trips (landside construction1)	9 trips per day for SAC 71.3R, 23 trips per day for SAC 73.5L, 8 trips per day for SAC 78.8L, 19 trips per day for SAC 87.0L, 23 trips per day for SAC 93.7L, 32 trips per day for SAC 114.5R, 8 trips per day for SAC 130.0L, 5 trips per day for SAC 136.7R, 13 trips per day for SAC 136.9R, 27 trips per day for SAC 157.7R, 21 trips per day for FR 1.0L, 66 trips per day for FR 3.7L, 13 trips per day for FR 5.5L, 13 trips per day for FR 7.0L, 10 trips per day for LAR 10.0L, 9 trips per day for LAR 10.6L, 9 trips per day for CC 2.8L, 6 trips per day for CC 3.4L, 1 trip per day for DC 0.9N, and 2 trips per day for SBP 0.4E Average round trip for trucks: 66 miles 20 cubic yards average load for trucks 64 hauling days
Fuel-fired construction equipment (waterside construction2)	Chain saws (2) Cranes (2) Generators (3) Excavator (1) Winches (4) Motor boats (2) Pick-up trucks (2) Light plants (2) Air compressor (1) Tug boats (1)
Fuel-fired construction equipment (landside construction1)	Chain saws (2) Crane (1) Generators (2) Excavator (1) Dump trucks (5) Winches (2) Pick-up trucks (2) Light plants (2) Front end loader (1) Crawler tractor (1)

[1] *Landside construction will occur at sites SAC 71.3R, SAC 73.5L, SAC 78.8L, SAC 87.0L, SAC 93.7L, SAC 114.5R, SAC 130.0L, SAC 136.7R, SAC 136.9R, SAC 157.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L, DC 0.9N, and SBP 0.4E.*

[2] *Waterside construction will occur at sites SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, and SAC 41.9R.*

Emissions thresholds developed by the SMAQMD, YSAQMD, FRAQMD, TCAPCD, and the EPA were used in determining the significance of project-related air quality effects. Emissions would be considered significant if emissions exceeded the local thresholds established by these agencies for construction activities.

These thresholds were established to assist in CEQA analyses within the SMAQMD boundaries (Sacramento Metropolitan Air Quality Management District 2004):

- 85 pounds per day of nitrogen oxides (NO_X)
- 85 pounds per day of reactive organic gas (ROG)
- 275 pounds per day of PM_{10}

Thresholds established by the YSAQMD (2002) include:

- 82 pounds per day of NO_X
- 82 pounds per day of ROG
- 150 pounds per day of PM_{10}

Thresholds established by the FRAQMD (1998) include:

- 25 pounds per day of NO_X
- 25 pounds per day of ROG
- 80 pounds per day of PM_{10}

Neither CCAPCD nor TCAPCD has identified significance thresholds, but TCAPCD does suggest following the guidelines of Butte and Shasta counties (Golsh, pers. comm. 2009); these thresholds are identical to those listed previously for the FRAQMD.

Emissions for the proposed action would be considered significant under NEPA if annual emissions exceeded EPA general conformity thresholds. Conformity thresholds are based on the *de minimis* thresholds included in the EPA general conformity guidelines for air pollutants in non-attainment areas (40 FR 51.853), as applicable for the Sacramento area. These guidelines do not include thresholds for counties that are designated as unclassified or attainment (i.e., North Sutter, Tehama, and Colusa counties for ozone; South Sutter, North Sutter, Solano, Yolo, Tehama, and Colusa counties for PM_{10}; South Sutter, North Sutter, Solano, Tehama, and Colusa counties for CO). The thresholds for the applicable sites are:

- 50 tons per year of NO_x (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 73.5L, SAC 78.8L, SAC 87.0L, SAC 93.7L, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L)

- 50 tons per year of ROG (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 73.5L, SAC 78.8L, SAC 87.0L, SAC 93.7L, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L)

- 100 tons per year of PM_{10} (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 73.5L, LAR 10.0L, LAR 10.6L)
- 100 tons per year of CO (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 73.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L)

Potential air pollutants generated during construction include PM_{10} emissions from debris-moving activities and vehicle travel on unpaved roads, and exhaust emissions from operation of construction equipment, delivery and haul trucks, and employee vehicles. Tailpipe exhaust emissions include ozone precursors (NO_x and ROG) and PM_{10}. The air quality estimates are based on waterside construction equipment emissions (barges and boats) for sites SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, and SAC 41.9R, and landside emissions (trucks) for sites SAC 71.3R, SAC 73.5L, SAC 78.8L, SAC 87.0L, SAC 93.7L, SAC 114.5R, SAC 130.0L, SAC 136.7R, SAC 136.9R, SAC 157.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L, DC 0.9N, and SBP 0.4E (Table 3-16).

The maximum daily emissions in pounds per day (lbs/day) for construction sites of the proposed action were estimated (Table 3-17). The average annual emissions in tons per year (tons/yr) for the construction period were also estimated (Table 3-18).

Table 3-17 Maximum Daily Construction Emission Estimates (pounds per day)

Project Component	NO_x	ROG	PM10	CO	Air Quality District
SAC 114.5R	127	14	16	98	CCAPCD
SAC 136.7R	63	8	13	40	
SAC 136.9R	77	10	14	54	
SAC 157.7R*	118	13	16	88	
Threshold	N/A	N/A	N/A	N/A	
FR 1.0L*	105	12	15	76	FRAQMD
FR 3.7L*	226	24	20	181	
FR 5.5L	89	11	15	59	
FR 7.0L	92	11	15	61	
SAC 78.8L	71	9	14	47	
SAC 87.0L	107	12	15	75	
SAC 93.7L	95	11	15	73	
SAC 130.0L*	67	9	14	44	
SBP 0.4E	63	8	14	35	
Threshold	25	25	80	N/A	

Table 3-17 Maximum Daily Construction Emission Estimates (pounds per day)

Project Component	NO_x	ROG	PM10	CO	Air Quality District
LAR 10.0L	87	10	14	56	SMAQMD
LAR 10.6L	84	10	14	53	
SAC 8.0L*	111	14	6	58	
SAC 10.8L*	111	14	6	58	
SAC 26.0L*	111	14	6	58	
SAC 73.5L	108	12	15	80	
Threshold	85	85	275	N/A	
DC 0.9N*	62	8	13	34	TCAPCD
Threshold[1]	25	25	80	N/A	
CC 2.8L*	89	11	15	56	YSAQMD
CC 3.4L*	80	10	14	48	
SAC 35.4L	111	14	6	58	
SAC 41.9R*	111	14	6	58	
SAC 71.3R*	90	11	15	56	
Threshold	82	82	150	N/A	

** Construction begins in summer 2010; all other sites to begin construction in summer 2009.*

N/A - not applicable, California Ambient Air Quality Standards not based upon emission rate, but require no increase in ambient CO concentrations by 5% or more, or no thresholds established for CCAPCD (sites SAC 114.5R, SAC 136.7R, SAC 136.9R, and SAC 157.7R).

[1]Suggested by TCAPCD to follow thresholds of Butte and Shasta counties.

Table 3-18 Average Annual Construction Emission Estimates (tons per year)

Project Component	NO_x	ROG	PM10	CO	Air Quality District
SAC 114.5R	2.9	<1	<1	2.4	CCAPCD
SAC 136.7R	1.5	<1	<1	<1	
SAC 136.9R	1.8	<1	<1	1.2	
SAC 157.7R*	2.2	<1	<1	1.7	
Threshold	N/A	N/A	N/A	N/A	

Table 3-18 Average Annual Construction Emission Estimates (tons per year)

Project Component	NO_x	ROG	PM10	CO	Air Quality District
FR 1.0L*	2.4	<1	<1	1.9	FRAQMD
FR 3.7L*	4.8	<1	<1	4.7	
FR 5.5L	2.1	<1	<1	1.4	
FR 7.0L	2.1	<1	<1	1.5	
SAC 78.8L	1.7	<1	<1	1.1	
SAC 87.0L	2.4	<1	<1	1.8	
SAC 93.7L	2.3	<1	<1	1.7	
Threshold	50	50	N/A	N/A	
SAC 130.0L*	1.6	<1	<1	1.0	FRAQMD
SBP 0.4E	1.5	<1	<1	<1	
Threshold	N/A	N/A	N/A	N/A	
SAC 8.0L*	2.6	<1	<1	1.4	SMAQMD
SAC 10.8L*	2.6	<1	<1	1.4	
SAC 26.0L*	2.6	<1	<1	1.4	
SAC 73.5L	2.4	<1	<1	2.0	
LAR 10.0L	2.0	<1	<1	1.4	
LAR 10.6L	1.9	<1	<1	1.3	
Threshold	50	50	100	100	
DC 0.9N*	1.5	<1	<1	<1	TCAPCD
Threshold	N/A	N/A	N/A	N/A	
SAC 35.4L	2.6	<1	<1	1.4	YSAQMD
SAC 41.9R*	2.6	<1	<1	1.4	
SAC 71.3R*	2.0	<1	<1	1.4	
CC 2.8L*	2.0	<1	<1	1.4	
CC 3.4L*	1.8	<1	<1	1.2	
Threshold	50	50	N/A	100	

** Construction begins in summer 2010; all other sites to begin construction in summer 2009.*

N/A - not applicable, due to being unclassified or attainment for criteria pollutants based on federal standards.

Impact AQ1: Temporary Increase in Emissions

Based on the analysis in this section, construction of the proposed action would result in temporary increases in emissions of NO_x, ROG, PM_{10}, and CO. Estimated daily

emissions of NO_x (Table 3-17) would exceed thresholds established by SMAQMD, YSAQMD, and FRAQMD and the threshold suggested by TCAPCD under the proposed action in both 2009 and 2010. Estimated daily emissions of ROG would exceed the threshold established by FRAQMD in both 2009 and 2010. For PM_{10}, the SMAQMD and other air districts revised their CEQA thresholds from a pound-per-day threshold to a concentration-based threshold in 2002. The current threshold for PM_{10} is set at 50 $\mu g/m^3$ averaged over a 24-hour period. Under NEPA, federal conformity for NO_x, ROG, PM_{10}, and CO would not be exceeded in either 2009 or 2010, based on annual thresholds (Table 3-18).

Temporary increase in emissions are considered to be a significant impact. Implementation of Mitigation Measure AQ1 would reduce potential impacts to a less-than-significant level.

Impact AQ2: Generation of GHG Emissions

Potential ways the proposed action would contribute to the generation of GHG emissions could be through short-term construction activities at the erosion sites. Short-term air pollution in the form of particulate matter (fugitive dust) and CO_2 may be caused by construction activity, including truck and equipment movement, grading, and earthwork. Transportation currently accounts for a large fraction of overall GHG emissions, mostly in the form of CO_2 (Bemis 2007). Hybrid vehicles may be used to decrease the amount of GHG emissions contributed by a project. In addition, meeting regional air quality district significance thresholds through construction equipment modifications or substitution as quantified in emissions modeling, or providing off-site mitigation for any violations of standards, would contribute to GHG reduction. In comparison to the overall amount of GHG emissions being produced and due to the relatively short duration of the construction period, the proposed action is not expected to significantly influence GCC. No mitigation is required.

Impact AQ3: Expose Sensitive Receptors to Pollutants and Objectionable Odors

Sensitive receptors are located within the proposed action area, primarily individual residences within one-fourth mile of sites SAC 26.0L, SAC 35.4L, SAC 41.9R, SAC 71.3R, SAC 73.5L, SAC 78.8L, SAC 87.0L, SAC 114.5R, SAC 130.0L, SAC 136.7R, SAC 136.9R, FR 3.7L, LAR 10.0L, and LAR 10.6L. No schools or hospitals are found within one-fourth mile of the proposed action area. Changes in air quality would occur only during the construction period, which would be over a short period of time. Although the proposed action is adjacent to several urban areas, it is not expected to create objectionable odors because diesel exhaust would be readily dispersed. Due to the short-term duration of construction activities associated with the proposed action and the dispersive nature of diesel emissions (Zhu et al. 2002), the impact on sensitive receptors is considered to be less than significant. No mitigation is required.

The proposed action is not expected to create objectionable odors that would affect a large number of people or expose sensitive receptors to substantial pollutant concentrations. Therefore, the proposed action would result in less-than-significant

impacts on air quality associated with increased objectionable odors or substantial increases in pollutant concentrations. No mitigation is required.

3.8.3.3. Alternative 2: Thin Rock Armor

The effects of the thin rock armor alternative would likely be greater than those of the proposed action due to likely failure of the thin riprap. When the riprap fails, there would be a need to haul more rock. Emissions during the initial rock hauling for Alternative 2 would be comparable to the proposed action, because emissions are primarily related to the movement of larger materials (e.g., quarry stone) that would be also be substantial for this alternative. The additional emissions that would occur during hauling to address riprap failure would make this alternative more intensive than the proposed action in terms of overall emissions.

3.8.4. Mitigation

Implementation of the following mitigation measures would reduce potential impacts from the proposed action to a less-than-significant level.

Mitigation Measure AQ1: Temporary Increase in Emissions

a. Standard construction practices at the erosion sites would ensure that exhaust emissions from all off-road diesel-powered equipment used on the sites do not exceed 40 percent opacity for more than 3 minutes in any 1 hour. Any equipment found to exceed 40 percent opacity (or Ringelmann 2.0) shall be repaired immediately, and the Corps or CVFPB and the appropriate local air quality agency shall be notified within 48 hours of identification of non-compliant equipment. A visual survey of all in-operation equipment shall be made at least weekly and a monthly summary of the visual survey results shall be submitted throughout the duration of construction activities, except that the monthly summary will not be required for any 30-day period in which there is no construction activity. The monthly summary shall include the quantity and type of vehicles surveyed, as well as the dates of each survey. The SMAQMD and/or other officials shall be authorized to conduct periodic site inspections to determine compliance. None of the mitigation measures presented in this section would supersede SMAQMD, YSAQMD, FRAQMD, TCAPCD, CCAPCD, or state rules or regulations.

b. Additional BMPs shall be implemented for ozone and PM_{10} to help protect ambient air quality conditions. To reduce ozone and PM_{10} levels, the contractor shall perform routine tuning and maintenance of construction equipment to ensure that the equipment is in proper running order. The contractor shall also monitor dust conditions along access roads and within the construction area to ensure that the generation of fugitive dust is minimized below the 50 $\mu g/m^3$ 24-hour threshold. Water sprays shall be periodically applied to disturbed areas and soil stockpiles for dust control, at least three times per day during hot weather. Minimum freeboard for all haul vehicles shall be 2 feet or greater. Soil-

disturbing activities shall be suspended during periods with winds over 25 miles per hour.

c. For NO_x, significant air quality effects have been identified, and the Corps or CVFPB shall implement the mitigation measures at the end of this section to reduce emissions in years when SMAQMD, YSAQMD, or FRAQMD thresholds are exceeded (Tables 3-17 and 3-18).

d. The project applicant or representative shall provide a plan for approval by SMAQMD (Sites SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 73.5L, and LAR 10.0L, and LAR 10.6L), YSAQMD (Sites SAC 35.4L, SAC 41.9R, SAC 71.3R, CC 2.8L, and CC 3.4L,), FRAQMD (Sites SAC 78.8L, SAC 87.0L, SAC 93.7L, SAC 130.0L, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, and SBP 0.4E), CCAPCD (Sites SAC 114.5R, SAC 136.7R, SAC 136.9R, and SAC 157.7R), TCAPCD (Site DC 0.9N), and the Corps or CVFPB demonstrating that the construction activities shall not exceed 85 pounds per day of NO_x (Sites SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 73.5L, LAR 10.0L, and LAR 10.6L), 82 lbs/day of NO_x (Sites SAC 35.4L, SAC 41.9R, SAC 71.3R, CC 2.8L, and CC 3.4L), and 25 lbs/day of NO_x (Sites SAC 78.8L, SAC 87.0L, SAC 93.7L, SAC 130.0L, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, DC 0.9N, and SBP 0.4E). The plan shall demonstrate that heavy-duty (>50 horsepower) off-road vehicles to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project-wide fleet-average 20 percent NO_x reduction and 45 percent particulate reduction compared to the most recent CARB fleet average at time of construction. To reduce NO_x emissions for this project, the applicant may employ one or more of the following measures:

- Require injection timing retard of 2 degrees on all diesel vehicles, where applicable.
- Install high-pressure injectors on all vehicles, where feasible.
- Encourage the use of reformulated diesel fuel.
- Electrify equipment, where feasible.
- Maintain equipment in tune with manufacturer's specifications.
- Install catalytic converters on gasoline-powered equipment.
- Substitute gasoline-powered for diesel-powered equipment where feasible.
- Use compressed natural gas or on-site propane mobile equipment instead of diesel-powered equipment, where feasible.

e. The contractor shall submit to the lead agency and all relevant air quality management districts a comprehensive inventory of all off-road construction

equipment equal to or greater than 50 horsepower that will be used an aggregate of 40 or more hours during any portion of the construction project. The inventory shall include the horsepower rating, engine production year, and projected hours of use or fuel throughput for each piece of equipment. The inventory shall be updated and submitted monthly throughout the duration of construction activities, except that an inventory shall not be required for any 30-day period in which no construction activity occurs. At least 48 hours prior to the use of subject heavy-duty off-road equipment, the contractor shall provide the relevant air quality management districts with the anticipated construction timeline, including start date and the name and phone number of the project manager and on-site foreman.

f. An off-site mitigation fee shall be paid to the appropriate local air quality management districts. The off-site mitigation fee shall be based on the incremental significant emissions at a rate of $16,000/ton (or other negotiated amount) of NO_x. The mitigation fees shall be paid to the districts prior to beginning construction. The districts will use the payments to fund various emission reduction projects in their respective air quality basins. Payments that are due were estimated using the latest version of the SMAQMD Mitigation Fee Calculator (revised July 2008, Sacramento Metropolitan Air Quality Management District 2008b), which assumes 20 percent reduction in NO_x due to the proposed mitigation plan. Calculations used in the Mitigation Fee Calculator were also applied to district-specific thresholds to obtain potential fees due to the other air quality or air pollution control districts involved. YSAQMD, TCAPCD, and CCAPCD do not require mitigation fees. The required payment is calculated to be $171,398 to SMAQMD for exceedance of 10.2 tons during the construction of the proposed action, assuming simultaneous construction at SAC 73.5L, LAR 10.0L, and LAR 10.6L during 2009 and construction at SAC 8.0L, SAC 10.8L, SAC 26.0L during 2010; $302,095 to FRAQMD for exceedance of 18.0 tons during the construction of the proposed action, assuming simultaneous construction at SAC 78.8L, SAC 87.0L, SAC 93.7L, FR 5.5L, FR 7.0L, and SBP 0.4E during 2009 and simultaneous construction at SAC 130.0L, FR 1.0L, and FR 3.7L during 2010. At this point, it is difficult to verify the fee estimates above because the specific number of days that each piece of equipment would be used and the specific length of the construction period is not yet known. Final emissions estimates and fees shall be determined by the contractor in consultation with the appropriate agency.

3.9. Traffic and Circulation

This section focuses on landside transportation systems, particularly access roads to erosion sites and truck routes that may be needed for construction. Due to the proximity of SAC 71.3R and SAC 73.5L to the Sacramento International Airport and the proximity of SAC 41.9R to the Borges-Clarksburg Airport, the potential for effects on aircraft safety is also assessed. Potential effects related to boat traffic on the rivers and related safety issues (e.g., in proximity to the waterside construction barge) are covered section 3.3, Recreation.

3.9.1. Environmental Setting

The road systems in the immediate vicinity of the 25 erosion sites vary from interstate highways and state routes to rural two-lane roadways and levee roads with limited access. Roadway capacities also vary widely, governed by factors such as alignment, shoulder and travel way width, passing sight distance, and the percentage of trucks, agricultural equipment, and other large vehicles that use the roads. Operational levels of service (LOS) vary throughout the year. LOS is a qualitative description of operation of a roadway based on length of delay and degree of maneuverability, ranging from "A", representing free-flow conditions, to "F", representing gridlock.

The highways and roads that would be used to transport materials, equipment, and personnel to the erosion sites receive widely varying levels of traffic. Existing traffic volumes not only vary widely among the road systems serving the 25 erosion sites, but they also vary at each erosion site in accordance with time of day and season of year. Some of the sites (e.g., CC 2.8L, CC 3.4L) receive little traffic because they are located on levee roads behind locked gates where public travel is restricted. Other sites (e.g., SAC 8.0L, SAC 10.8L) are located along highways that receive substantial use. Some of the sites (e.g., LAR 10.0L, LAR 10.6L) are located closer to urban areas and would require haul routes that include busy roads. Other erosion sites (e.g., SAC 157.7R) are located in sparsely populated agricultural areas, and haul routes would use roads with lower existing traffic levels. Table 3-19 identifies the most likely roadways that would be used for transportation of construction materials, equipment and personnel to the erosion sites.

Table 3-19 Roads Used to Access the Erosion Sites

Erosion Site	Access Roads
SAC 8.0L	Interstate 5 (I-5) to State Route 12 (SR 12) to SR 160 (River Road)
SAC 10.8L	I-5 to SR 12 to SR 160 (River Road)
SAC 26.0L	I-5 to West Walnut Grove Road to Isleton Road
SAC 35.4L	I-5 to Hood Franklin Road to SR 160 (River Road) to Randall Island Road
SAC 41.9R	I-5 to Pocket Road to SR160 (Freeport Blvd.) to South River Road
SAC 71.3R	I-5 to Old River Road to County Road 117 (CR 117)
SAC 87.0L	I-5 to CR 102 to SR 113 to Knights Road to Ensley Road to Karnak Road to Gifford Road
SAC 130.0L	I-5 to CR 102 to SR 113 to Reclamation Road to Progress Road to McGrath Road /Moronui to South Meridian Road

Table 3-19 Roads Used to Access the Erosion Sites

Erosion Site	Access Roads
SAC 136.7R	I-5 to Old Highway 99W to Grimes Arbuckle Road to Sycamore Slough Road to SR 45 to Sycamore Cutoff Road to SR 20 to Moonbend Road
FR 1.0L	SR 99 to Riego Road to Garden Highway
FR 3.7L	SR 99 to Riego Road to Garden Highway
FR 5.5L	SR 99 to Riego Road to Garden Highway
FR 7.0L	SR 99 to Riego Road to Garden Highway
LAR 10.0L	I-80 to Highway 50 to Watt Avenue to La Riviera Drive to levee access road
LAR 10.6L	I-80 to Highway 50 to Watt Avenue to La Riviera Drive to levee access road
CC 2.8L	I-5 to CR 17 to Hwy 99 to Hwy 97 to Hwy 16 to CR98 to private road (at Jackson St.) to levee road
CC 3.4L	I-5 to SR 113 to CR 17A to levee road
DC 0.9N	I-5 to Corning Road to Solano St./Hoag Road to Hall Road to South Avenue to SR 99 to Lassen Road to Leininger Road
SBP 0.4E	SR 70 to SR 20
SAC 73.5L	I-5 to Garden Hwy to N. Bayou Road to Crossfield Drive to Airport Boulevard to I-5 North Ramp to SR 113 to 4th St./SR 45
SAC 78.8L	SR 99 to Snakey Road to Garden Highway
SAC 93.7L	I-5 to Zamora/CR 13 becoming SR 113 becoming Locust St. becoming Knights Road to Donahue Road to Cranmore Road
SAC 114.5R	I-5 to Zamora/CR 13 becoming SR 113 becoming Locust St. to 4th St./SR45 to Millers Landing Road
SAC 136.9R	I-5 to Old Highway 99W to Grimes Arbuckle Road to Sycamore Slough Road to SR 45 to Sycamore Cutoff Road to SR 20 to Moonbend Road
SAC 157.7R	I-5 to Maxwell Road to Princeton Road to Packer Road

Sacramento International Airport is located approximately 1.75 miles from SAC 71.3R and 0.75 mile from SAC 73.5L. The Sacramento International Airport services a 29-county

regional area and has about 160 scheduled daily flights serving about 20,000 passengers (Sacramento International Airport 2009). The Borges-Clarksburg Airport is located approximately 1.75 miles from SAC 41.9R. The Borges-Clarksburg Airport is a privately owned facility with a turf runway. There are approximately 18 aircraft based at the Borges-Clarksburg Airport (Airport Land Use Commission 1994).

3.9.2. Regulatory Setting

3.9.2.1. Federal and State Laws and Regulations

The Caltrans manages interregional transportation, including construction and management of the state highway system. Caltrans's construction practices require temporary traffic control planning any time the normal function of a roadway is suspended. Caltrans is also responsible for permitting uses and encroachments on state roads and highways. Oversized loads are also subject to permitting requirements.

3.9.2.2. Local Laws and Regulations

Colusa County General Plan

The Circulation Element of the Colusa County General Plan contains an objective to maintain safe and uncrowded operating conditions on all county roadways and limit the intrusion of agricultural vehicles and heavy trucks on residential streets. Circulation Policy 8 states that the county shall encourage the operation of I-5 at LOS "B" or better and all other roads at LOS "C" or better (Colusa County 1989).

Sacramento County General Plan

The Circulation Element of the Sacramento County General Plan identifies all state and national highways within the county as truck routes, per Caltrans, as part of the Service Transportation Assistance Act (Sacramento County 1993).

Sutter County General Plan

The Transportation and Circulation Element of the Sutter County General Plan establishes a goal of providing for the safe and efficient movement of people and goods throughout Sutter County. Policy 2.A-4 identifies LOS "D" as the minimum acceptable standard (Sutter County 1996).

Tehama County General Plan

The Transportation and Circulation Element of the Tehama County General Plan establishes the following polices regarding proposed and existing projects. For operations that generate a substantial number of large trucks and/or heavy load vehicles, the county shall explore options for the adoption of a roadway tonnage fee or oversized load fee to ensure that those projects or operations do not cause, or will adequately mitigate, significant deterioration of county roads. Proposed projects shall be required to reserve or dedicate sufficient rights-of-way. The Tehama County General Plan identifies LOS "A-C" as acceptable during non-peak hours and LOS "D" as acceptable during peak hours (Tehama County 2008).

Yolo County General Plan

The Circulation policies of the adopted Yolo County General Plan address issues concerning the design and construction of the proposed levee repairs. The general plan states that the county and applicable reclamation districts will develop agreements to establish and maintain hiking, biking, and horse trails on levees and other rights-of-way; the county and the districts will also establish provisions for ensuring the safety of the public and the security of the adjoining land owners and users. Circulation Policy 7 requires that county roads maintain a stable flow of traffic and a relatively satisfactory operating speed (service level "C"). Circulation Policy 17 discourages truck traffic on residential streets.

3.9.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system;
- Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads and highways;
- Result in a change in air traffic patterns or aircraft safety, including either an increase in traffic levels or a change in location, that results in substantial safety risks;
- Substantially increase hazards to a design feature or incompatible uses;
- Result in inadequate emergency access;
- Result in inadequate parking capacity; or
- Conflict with adopted policies, plans, or programs supporting alternative transportation.

3.9.3.1. No-Action Alternative

Under the no-action alternative, no activities would be conducted to halt erosion at the 25 erosion sites. Traffic conditions near the erosion sites would remain unchanged; no impacts would occur from erosion site-related construction traffic. Over time, wave wash, flood flows, and human disturbance would contribute to continued erosion and risk of levee failure. Given the extent of existing erosion, erosion would likely increase in severity to the point that pre-failure emergency repairs would be warranted or the levee would fail, resulting in flooding, greatly accelerated erosion, and the need for post-failure emergency repairs.

Pre-failure and post-failure emergency repairs would result in substantial traffic increases during transportation of equipment and personnel to the erosion sites. Lane closures and traffic delays might be necessary to accommodate emergency staging and construction activities. The duration of traffic impacts might be greater than under the proposed action because a larger repair area would likely be required. Additionally, the need for emergency repairs would allow minimal opportunity for planning haul routes and traffic detours to minimize impacts to traffic.

Levee failure and flooding could result in road closures and other restrictions in traffic flow, including access by emergency vehicles.

3.9.3.2. Alternative 1: Proposed Action

The proposed action would involve the placement of rock and soil revetment on the eroding levee slopes. In the case of landside construction, this construction work would involve the steady transport of large loads of quarry stone and soil fill for a substantial portion of the construction timeframe. The duration of construction activities is estimated to be up to 120 days, with the majority of material and debris hauling completed within 60 days. Estimated construction personnel commute trips is 5 trips/day per site, with an estimated average round trip commute of 40 miles. The estimated number of truck trips to deliver and remove materials from the sites ranges from 1 trip/day for DC 0.9N to 66 trips/day for FR 3.7L, with an average estimated round trip of 66 miles.

Vehicle trips associated with construction activities would generally take place between the hours of 6:00 a.m. and 5:00 p.m. Most trips would occur during off-peak traffic hours between 9:00 a.m. and 4:00 p.m. Waterside construction would eliminate truck traffic associated with transporting the quarry stone and soil fill to the site by land, but there would still be an increase in traffic levels from worker commutes and transportation of construction equipment and materials. Mobilization of a barge to the erosion sites for waterside construction would also require coordination with the drawbridge authority.

Erosion sites SAC 71.3R and SAC 73.5L are located within 2 miles of the Sacramento International Airport, and SAC 41.9R is located within 2 miles of the Borges-Clarksburg Airport. Due to the proximity of these sites to the airports, the potential for the proposed action to result in increased wildlife-aircraft collisions or structural hazards to aircraft has been evaluated. Existing native trees would be preserved to the greatest extent possible at each of the erosion sites. However, removal of riparian understory vegetation would be required for placement of revetment. To compensate for the loss of riparian vegetation, the sites would be revegetated with native riparian species in accordance with the revegetation plans prepared for the proposed action (Appendix F). Retention of existing trees and revegetation of the erosion sites is intended to preserve and replace existing habitat values for federally listed and other sensitive species. The proposed action is not anticipated to result in an increase in the number or types of wildlife species using the erosion sites. Therefore, the proposed action is not anticipated to result in an increased hazard of wildlife-aircraft collisions. The riparian vegetation to be planted at the erosion sites consists of understory and tree species native to the Sacramento River watershed. When mature, the tree species are not anticipated to exceed the height of the existing canopy. Therefore, the proposed action would not result in increased structural hazards to aircraft. The proposed action would not affect aircraft safety.

Potential impacts to traffic and circulation associated with implementation of the proposed action are identified below.

Impact TR1: Temporary Impacts to Traffic and Circulation from Construction Activities

Transportation of materials, equipment, and personnel to the erosion sites would result in an increase of traffic levels on the surrounding roadways during project construction. Some lane closures and traffic delays may be necessary to facilitate staging and construction where state or county roads occur along the levee crest. Traffic delays could also occur along roads in the vicinity of the erosion sites as trucks hauling materials are entering and leaving these areas. Moving a barge by river to the waterside construction sites may result in traffic delays as the barge passes under drawbridges. Implementation of Mitigation Measures TR1, TR2, and TR3 would reduce potential impacts to less-than-significant levels.

3.9.3.3. Alternative 2: Thin Rock Armor

The thin rock armor alternative would involve the placement of rock revetment on the eroding slope of the levee as in the proposed action; however, this alternative would require a smaller quantity of rock. Landside construction would involve the steady transport of large loads of quarry stone and soil fill for a substantial portion of the construction timeframe. These trips would take place between the hours of 6:00 a.m. and 5:00 p.m. Most trips would occur during off-peak traffic hours, between 9:00 a.m. and 4:00 p.m. Waterside construction would eliminate the need for truck traffic associated with transporting the quarry stone and soil fill to the site by land. In either case, the repair process would result in an increase in traffic compared to existing conditions similar to or slightly less than the traffic associated with the proposed action.

3.9.4. Mitigation

Implementation of the following mitigation measures would reduce potential traffic- and circulation-related impacts to less-than-significant levels. These measures shall be incorporated as appropriate in construction plans and specifications.

Mitigation Measure TR1: Traffic Control Plan

a. The construction contractor shall prepare and implement a traffic control plan (or plans) that addresses conditions at each site. The plan(s) shall be approved by the responsible counties, cities (in cases where city streets would be used), and Caltrans, as applicable, prior to the initiation of construction activities. The plan(s) shall include measures to (1) reduce, to the extent practicable, the number of vehicles (construction-related and other) on the roadways adjacent to the sites; (2) reduce, to the extent practicable, the interaction between construction equipment and other vehicles; and (3) promote public safety through actions aimed at driver and road safety.

b. Prior to implementation of construction activities, the contractor shall verify that all roads, bridges, culverts, and other infrastructure along the access routes can support expected vehicle loads.

c. The plan(s) shall identify all intended haul routes, locations of signage, locations of flaggers, approved permits, documentation of coordination with local and state agencies, and locations of potential delays to vehicle and pedestrian traffic. Construction vehicles shall follow established truck routes to the greatest extent practicable.

Mitigation Measure TR2: Travel Flow and Access

a. The contractor shall maintain travel traffic on all roads adjacent to the site and on all affected public roads during the construction period. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by state and local authorities having jurisdiction.

b. The traveling public shall be protected from construction and work damage to person and property. The contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic.

c. Traffic controls on major roads and collectors shall include flag-persons wearing safety vests and using “stop/slow” paddles to direct drivers.

d. Through access for emergency vehicles shall be provided at all times.

e. Access to public transit shall be maintained, and movement of public transit vehicles shall not be impeded as a result of construction activities.

f. Access to driveways and private roads shall be maintained.

Mitigation Measure TR3: Construction-Related Traffic Measures

a. Construction parking shall be restricted to the designated staging areas.

b. During peak periods, construction-generated traffic shall avoid roadway segments or intersections that are at, or approaching, a LOS that exceeds local standards.

c. The speed of all construction vehicles shall be limited to a maximum of 10 mph on the levee access roads. The contractor shall provide a minimum of four construction speed limit signs large enough to be visible by the passing traffic. The speed limit signs shall be in English units and posted on the levee and on each of the access roads. Signs shall be posted for both incoming and outgoing traffic.

d. Construction warning signs shall be posted in accordance with the local standards or those set forth in the Manual on Uniform Traffic Control Devices (Federal

Highway Administration 2007) in advance of the construction area and at any intersection that provides access to the construction area.

e. A sign, at least one square yard in size, shall be posted at all active construction sites that gives the name and telephone number or email address to contact with complaints regarding construction traffic.

f. Measures shall be implemented as needed to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. The construction contractor shall minimize the amount of mud transported onto paved public roads by vehicles or runoff.

g. Rock, dirt, and/or other fill materials shall be prevented from being accidently dropped from trucks traveling on highways to and from the erosion sites.

h. Any damage to roads caused by construction operations shall be repaired to pre-project conditions.

3.10. Noise

Noise is commonly defined as sound that is loud, unpleasant, unexpected, unwanted, or otherwise undesirable. Sound is a vibratory disturbance, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone. Various measurements are used to quantify sound; measurements used in this discussion are briefly defined below.

Decibel (dB): A unitless measure of sound; describes the logarithmic ratio of a measured sound pressure level to a reference sound pressure level of 20 micropascals.

A-Weighted Decibel (dBA): An overall frequency-weighted sound level that approximates the frequency response of the human ear.

Equivalent Noise Level (L_{eq}): The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq}.

Day-Night Noise Level (L_{dn}): The 24-hour L_{eq} with a 10 dBA "penalty" for the noise-sensitive hours between 10:00 p.m. and 6:00 a.m. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.

Community Noise Equivalent Level (CNEL): The CNEL is similar to the L_{dn} described above, but with an additional 4.77 dBA "penalty" for the noise-sensitive hours between 7:00 p.m. to 10:00 p.m., which are typically reserved for relaxation, conversation, reading, and television. If using the same 24-hour noise data, the CNEL is typically approximately 0.5 dBA higher than the L_{dn}.

Single Event [Impulsive] Noise Level (SEL): The SEL describes a receiver's cumulative noise exposure from a single impulsive noise event, which is defined as an acoustical event of short duration (0.5 second) and involves a change in sound pressure above some reference value (approximately 40 dB).

Sound travels uniformly outward from a point source in a spherical pattern with an attenuation rate of 6 dBA/DD (doubling of distance). As sound (noise) propagates from the source to the receptor, the attenuation depends on such factors as surface characteristics, atmospheric conditions, and the presence of physical barriers. From a linear source location (such as a road), sound travels uniformly outward in a cylindrical pattern with an attenuation rate of 3 dBA/DD. Surface characteristics between the source and receptor may result in additional sound absorption and/or reflection.

3.10.1. Environmental Setting

The existing noise levels at the 25 erosion sites have primarily been characterized based on the relative intensity of vehicle and boat activity in the surrounding areas. Residences and public use areas, which could potentially be affected by noise-generating erosion repair activities, are located in proximity to some of the erosion sites. Table 3-20 summarizes existing noise conditions and nearby noise-sensitive land uses for the 25 erosion sites.

Table 3-20 Existing Noise Conditions and Surrounding Noise-Sensitive Land Uses

Erosion Site	Existing Noise Conditions	Noise-Sensitive Land Uses and Approximate Distance from Construction Area
SAC 8.0L	Heavy amount of vehicle traffic on Highway 160	Rural residence approximately 200 feet east of erosion site
SAC 10.8L	Heavy amount of vehicle traffic adjacent to site on Highway 160, light boat traffic	None observed
SAC 26.0L	Heavy vehicle traffic on Isleton Road and Highway 160	Rural residence approximately 100 feet south of erosion site
SAC 35.4L	Vehicle traffic on opposite levee, boat traffic, agricultural equipment	Rural residences within approximately 0.25 mile of erosion site
SAC 41.9R	Vehicle traffic, boat traffic	Residential housing and commercial buildings within approximately 100 feet west of erosion site
SAC 71.3R	Vehicle traffic on adjacent road, audible vehicle traffic from I-5, boat traffic, nearby airport	Residential housing located on opposite bank of river approximately 500 feet from erosion site

Table 3-20 Existing Noise Conditions and Surrounding Noise-Sensitive Land Uses

Erosion Site	Existing Noise Conditions	Noise-Sensitive Land Uses and Approximate Distance from Construction Area
SAC 87.0L	Light boat traffic, light vehicle traffic, aircraft, generator for pump station	Rural residence approximately 400 feet west
SAC 130.0L	Small amount of vehicle traffic on Meridian Road, boat traffic	Rural residence approximately 100 feet east
SAC 136.7R	Small amount of vehicle traffic from opposite levee, boat traffic, agricultural equipment, rooster crowing	Rural residence approximately 100 feet west
FR 1.0L	Small amount of vehicle traffic, irrigation pump noise across from erosion site	None observed
FR 3.7L	Infrequent and small amount of vehicle traffic	Rural residence approximately 100 feet east
FR 5.5L	Small amount of vehicle traffic on Garden Highway	Rural residence approximately 0.25 mile north
FR 7.0L	Small amount of vehicle traffic along road	Golf course within 100 feet west
LAR 10.0L	Vehicle traffic on Howe Road, road construction on Watt Avenue, emergency vehicle noise (sirens)	Located within the American River Parkway; residential housing on opposite side of the levee
LAR 10.6L	Vehicle traffic on residential roads, boat traffic, nearby park	Located within the American River Parkway; residential housing on opposite side of the levee
CC 2.8L	Low amount of noise from distant vehicle traffic on highway	Rural residence approximately 600 feet west-southwest
CC 3.4L	Agricultural equipment to the east, small amount of vehicle traffic	Rural residence approximately 800 feet east
DC 0.9N	Small amount of vehicle traffic, including construction traffic	Rural residence approximately 0.25 mile east-southeast
SBP 0.4E	Small amount of vehicle traffic on levee road, Highway 20 barely audible, construction	Rural residence approximately 0.50 mile north-northwest

Table 3-20 Existing Noise Conditions and Surrounding Noise-Sensitive Land Uses

Erosion Site	Existing Noise Conditions	Noise-Sensitive Land Uses and Approximate Distance from Construction Area
SAC 73.5L	Small amount of vehicle traffic on Garden Highway, boat traffic	Residence within 100 feet north
SAC 78.8L	Small amount of vehicle traffic on Garden Highway	Mobile home park adjacent to northern boundary of site
SAC 93.7L	Agricultural equipment	Rural residence approximately 0.5 mile east-southeast
SAC 114.5R	Agricultural equipment	None observed
SAC 136.9R	Small amount of vehicle traffic on North Meridian Road	Residence approximately 100 feet south
SAC 157.7R	Boat traffic, moderate vehicle traffic on Highway 45, pump to south of site (very faint)	None observed

3.10.1.1. Construction Equipment Noise Levels

Noise would be generated by equipment associated with the proposed construction activities at the erosion sites. Table 3-21 summarizes noise levels from typical construction equipment that may be used during construction.

Table 3-21 Typical Construction-Related Noise Levels

Construction Equipment	Number of Equipment Pieces	Typical Noise Level (dB) 50 Feet from Source
Crane	2	82
Excavator	1	82
Dump truck	5	80
Front end loader	1	80
Crawler tractor	1	80
Motor boat	2	82
Pick-up truck	2	65
Tugboat	1	82
Generator	3	75

Table 3-21 Typical Construction-Related Noise Levels

Construction Equipment	Number of Equipment Pieces	Typical Noise Level (dB) 50 Feet from Source
Air compressor	1	75
Winch	4	75
Chainsaw	2	75

Source: Federal Transit Administration 1995, Geier & Geier Consulting 1997, Sincero and Sincero 1996

3.10.2. Regulatory Setting

3.10.2.1. Federal and State Laws and Regulations

Code of Federal Regulations

Federal regulations establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under part 205 subpart B of the Code of Federal Regulations (CFR). The federal truck pass-by noise standard is 80 dB at 15 meters from the vehicle pathway center line.

California Health and Safety Code

The Noise Control Act, Division 28 of the California Health and Safety Code, is based on the understanding that all Californians are entitled to a peaceful and quiet environment, free from the intrusion of noise that may be hazardous to their health or welfare. The act established an office to develop criteria and otherwise aid local agencies in preparing noise elements (State of California 1973).

California Code of Regulations

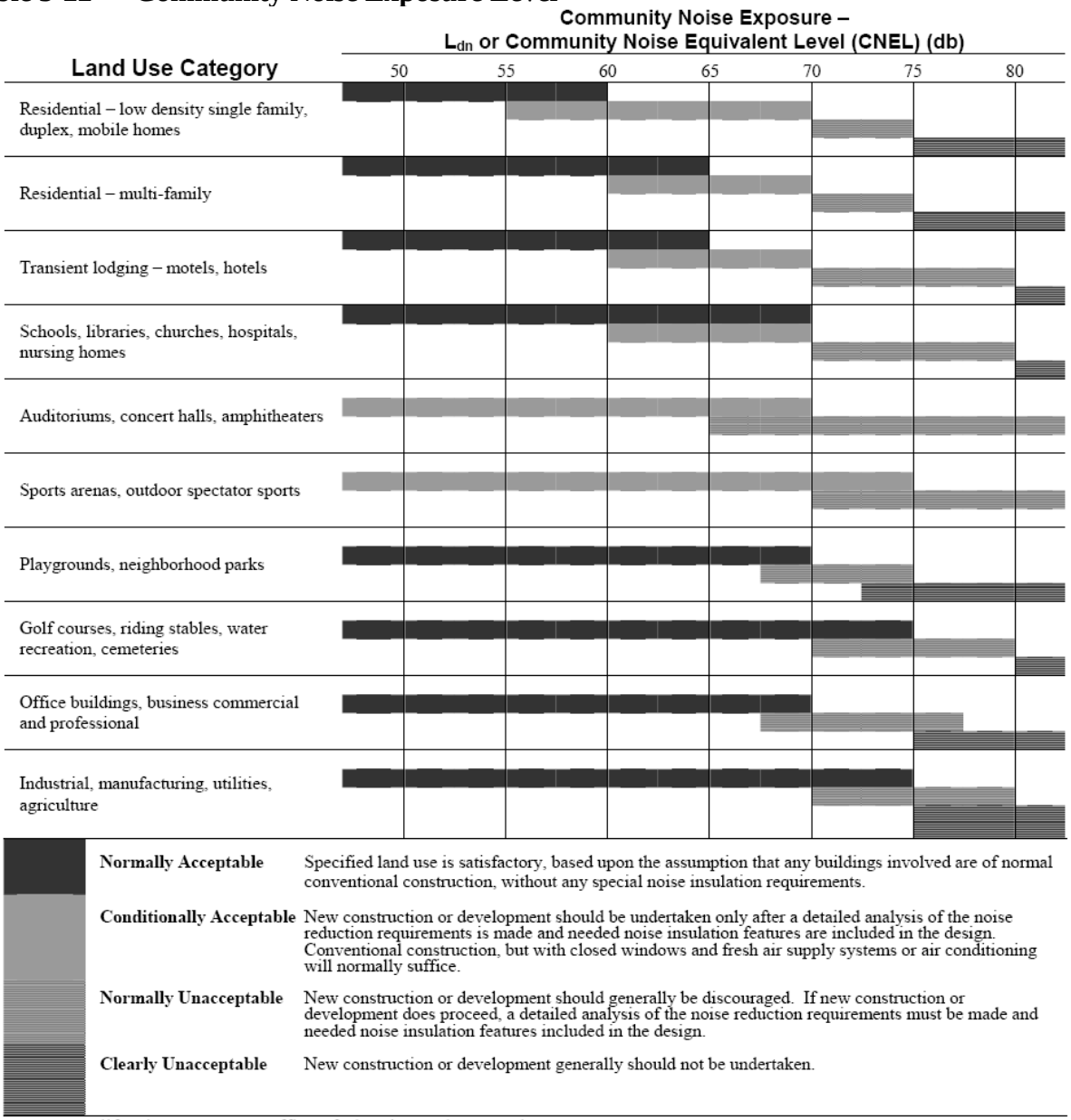
Title 4 of the California Code of Regulations has guidelines for evaluation of the compatibility of various land uses as a function of community noise exposure. These guidelines are listed in Table 3-22.

In addition, the State of California establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the state pass-by standard is consistent with the federal limit of 80db. The state pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dB at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by state and local law enforcement officials.

3.10.2.2. Local Laws and Regulations

Applicable local planning policies and ordinances are described in the following paragraphs. Any local jurisdiction that does not have specific standards is expected to comply with state and federal laws.

Table 3-22 Community Noise Exposure Level



Source: California Governor's Office of Planning and Research 2003.

American River Parkway Plan

Excessive noise in the area of the American River Parkway has the potential to adversely affect parkway visitors and wildlife. Under the American River Parkway Plan, noise levels are considered an element of the aesthetic quality. As a result, the plan encourages policies that limit the impacts of noise associated with recreation and other uses. Specifically, noise associated with construction must be limited or mitigated to the greatest extent possible (Sacramento County 2008).

Colusa County General Plan

The Colusa County General Plan states that regulation of non-vehicular noise (construction, air compressors, manufacturing, loud music) should be encouraged to avoid disturbing adjacent uses (Colusa County 1989).

Sacramento County General Plan

The goal of the Noise Element of the Sacramento County General Plan is to protect the citizens of Sacramento County from the harmful and annoying effects of exposure to excessive noise, while protecting the economic base of Sacramento County by preventing incompatible land uses from encroaching on existing or planned noise-producing uses (Sacramento County 1993).

Sacramento County Noise Control Ordinance

The Sacramento County Noise Control ordinance is contained in Sacramento County Code Chapter 6.68. This ordinance limits maximum exterior noise levels to 55 dBA between 7:00 a.m. and 10:00 p.m. and 50 dBA between 10:00 p.m. and 7:00 a.m. in residential and agricultural residential land use zones. Noise sources associated with construction, repair, remodeling, demolition, paving or grading are exempt from this ordinance if those activities occur between 6:00 a.m. and 8:00 p.m., Monday through Friday, and between 7:00 a.m. and 8:00 p.m. on weekends. If conditions require that work in progress be continued until a specific phase is completed, then work after 8:00 p.m. will be allowed until completion of the specific work in progress can be brought to conclusion.

Sutter County General Plan

Goal 8.A of the Sutter County General Plan is to protect County residents from the harmful effects of exposure to excessive noise.

Tehama County General Plan

Policy N2.4 of the Tehama County General Plan states that construction activities will be limited to the hours specified in the Countywide Noise Control Ordinance; however, the county has not adopted a Countywide Noise Control Ordinance. If such legislation were to be implemented, an exemption would be available from the County to cover special circumstances, which include emergency operations, short-duration construction, and other situations. Implementation measure N-4.2 b of the general plan requires internal combustion engines used on construction projects to be muffled to manufacturer's specifications (Tehama County 2008).

Yolo County General Plan

A goal of the Yolo County General Plan is to work on noise problems and their solutions and to mitigate or eliminate hazards and nuisances. The noise policies of the general plan state that Yolo County shall review all new and redevelopment projects in terms of the Standards of Noise Avoidance or Control; the County shall set and enforce measurable standards for noise reduction and control on construction projects; and the County shall coordinate with other governmental agencies as well as the private sector in efforts to combat, alleviate, or mitigate excessive, hazardous, or annoying noise (Yolo County 1983).

3.10.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Generation of noise levels in excess of standards established by local general plans or noise ordinances, or applicable standards of other agencies;
- Generation of excessive ground-borne vibration or noise;
- A substantial permanent increase in ambient noise levels in the vicinity of the project, above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity, relative to levels existing without the project; or
- For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels.

3.10.3.1. No-Action Alternative

The no-action alternative would not affect ambient sound levels on the levee or conflict with any noise ordinance, plan, or regulation. The current erosion processes would continue, and it is likely that some levees could be degraded to the point that pre-failure emergency repairs would be warranted, or to the point that the levee could actually fail, necessitating emergency repairs. Noise levels under such emergency repairs would not be constrained to normal construction hours, which would result in greater noise disturbance than under more controlled circumstances. The length of repair and the volume of materials needed for emergency repairs would be greater than those needed for repair under existing conditions, prolonging the exposure of surrounding land uses to construction-generated noise.

3.10.3.2. Alternative 1: Proposed Action

Table 3-20 illustrates the proximity to noise-sensitive land uses among the 25 erosion sites. Some sites occur in agricultural areas with no residences nearby and receive little recreational use (e.g., SAC 10.8L and SAC 157.7R), while other sites occur near well-developed communities or within recreation areas (e.g., LAR 10.0L and LAR 10.6L). The primary source of existing noise at the erosion sites is vehicle traffic from surrounding roads. Other sources of noise include agricultural equipment, irrigation pumps, boat traffic, a nearby airport, and construction projects.

The proposed action would temporarily increase noise levels at the erosion sites. Dumping of quarry stone may generate loud but intermittent noise during that phase of construction. Additionally, heavy construction equipment (e.g., crane, excavator, dump truck) and noise generating tools (e.g., chainsaw, compressor) would be used for site repair activities,

including site preparation, importing rock and embankment materials, and placement of revetment materials. Construction activities could generate noise in excess of established local standards (Table 3-23).

Table 3-23 Noise Policy Jurisdiction and Compliance

Erosion Site	Jurisdiction	Local Applicable Ordinance	Potential to Exceed Allowable Noise Levels
SAC 8.0L	Sacramento County	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes
SAC 10.8L	Sacramento County	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes
SAC 26.0L	Sacramento County	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes
SAC 35.4L	Sacramento County	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes
SAC 41.9R	Yolo County	None	No
SAC 71.3R	Yolo County	None	No
SAC 87.0L	Sutter County	None	No
SAC 130.0L	Sutter County	None	No
SAC 136.7R	Sutter County	None	No
FR 1.0L	Sutter County	None	No
FR 3.7L	Sutter County	None	No
FR 5.5L	Sutter County	None	No
FR 7.0L	Sutter County	None	No
LAR 10.0L	Sacramento County; American River Parkway Plan	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes
LAR 10.6L	Sacramento County; American River Parkway Plan	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes

Table 3-23 Noise Policy Jurisdiction and Compliance

Erosion Site	Jurisdiction	Local Applicable Ordinance	Potential to Exceed Allowable Noise Levels
CC 2.8L	Yolo County	None	No
CC 3.4L	Yolo County	None	No
DC 0.9N	Tehama County	None	No
SBP 0.4E	Sutter County	None	No
SAC 73.5L	Sacramento County	Sacramento County Noise Ordinance (Sacramento County Code Chapter 6.68; Noise Control)	Yes
SAC 78.8L	Sutter County	None	No
SAC 93.7L	Sutter County	None	No
SAC 114.5R	Colusa County	None	No
SAC 136.9R	Colusa County	None	No
SAC 157.7R	Colusa County	None	No

Potentially significant impacts resulting from implementation of the proposed action are identified below, followed by mitigation measures that would reduce the impacts to less-than-significant levels.

Impact NOI1: Construction Noise

Construction equipment used for levee repair (e.g., crane, excavator, dump truck) would generate peak noise levels of approximately 82 dB at a distance of 50 feet. Rock dumping may generate the highest SEL, possibly reaching 100 dB at 50 feet. Noise produced by these activities would be reduced over distance at an average rate of about 6 dB per doubling of distance in open landscapes. Where the existing riverbank or levee serves as a sound barrier, it would be expected to reduce noise at nearby residences by up to an additional 15 dB. Materials hauled by trucks on the levee crown, where applicable, would typically be the source of noise and vibration having the greatest potential to disturb neighboring residents because this activity would not blocked by the levee.

Construction would generally not subject residences to prolonged noise exposure above 65 dB or severe (instantaneous) noise levels above 80 dB. However, it is possible that construction activities could expose persons to noise levels in excess of established local standards (see Table 3-23) and result in adverse increases in ambient sound levels or vibration in the vicinity of the erosion sites. Implementation of Mitigation Measure NOI1 would reduce these potential impacts to less-than-significant levels.

3.10.3.3. Alternative 2: Thin Rock Armor

The thin rock armor alternative would place a thin layer of rock revetment on the erosion sites. The duration of construction would likely be shorter than that expected under the proposed action, thereby reducing potential noise impacts. However, the same equipment would be required to import and place the revetment material, and noise impacts would be generally similar to that for the proposed action.

3.10.4. Mitigation

Implementation of the following mitigation measures would reduce potential noise impacts to less-than-significant levels:

Mitigation Measures NOI1: Construction Noise

a. Construction activities (including equipment warm-up) shall be limited to 7:00 a.m. to 7:00 p.m. (Monday through Saturday) and 9:00 a.m. to 6:00 p.m. (Sunday). Work hours shall not deviate from this schedule unless otherwise approved by the Corps.

b. Haul truck routes shall avoid residential areas to the extent practicable.

c. Where possible, noise-generating activities shall be combined to occur in the same time period. The total noise level produced shall not be significantly greater than the level produced if the operations were performed separately.

d. To the extent practicable, the contractor shall use newer construction equipment or retrofit older equipment to make the associated noise as unobtrusive as possible (i.e., installing mufflers).

3.11. Hazardous, Toxic, and Radioactive Waste

This section analyzes the potential for hazardous, toxic, or radioactive waste (HTRW) materials to create a significant hazard to the public or the environment as a result of the proposed action. For the purposes of this section, HTRW is defined as substances or a combination of substances that, because of their quantity, concentration, or physical, chemical, or other characteristics, pose a substantial hazard to the public or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

This section is based on the findings of HTRW site assessments conducted for the proposed action (Lawrence & Associates 2009a, 2009b). Copies of the HTRW site assessments are included as Appendix J.

3.11.1. Environmental Setting

Land uses surrounding the levee system include agricultural, residential, and commercial uses. These lands may use and/or contain hazardous substances. Storage of petroleum products and pesticides are the most likely materials that may have been released into the surrounding

environment. Older gas wells and underground storage tanks used to store petroleum products and other hazardous materials may develop leaks. These leaks can lead to the contamination of soils and groundwater.

The river elevation fluctuates seasonally and the ground water elevation is assumed to fluctuate with river levels. During periods of low flow, it is likely that ground water flows toward the river and that any contaminated water could be transported to the soils within and near the levees.

The Flood Control Act of 1917 set the stage for the development of the current levee system along the Sacramento River and its tributaries. As the levee system was built, non-hazardous and hazardous materials were incorporated into levee construction and repair. In addition to soil, rock, and concrete, materials used for bank protection included asphalt, fiberglass, automobile bodies and tires, asbestos fiber, metal, and other available materials. Therefore, the underlying materials of the existing levees may contain hazardous substances. The exact composition of the levee materials below the surface is not known.

Potential sources of contamination of the surface of the levees may include trash and debris from litter and illegal dumping, contaminant-laden sediment transported in the waterway and deposited on the levee, and topical application of herbicides commonly used for weed control along the levee.

The HTRW site assessments prepared for the proposed action (Appendix J) consisted of a review of information sources, including Environmental Data Resources, Inc. (EDR) hazardous materials reports, federal and state databases of known hazardous materials sites; historic aerial photographs; topographic maps; and field inspections by qualified personnel. Varying amounts of solid waste, trash, and debris (e.g., paper, plastic, beverage containers) were observed on the surface at each of the 25 erosion sites. These materials are not considered to present a substantial hazard to the public or the environment.

According to the American Society for Testing and Materials, recognized environmental conditions (RECs) are defined as “the presence or likely presence of any hazardous substance or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of release into the ground, ground water, or surface water of the property” (American Society for Testing and Materials 2005). The term is not intended to include minor conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

Potential sources of contamination, or RECs, were identified at five of the 25 erosion sites. These sites are SAC 10.8L, SAC 41.9R, LAR 10.L, LAR 10.6L, and FR 3.7L. The potential RECs are summarized in Table 3-24.

Table 3-24 Potential RECs Identified in the HTRW Assessment

Erosion Site	Possible RECs
SAC 10.8L	Historical and current aerial photographs indicate that several gas wells are located on adjacent properties to the east of the site. Though not determined during the site investigation, it is possible, based on common practices, that total petroleum hydrocarbons and volatile organic constituents may have been released to soils and possibly groundwater near the site by leaking compressors. Groundwater flow direction near the site is unknown. However, in times of low river flow, groundwater is assumed to flow toward the river.
SAC 41.9R	Historical aerial photographs indicate that the area designated for construction parking or a staging area on the west side of S. River Road (within 100 feet of the erosion site) may have been the location of a former service station, including an underground storage tank (UST) site. At the time of the site reconnaissance, it was noted that the site was vacant with no obvious improvements remaining other than a graveled parking area. Three more UST sites were identified within 1,500 feet of the site. Two of the tanks were identified as leaking underground storage tanks. It is unknown whether soil or groundwater contamination exists at the tank site or whether contamination has migrated to the erosion site. An aboveground storage tank site located at the Clarksburg Plant is within 100 feet of the erosion site. No records of investigation were found for the facility. Bulk plants such as the Clarksburg Plant have been determined to have the potential for release of petroleum products.
LAR 10.0L	The EDR report identifies three sites near LAR 10.0L that include a stormwater pumping station, an electric yard, and a dry cleaning business. The stormwater pumping station is located on land adjoining the erosion site. The site is listed because diesel is stored and used on the site. The diesel is used to power emergency generators that provide power to the electric stormwater discharge pumps. Required precautions typically prevent a release of diesel, which if released would likely cause an air pollution risk and not a soil or groundwater risk. The remaining two sites are either at a distance or location that any spills or releases would not likely cause concern within the erosion site.

Table 3-24 Potential RECs Identified in the HTRW Assessment

Erosion Site	Possible RECs
LAR 10.6L	The EDR report identifies four sites near LAR 10.6L that include a water treatment plant, an elementary school, a residence, and a steel supplier. The water treatment plant is on adjoining land downstream of the erosion site. The site is listed because of the chlorine stored and used on the site. Chlorine is stored in cylinders and regulated for use. Required precautions typically prevent a release of chlorine, which if released would likely cause an air pollution risk and not a soil or groundwater risk. The remaining sites are either at a distance or location that any spills or releases would not likely cause concern within the erosion site.
FR 3.7L	Several car bodies were observed partially buried in the riverbank at the north end of the erosion site. The vehicles appear to be vintage or early model. It appears the car bodies and their related parts have been at the location for a number of years. There was no observation of soil staining or of materials considered to be hazardous. However, there is a potential of metals from an old deteriorating car body to leach into the soils and possibly into the river.

3.11.2. Regulatory Setting

3.11.2.1. Federal and State Laws and Regulations

Federal Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) is a federal regulatory statute designed to provide "cradle to grave" control of hazardous waste by imposing management requirements on generators and transporters of hazardous wastes and on owners and operators of treatment, storage, and disposal facilities.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA), in addition to having several other responsibilities, regulates disposal of hazardous wastes through the RCRA. Under the RCRA, the EPA regulates the activities of waste generators, transporters, and handlers (any individual who treats, stores, and/or disposes of a designated hazardous waste). The EPA is also responsible for tracking hazardous waste from its generation to its final disposal (i.e., cradle to grave) to ensure proper accountability.

Occupational Safety and Health Administration

Under the Occupational Safety and Health Act, the Occupational Safety and Health Administration (OSHA) is obligated to prepare and enforce occupational health and safety regulations with the goal of providing employees a safe working environment. OSHA regulations apply to the work place and cover activities ranging from confined space entry to

toxic chemical exposure. OSHA regulates workplace exposure to hazardous chemicals and activities through promulgating regulations specifying work place procedures and equipment.

U.S. Department of Transportation

The U.S. Department of Transportation regulates the interstate transport of hazardous materials and wastes through implementation of the Hazardous Materials Transportation Act. This act specifies driver training requirements, load labeling procedures, and container design and safety specifications. Transporters of hazardous wastes must also meet the requirements of additional statutes such as the RCRA.

Code of Federal Regulations

Title 40 of the Code of Federal Regulations (CFR) Part 302 implements the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous materials release requirements and identifies hazardous substances, reportable quantities (RQs), and notification requirements. The National Response Center in Washington, D.C., must be notified of an accidental release of a hazardous substance in excess of an RQ. CERCLA-listed hazardous substances and RQs are listed in 40 CFR Part 302.4.

40 CFR Part 355 codifies the Emergency Planning and Community Right-to-Know Act (EPCRA) planning requirements and establishes the list of Extremely Hazardous Substances, threshold planning quantities, and emergency response planning requirements. 40 CFR Part 68, Chemical Accident Prevention Provisions, identifies regulated substances, threshold quantities (TQs), and requirements for preventing accidental releases of these substances. A Risk Management Plan is required for any processes involving regulated substances in excess of their respective TQ.

40 CFR Parts 260–272 govern the generation, transportation, treatment, storage and disposal of hazardous waste through a comprehensive management system. These regulations also list the characteristics of hazardous wastes, including ignitability, corrosivity, reactivity and toxicity. Subtitle D of these parts grants authority for regulating nonhazardous waste to the state.

California Environmental Protection Agency Department of Toxic Substances Control

The California Environmental Protection Agency Department of Toxic Substances Control (DTSC) regulates the generation, transportation, treatment, storage, and disposal of hazardous waste under the RCRA and the State Hazardous Waste Control Law. Both laws impose “cradle to grave” regulatory systems for handling hazardous waste in a manner that protects human health and the environment.

California Emergency Response to Hazardous Materials Incidents

California has developed an Emergency Response Plan to coordinate emergency services provided by federal, state, and local government and private agencies. Response to hazardous materials incidents is one part of this plan. The plan is administered by the state Office of Emergency Services, which coordinates the responses of other agencies, including the California Environmental Protection Agency (CalEPA), California Highway Patrol, California Department of Forestry and Fire Protection (CalFire), RWQCB, local fire departments, and other emergency service providers.

California Code of Regulations

Title 8 of the CCR addresses the control of hazardous substances. Section 5189 of Title 8 sets forth the Process Safety Management (PSM) standard for processes involving a highly hazardous chemical in excess of certain quantities. PSM requires a process hazard analysis, current safety information, an employee participation program, written operating procedures, a mechanical integrity program, and other procedures.

Title 8 of the CCR also contains the California Occupational Safety and Health Administration regulations for worker safety, including the storage and handling of hazardous materials. It also identifies protective equipment for workers who handle hazardous materials and requirements for general facility safety.

Toxic Release Contingency Plan

The Toxic Release Contingency Plan (California Government Code Section 8574.16) requires that regional and local planning agencies incorporate into their planning the state's effort to respond to emergency toxic releases, and ensure the effective and efficient use of regional and local resources in the areas of traffic and crowd control, firefighting, hazardous materials response and cleanup, radio and communications control, and provision of medical emergency services.

3.11.2.2. Local Laws and Regulations

Local governments often have requirements that are more stringent than those set forth in federal and state regulations. These laws, regulations, and policies can be found in the county or city General Plans, Municipal Codes, Hazardous Waste Management Plans, or other documents produced by city or county governments. Applicable local government regulations are discussed below.

Colusa County General Plan

The Colusa County General Plan addresses hazardous materials in the safety element of the General Plan. It is an objective of the General Plan to recognize and address threats to public health posed by the use, transport, storage, manufacture, and disposal of hazardous materials. However, the General Plan does not contain any policies pertaining to hazardous waste (Colusa County 1989).

Sacramento County General Plan

According to the Sacramento County General Plan, Sacramento County does not impose more stringent standards or requirements on hazardous material handlers than are in state or federal law (Sacramento County 1993).

Sutter County Hazardous Waste Management Plan

The Sutter County Hazardous Waste Management Plan was adopted in 1990. The Plan establishes a waste management hierarchy, which focuses on waste reduction and minimization. The Sutter County Community Services Department is the local agency responsible for enforcing a variety of hazardous material and waste requirements. The majority of the hazardous waste generated in the county (approximately 95 percent) is from small quantity generators and individual households. The predominant hazardous waste stream produced by both manifested

generators and estimated for all small quantity generators in Sutter County is waste oil. As a result, Sutter County's generator programs, as recommended in the Sutter County Hazardous Waste Management Plan, focus on encouraging recycling of waste oil (Sutter County 1990).

Tehama County General Plan

The safety and open space elements of the Tehama County General Plan address hazardous waste. The safety section deals with compliance with federal, state, and local regulations, along with the development of a Hazardous Waste Management Plan. The open space section restricts hazardous material storage in a 100-year floodplain (Tehama County 2008).

Yolo County General Plan

The Yolo County General Plan has a brief section on toxic or hazardous materials which states: "Yolo County shall develop emergency plans for implementation in the event of accident, fire, or flood involving toxic or hazardous materials" (Yolo County 1983).

3.11.3. Environmental Effects

The assessment of potential effects takes into consideration the significance of an action in terms of its context and its intensity as required under NEPA. Effects are considered significant under CEQA if the project would:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment;
- Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment.

3.11.3.1. No-Action Alternative

Under the no-action alternative, no activities would be conducted to halt erosion at the 25 erosion sites. Assuming no levee failures, any HTRW materials would remain in the locations and concentrations present under existing conditions. Given the extent of existing erosion, it is likely that the erosion would eventually increase in severity to the point that levee failure is probable. Levee failure and resultant flooding would likely result in the uncontrolled release of HTRW materials into the environment. Any fertilizers, herbicides, and pesticides applied to agricultural lands would become entrained in the floodwaters. Floodwaters reaching more densely populated areas would likely entrain hydrocarbons and oils from flooded vehicles, and any other compounds (e.g., paint, fuels, chemical cleaners, household products) routinely used and stored in residential and commercial areas.

3.11.3.2. Alternative 1: Proposed Action

Under the proposed action, bank protection measures would be implemented to prevent ongoing erosion and increase levee stability. The proposed bank protection measures include (1) protecting the toe and slopes of the levees with quarry stone; (2) constructing riparian benches at many of the erosion sites; (3) anchoring IWM at and around the MSWL to provide instream aquatic structure; and (4) planting native riparian vegetation to stabilize the bank and replace vegetation lost during construction. Site preparation activities would include the removal of all vegetation other than trees greater than 4 inches dbh and removal of non-hazardous solid waste, debris, and trash. All materials removed from the sites would be disposed of at an appropriate facility. No grading or removal of existing levee materials would occur. Setback levees would be built at sites CC 2.8L, CC 3.4L, and DC 0.9N where repair of the existing levees is not practicable.

During construction activities, the use of potentially hazardous materials would include substances such as gasoline, diesel fuel, motor oil, and hydraulic fluid. Fueling and oiling of construction equipment would be performed daily. Material Safety Data Sheets for all contaminants used and stored during construction activities would be available onsite. Typical construction management practices limit and often eliminate the potential for accidental releases of potentially hazardous materials. However, if a spill of significant quantity were to occur, the accidental release could present a threat to human health or the environment. Potentially significant impacts resulting from implementation of the proposed action and the required mitigation measures are identified below.

Impact HAZ1: Presence of Recognized Environmental Conditions (RECs)
The HTRW site assessments identified potential RECs at five of the erosion sites: SAC 10.8L, SAC 41.9R, LAR 10.L, LAR 10.6L, and FR 3.7L. The potential RECs consist of possible contamination of soil and groundwater due to leakage and migration from nearby gas wells and underground storage tanks, adjacent land uses that may include use and storage of hazardous materials (e.g., diesel stored at pumping station, chlorine stored at water treatment plant), and partially buried automobile bodies on the levee bank. The proposed action would not result in excavation, grading, or other subsurface soil disturbance and is therefore not expected to expose any contaminants that may have migrated from adjacent areas. Construction activities associated with the proposed action would be limited to the designated roadways, construction easement, and staging areas, and would not result in disturbance of adjacent properties. The partially buried automobile bodies at FR 3.7L and other potentially hazardous buried materials that may be incorporated into the existing levees would not be excavated during construction activities. Construction activities would be limited to removal of vegetation other than native trees larger than 4 inches dbh and placement of revetment over the existing levee materials. The impact is considered to be less than significant, and no mitigation is required.

Impact HAZ2: Discovery of Undocumented HTRW Materials
During the HTRW site assessment, not all areas were readily visible (e.g., areas obscured by vegetation or on an inaccessible bank slope). Therefore, there is a potential that

undocumented HTRW materials could be discovered during vegetation clearing or other construction activities. The presence, exposure, and/or inappropriate treatment of HTRW materials during construction activities would be considered a potentially significant impact. Implementation of Mitigation Measure HAZ1 would reduce potential impacts to a less-than-significant level.

Impact HAZ3: Use of Hazardous Materials during Construction
Construction activities at the erosion sites would involve the use of fuel, oil, and other potentially hazardous materials. Spillage or other release of these materials could result in adverse effects to human health or the environment. Additionally, construction activities involve the use of equipment (e.g., heavy equipment, chainsaws, power tools) that could create sparks and ignite combustible materials. Impacts are considered to be potentially significant. Implementation of Mitigation Measure HAZ2 would reduce potential impacts to a less-than-significant level.

3.11.3.3. Alternative 3: Thin Rock Armor

Under the thin rock armor alternative, vegetation would be cleared from the levee and a thin layer of rock revetment would be placed on the existing slope of the levee. No grading or removal of existing levee materials would occur. Potential impacts from HTRW materials exposed or used during construction activities would be similar to those identified for the proposed action.

3.11.4. Mitigation

Implementation of the following mitigation measures would reduce potential impacts from the proposed action to a less-than-significant level.

Mitigation Measure HAZ1: Discovery of Undocumented HTRW Materials

a. If previously undocumented HTRW materials or contamination (e.g., stained soils) are exposed or otherwise identified during construction activities, all work in the vicinity of the discovery shall be stopped and the Corps and/or CVFPB, as appropriate, shall be notified immediately. The potential contamination shall be evaluated by a qualified professional and work in the vicinity shall not resume until appropriate remediation measures (if determined to be necessary) have been implemented. Appropriate remediation measures may include, but are not limited to, testing and evaluating the suspected areas, removal or treatment of contaminated soils, or capping the contaminated areas with imported material.

Mitigation Measure HAZ2: Use of Hazardous Materials During Construction

a. Prior to initiation of construction activities, the construction contractor shall submit for approval to the Corps and/or CVFPB, as appropriate, a contamination prevention plan. The plan shall include, but is not limited to: 1) a list of all potentially hazardous petroleum products and toxic materials to be used during construction; 2) provisions to prevent accidental or intentional introduction of

such materials into any waterway, the air, or the ground; 3) methods for preventing polluted runoff from plant, equipment parking, and maintenance areas from entering directly into local water bodies; 4) procedures, instructions, and reports for contaminant cleanup; 5) and the name of the individual who will report any spills, who will be responsible for implementing and supervising containment and cleanup, and who will follow up with complete documentation.

b. All construction personnel shall be trained in the proper use and handling of fuels, lubricants, and other potentially hazardous materials.

c. Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants, and oil shall be managed and stored in accordance with all federal, state, regional, and local laws and regulations. There shall be no storage of fuel on the project site. Fuel must be brought to the project site each day that work is performed.

d. The Corps and/or CVFPB, as appropriate, shall be notified immediately of any spill of petroleum products, organic or earthen materials, or any other potentially hazardous materials.

e. Solid wastes (excluding clearing debris) shall be placed in containers that are emptied on a regular schedule. Handling, storage, and disposal shall be conducted so as to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. All solid waste shall be transported from the construction site and disposed of in compliance with federal, state, and local requirements for solid waste disposal.

f. Construction materials, such as revetment, IWM, and fill soil used during construction activities shall be free of HTRW materials. To alleviate the possibility that HTRW are released to the environment through these materials, the construction contractor shall have strict specifications for these materials and the supplier providing these materials shall provide certificates indicating these materials are free of HTRW materials.

g. Any construction equipment that normally includes a spark arrester shall be equipped with an arrester in good working order. This includes, but is not limited to, vehicles, heavy equipment, and chainsaws. No smoking shall be allowed in refueling areas. The construction contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP/IIPP, the AHA, federal and/or state OSHA regulations, and other related fire and safety regulations. The most stringent standard shall prevail.

3.12. Socioeconomics and Environmental Justice

This section discusses socioeconomic and environmental justice factors as they relate to the proposed action. NEPA and CEQA requirements for the analysis of social and economic impacts are somewhat different. NEPA requires that social and economic effects be considered if they are related to effects on the natural or physical environment, and the NEPA definition of effects includes social and economic factors (40 CFR 1508.8, 1508.14). CEQA requires analysis of a proposed project's potential impacts on population growth and housing supply, but social and economic changes are not considered environmental impacts in and of themselves. CEQA, however, does allow discussion of social and economic changes that would result from a change in the physical environment and could in turn lead to additional changes in the physical environment (CEQA Guidelines Sec. 15064[f]).

The concept of environmental justice is rooted in the Civil Rights Act of 1964, which prohibits discrimination in federally assisted programs, and in Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations), issued February 11, 1994. Environmental justice is intended to ensure that federal actions and policies do not result in disproportionately high adverse effects on minority or low-income populations. Compliance with NEPA requires analysis of environmental justice effects. CEQA does not require state or local agencies to address environmental justice concerns, and environmental justice is not a CEQA issue.

3.12.1. Environmental Setting

In order to determine which locations along the Sacramento River and its tributaries require levee repairs, a field reconnaissance review of the Sacramento River Flood Control System is conducted each year by the Corps and CVFPB. The study provides a review of the SRBPP levees and an inventory of erosion sites. The inclusion of an erosion site in the inventory requires professional judgment relative to the severity of the erosion and the threat to the levee. To be eligible for repair, an erosion site must meet one or both of the following two criteria: (1) bank erosion extends into the profile of the levee slope (3H:1V levee prism slope), or (2) the bench (berm) width is less than 35 feet.

The erosion sites were further evaluated based on four methodologies which weighted up to 16 physical factors. Two of the methods included an economic factor. The 16 physical factors and the economic factor are defined in Table 3-25. Method 1 considered all 16 physical factors and the economic factor. Method 2 included 10 physical factors and no economic factors. Method 3 evaluated five physical factors and the economic factor. Method 4 assessed five physical factors. Erosion sites that are demonstrated to show the technical signs of erosion are not excluded from the repair process based on the demographics of the area in which they occur. The 25 erosion sites proposed for repair have been chosen based solely on the severity of erosion and the threat of levee failure.

Table 3-25 Site Ranking Factors

Factor	Definition
Bank slope	The bank slope is the horizontal to vertical ratio of the eroding slope
Berm width	The berm width is the horizontal segment of the bank that extends from the levee toe to the top of the riverbank.
Length of erosion site	The length of an erosion site is the full length along the river over which the erosion occurs.
Location of erosion site	The location of the erosion is the position in the vertical direction where the erosion occurs; the lower on the slope, the greater the potential for erosion.
Bank stability	The bank stability criterion identifies any observed instabilities in the exposed riverbank and levee such as near vertical slopes, tension cracks, slumping, tree hazard, beaver holes or caves, and seepage history.
Rc/W	This factor is the radius of the meander bend divided by the top width length at bank full.
Site relative to bend	This factor relates to where within a meander bend an erosion site is located.
Geomorphologic processes	This criterion takes into account the active erosion and deposition patterns of the channel.
Vegetative cover	This criterion relates to how much vegetation exists on the site and its role in providing erosion protection.
Tree hazard	While vegetation can be helpful, large trees can put excessive weight on banks and can result in erosion; therefore, the older and larger trees result in a higher stability hazard.
Soil type	Soil types were determined based on the Unified Soil Classification System.
Velocity	The velocity for the Sacramento River sites has been obtained from the existing UNET hydraulic model using the 100-year discharge, where available.
Wave action	Wave action accounts for natural (wind) and unnatural (boats) waves that impact the banks.
Economic factor	The economic factor is based primarily on the estimated population within the potential inundation areas.
Human usage	The human usage criterion takes into account how much the site is used by humans and accounts for site damage from such usage.
Seepage potential	The seepage potential takes into account any documented history of seepage.
Tidal fluctuation	Reaches of the river that are affected by tides have a lower bank zone that is usually devoid of vegetation and more susceptible to erosion.

The 25 erosion sites proposed for repair are located in a variety of settings. Many sites are located in agricultural areas with low-density land uses, while others are located in proximity to major population centers and adjacent to residences and commercial buildings. For a detailed discussion of zoning and surrounding land use, please refer to section 3.1, Land Use.

3.12.2. Regulatory Setting

The assessment of socioeconomic resources is guided primarily by federal laws and policies, while state and local plans and policies typically promote economic development and diversity, public health and safety, housing, and other concerns of the communities and residents within their jurisdictions. Environmental justice issues are primarily mandated and regulated at the federal level. The major regulations concerning socioeconomic resources and environmental justice that are relevant to the proposed action are described below.

3.12.2.1. Federal and State Laws and Regulations

National Environmental Policy Act

Section 102 of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences" in planning and decision making (42 United States Code (USC) Section 4332). Section 1502.16(c) of NEPA requires federal agencies to identify potential conflicts between a proposed action and related plans and policies of federal, state, and local agencies and Indian tribes. This requirement helps federal agencies identify potential conflicts that may cause adverse effects on the social and economic environment of an action area.

Council on Environmental Quality

The Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations (CFR) 1500–1508) provide guidance related to social and economic impact assessment by noting that the "human environment" assessed under NEPA is to be "interpreted comprehensively" to include "the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). Furthermore, these regulations require agencies to assess "aesthetic, historic, cultural, economic, social, or health" effects, whether direct, indirect, or cumulative (40 CFR 1508.8).

The Civil Rights Act

In accordance with the Civil Rights Act of 1964, federal agencies must ensure that programs receiving federal financial assistance do not directly, through contractual or other arrangements, use criteria, methods, or practices that discriminate on the basis of race, color, or national origin.

Executive Order 12898, Environmental Justice

On February 11, 1994, President Clinton issued an "Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" designed to focus attention on environmental and human health conditions in areas of high minority populations and low-income communities, and promote non-discrimination in programs and projects substantially affecting human health and the environment. The order requires the Environmental Protection Agency (EPA) and all other federal agencies (as well as state agencies receiving federal funds) to identify these issues as they relate to their programs, policies, and

activities and their potential effect on minority and/or low-income populations. The agencies are further required to develop strategies to address this issue and provide citizens access to public information regarding human health and the environment.

The Sunshine Act

The Sunshine Act ensures the right of citizens "to have notice of and the right to attend all meetings of agencies at which agency business is discussed or acted upon."

California Government Code Section 65040.12

California Government Code, Section 65040.12(e), defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of all environmental laws, regulations and policies." California Government Code, Section 65040.12(a), designates the Governor's Office of Planning and Research (OPR) as the coordinating agency in state government for environmental justice programs, and required OPR to develop guidelines for incorporating justice into general plans.

3.12.2.2. Local Laws and Regulations

The local governments within the proposed action area have plans and policies intended to protect and improve a wide range of socioeconomic conditions, including housing, employment opportunities for minorities and low-income populations, economic diversification, and business activity in general. Local plans and policies are also intended to promote public health and safety while minimizing conflicts between projects of all types; their associated traffic, air, and noise impacts; and the social environment within which local residents live and work.

3.12.3. Environmental Effects

For NEPA purposes, the context and intensity of environmental effects on socioeconomics and environmental justice are discussed below. Effects considered under NEPA include the potential for the project to substantially disrupt local economies or businesses or disproportionately affect minority or low-income populations. Impacts are considered significant under CEQA if the project would:

- Induce substantial population growth in an area, either directly or indirectly;
- Foster economic or population growth, or the construction of additional housing, either directly or indirectly; or
- Remove obstacles to population growth.

3.12.3.1. No-Action Alternative

Under the no-action alternative, no action would be taken to halt erosion at the 25 erosion sites. Conditions associated with the existing levees would remain unchanged for the immediate future. However, continued erosion at the erosion sites would increase the risk of levee failure and possible flooding of surrounding areas. Levee failure and flooding could result in significant social and economic impacts to local and regional economies and residents.

3.12.3.2. Alternative 1: Proposed Action

Most of the erosion sites are located in communities characterized by agricultural land uses and rural low-density housing. LAR 10.0L and LAR 10.6L are located in the American River Parkway, which receives substantial recreational use and is bordered by suburban residential subdivisions. SAC 41.9R is located in the community of Clarksburg adjacent to the Clarksburg marina and directly across the street from a general store and other small businesses. A boat marina and a mobile home park are located just north of SAC 78.8L.

The proposed action would include the placement of rock and soil revetment on the eroding levees slopes. Construction activities at each site are anticipated to continue for up to 120 days. In the case of landside construction, activities would involve large trucks transporting materials to and from the site for a significant portion of the construction timeframe. On sites where construction access is from the waterside of the levee, barges and tugboats would occupy approximately 200 linear feet of the river channel. Heavy construction equipment (e.g., crane, excavator, dump truck) and construction personnel would be present on the sites throughout the duration of construction. Construction activities would require that the erosion sites and adjacent areas (approximately 100-foot radius) would be closed to public access. However, closure of neighboring marinas and businesses is not anticipated (e.g., SAC 41.9R, SAC 78.8L). The proposed action would result in the hiring of contractors and workers to construct the required repairs. Providing employment for contractors and workers may result in a temporary positive socioeconomic effect.

The construction of setback levees at sites CC 2.8L, CC 3.4L, and DC 0.9N would require the loss of approximately 8 acres of orchard and 2 acres of pasture. These areas represent a very small proportion of the agricultural land in active use in the adjacent landscape. Construction of the setback levees is necessary to provide flood protection to the surrounding lands. Given the relatively small area of agricultural land needed to construct the setback levees and the purpose of the setback levees to provide flood protection to the remaining agricultural land, the proposed action would not substantially disrupt the agricultural economies in these areas.

The proposed action consists of the repair of existing levees and would not result in substantial population growth in the project area, the construction of additional housing, or the removal of obstacles to population growth. The proposed action is not anticipated to result in any long-term adverse socioeconomic effects.

The erosion sites to be repaired were selected based on the severity of erosion and the threat of levee failure, not on the demographics of the communities in which they occur. Contractors would be hired following standard Corps procedures and would not be disadvantaged by such factors as race or national origin. The proposed action would not result in adverse effects as they relate to environmental justice.

3.12.3.3. Alternative 2: Thin Rock Armor

Under Alternative 2, the majority of vegetation would be cleared from the levee and a thin layer of rock would be placed over the existing levee slope. Temporary socioeconomic

impacts related to project construction would be similar to those experienced under the proposed action. After completion of the levee repair, the sites would be generally barren of vegetation. The removal of vegetation would result in a substantial reduction of the visual character and quality for most of the erosion sites. Access to the sites may also be difficult as a result of placement of the rock armor. The barren landscape and access difficulties would likely result in fewer people using the sites. The reduced visual quality and use of the sites could result in adverse socioeconomic effects to local communities and residents.

3.12.4. Mitigation

Implementation of the proposed action would not result in significant impacts related to socioeconomics or environmental justice. No mitigation is required.

CHAPTER 4

Cumulative and Growth-Inducing Effects

4. CUMULATIVE AND GROWTH-INDUCING EFFECTS

4.1. Cumulative Effects

Cumulative effects of the SRBPP program are described in detail in the EIR/SEIS IV (U.S. Army Corps of Engineers 1987). The cumulative effects discussion in the 1987 EIR/SEIS IV is hereby incorporated by reference.

Cumulative effects are the impacts on the environment that result from the incremental impacts of the proposed action when added to the impacts of other past, present, and reasonably foreseeable future actions (14 CCR 15355[b], 40 CFR 1508.7), regardless of what agency (federal or non-federal) or entity undertakes such other actions. These impacts can result from individually minor but collectively significant actions taking place over time.

The president's Council on Environmental Quality (CEQ) NEPA regulations and the State of California's CEQA Guidelines require that the cumulative impacts of a proposed action be addressed in an environmental document when the cumulative impacts are expected to be significant (40CFR 1508.25[a][2],14 CCR 15130[a]). When a lead agency is examining a project with an incremental effect that is not "cumulatively considerable," the lead agency need not consider that effect significant, but shall briefly describe its basis for concluding that the incremental effect is not cumulatively considerable.

Between 1963 and 2000, the SRBPP constructed some 152 miles of revetment between RM 0 and RM 194 of the Sacramento River, representing approximately 39 percent of the total bank-line length of 388 miles in this reach of the Sacramento River (U.S. Fish and Wildlife Service 2000). The entire SRBPP action area currently contains 333.5 miles of revetment, representing approximately 31 percent of the total SRBPP bank-line length of 1,092 miles (U.S. Army Corps of Engineers 2007a, 2007b, 2008e). The approximately 20,897 feet of waterside revetment at 22 of the 25 erosion sites addressed in this EA/IS is an increase of approximately 16,063 feet from pre-project conditions, increasing the total bank-line length with revetment placed under the existing SRBPP authority to approximately 335.9 miles—an increase of 0.91 percent. The approximately 3,000 feet of setback levee material to be placed at sites CC 2.8L, 3.4L, and DC 0.9N would not include rock revetment and therefore would not further increase the total bank-line length of revetment placed under the authority of the SRBPP.

A discussion of the potential cumulative effects resulting from implementation of the proposed action is provided below.

4.1.1. Land Use

As described in section 3.1, land uses where the existing levee would be repaired (22 of the 25 erosion sites) would remain unchanged from existing conditions.

Construction of setback levees at sites CC 2.8L, CC 3.4L, and DC 0.9N would result in the loss of approximately 8 acres of orchard designated as prime and unique farmland and 2

acres of pasture. The purpose of the setback levees is to provide flood protection for land uses and agricultural production within the project area, and the portion of existing agricultural lands needed for the setback levees would be very small compared to the remaining agricultural lands to be protected from flooding.

Because flood control projects are consistent with the historical use of the land within the project area and because a relatively small amount of land would be converted to non-agricultural use for protection of the remaining agricultural lands and uses, these impacts would be less than significant. While overall there has been a significant cumulative impact on agricultural resources in the region, primarily from urban development, the incremental effect of the proposed action on land use is not cumulatively considerable and protects valuable agricultural lands from flooding.

4.1.2. Aesthetics

As described in section 3.2 of this document, riparian vegetation communities along the levee slopes are the primary component of the existing aesthetic resources present at the erosion sites. Under the proposed action, trees greater than 4 inches dbh would be retained unless they posed a safety hazard, and existing vegetation that is removed would be replaced by planting native riparian vegetation. Implementation of these design features would largely preserve or enhance the long-term aesthetic value of the levee landscapes. Therefore, the incremental effect of the proposed action on aesthetic values is not cumulatively considerable and is therefore less than significant.

4.1.3. Recreation

As described in section 3.3, the proposed action is not anticipated to result in a long-term loss of recreational opportunities. The erosion sites are widely distributed over a large geographic area, and the short-term loss of recreational opportunities during project construction and revegetation is not considered to be significant. The incremental effect of the proposed action on recreation is not cumulatively considerable and is therefore less than significant.

4.1.4. Cultural Resources

The potential impacts of the proposed action on cultural resources are identified in section 3.4. The proposed action has a potential to result in impacts on potentially significant cultural resources and to uncover unknown or undocumented buried cultural resources. With implementation of the mitigation measures identified in section 3.4, the incremental effect of the proposed action is not cumulatively considerable on cultural resources and is therefore less than significant.

4.1.5. Biological Resources

4.1.5.1. Vegetation Communities

The potential impacts of the proposed action on vegetation communities are identified in section 3.5. Construction of the setback levees at CC 2.8L, CC 3.4L, and DC 0.9N would result

in the loss of 8 acres of orchard and 2 acres of pasture. These vegetation types are not considered to be sensitive and are abundant in the region. The loss of orchard and pasture resulting from implementation of the proposed action would not contribute to a cumulatively considerable adverse effect. Cumulative effects from the loss of orchard and pasture as they relate to agricultural land uses are addressed in section 4.1.1.

Construction activities at the erosion sites would involve the loss of ruderal vegetation communities. Ruderal habitats are typically dominated by short-lived annual and biennial, introduced, non-native herbaceous grasses and broad-leaved forbs that are adapted to periodic disturbance. Revegetation of the erosion sites after completion of construction activities would replace existing ruderal vegetation communities with native plant species. Replacement of ruderal vegetation communities with native riparian plant species may result in a cumulatively considerable beneficial effect.

The proposed action incorporates the retention of native trees to the greatest extent possible at each of the erosion sites as well as tree protection measures prior to placement of revetment. Preparation of the erosion sites would require the removal of all existing riparian understory vegetation. After placement of the revetment, all disturbed areas would be revegetated with native plant species in accordance with the revegetation plans (Appendix F). The revegetated areas would monitored for 3 years following completion of construction.

Although the proposed action would result in a short-term decrease in riparian vegetation, revegetation of the sites would result in the replacement of riparian vegetation communities over the long term. Additionally, by protecting the sites from continued erosion and reducing the potential for levee failure, the proposed action could result in a net benefit to riparian vegetation communities. The incremental effect of the proposed action on vegetation communities is not cumulatively considerable and is therefore less than significant.

4.1.5.2. Special-Status Species

Special-Status Plants

The potential impacts of the proposed action on special-status plants are addressed in section 3.5. Botanical surveys and habitat assessments were performed at all 25 erosion sites. Based on these investigations, special-status plant populations are present at SAC 8.0L and SAC 10.8L and potentially present at DC 0.9N and SBP 0.4E. The special-status plants at SAC 8.0L and SAC 10.8L would not be directly affected by the proposed action, and mitigation measures are identified to avoid the potential for indirect impacts. Suitable habitat at DC 0.9N would not be affected by construction of the setback levee.

The proposed action incorporates mitigation measures to avoid the potential for significant impacts to special-status plants at SBP 0.4E (if present). With incorporation of the mitigation measures identified in section 3.5, the incremental effect of the proposed action on special-status plants is not cumulatively considerable and is therefore less than significant.

Special-Status Fish Species

The potential impacts of the proposed action on special-status fish are addressed in section 3.5. Potential impacts include both temporary and long-term significant effects on aquatic habitat for special-status fish species.

Temporary impacts include displacement of fish from the erosion sites during construction activities and construction-related increases in turbidity and sedimentation. Mitigation measures identified in section 3.5 would minimize the potential for these temporary impacts. It is anticipated that most fish using the erosion sites would relocate to surrounding areas until the repair work is complete. Because the erosion sites are spread throughout the Sacramento River and its tributaries, it is anticipated that the riparian corridors and adjacent nearshore habitat between the sites will have the necessary capacity to absorb any displaced species until such a time as the sites can be recolonized.

The proposed action incorporates the placement of instream woody material (IWM) and planting of native riparian vegetation to offset long-term impacts on aquatic habitat for special-status fish species. Additional mitigation measures are identified in section 3.5 to address potential long-term impacts. These measures include augmentation of spawning gravel at LAR 10.0L and LAR 10.6L and the purchase or development of compensatory aquatic habitat within 50 miles of the erosion sites.

Installation of IWM, revegetation of the sites with native riparian vegetation, and implementation of the mitigation measures would compensate for temporary and long-term project-related impacts. Therefore, the incremental effect of the proposed action on special-status fish species is not cumulatively considerable and is therefore less than significant.

Special-Status Wildlife Species

The potential impacts of the proposed action on special-status wildlife are addressed in section 3.5. Field assessments for the presence of suitable habitat for special-status wildlife species were performed at all 25 erosion sites. The action area contains suitable habitat for nine special-status wildlife species: valley elderberry longhorn beetle, giant garter snake, western pond turtle, bank swallow, yellow warbler, yellow-breasted chat, white-tailed kite, Swainson's hawk, and western red bat. Implementation of the proposed action has a potential to result in direct and indirect impacts to these species.

Potential direct impacts include injury or mortality of individuals, disruption of breeding activities, loss of suitable habitat, and displacement of individuals from the construction sites. Potential indirect impacts include degradation of water quality and disruption of individuals (e.g., breeding activities) outside of the erosion sites from noise, vibration, and other construction-related disturbance.

The proposed action incorporates the placement of IWM and planting of native riparian vegetation to compensate for the loss of habitat value. The proposed action also incorporates mitigation measures to avoid or reduce the potential for direct and indirect impacts on special-status wildlife species. With implementation of the mitigation measures identified in section 3.5, the incremental effect of the proposed action on special-status wildlife species is not cumulatively considerable and therefore less than significant.

4.1.5.3. Non-Special-Status Species

The potential impacts of the proposed action on non-special-status species are addressed in section 3.5. The proposed action would halt erosion and limit future natural recruitment of IWM from the existing riparian areas at the 22 sites with waterside-repairs. However, the provision of greater amounts of IWM under post-project conditions and the potential for recruitment of IWM from upstream sources is anticipated to result in improved habitat conditions for non-special-status fish at these sites. Because the proposed action would implement site-specific habitat and erosion control measures that would benefit fisheries and aquatic habitat in the long term and because effects on non-special-status fish would not be considered significant, the incremental effect of the proposed action on non-special-status fish species is not cumulatively considerable and is therefore less than significant.

Disturbance from construction activities could result in temporary impacts to nesting raptors and migratory birds. The proposed action incorporates mitigation measures to avoid the potential for these adverse impacts. Vegetation removal and other construction activities could result in temporary impacts to other wildlife species. It is anticipated that most wildlife species using the erosion sites would relocate to surrounding areas until the repair work has been completed and the mitigation plantings provide sufficient habitat.

Since the erosion sites are spread along the Sacramento River and its tributaries, it is anticipated that the riparian habitat between the sites has the capacity to accommodate any displaced species. Revegetation of the erosion sites is anticipated to result in the replacement of riparian vegetation communities and wildlife habitats over the long-term. Additionally, by protecting the sites from continued erosion, the proposed action diminishes the possibility of impacts to wildlife resulting from levee failure and flooding. The incremental effect of the proposed action on non-special-status species is not cumulatively considerable and is therefore less than significant.

4.1.6. Hydrology and Water Quality

Section 3.6 describes the construction-related water quality effects of the proposed action, including the potential for increased turbidity due to soil and sediment disturbance. Minimizing construction-related water quality effects is required by the Clean Water Act. The program for implementing Clean Water Act requirements is managed locally by the Regional Water Quality Control Board. The proposed action would be required to comply with the requirements of a CWA section 401 Water Quality Certification and the statewide permit for general construction activity. These requirements typically involve the implementation of site-specific stormwater Best Management Practices (BMPs) to avoid and minimize adverse effects to receiving waters. Such BMPS are incorporated into the mitigation measures identified in section 3.6. Implementation of these measures would reduce any project-related water quality impacts to a less-than-significant level.

The incremental effect of the proposed action on hydrology and water quality is not cumulatively considerable and is therefore less than significant. Additionally, the proposed action may have a net benefit to water quality by reducing the potential for levee failure and catastrophic flood events.

4.1.7. Geomorphology

Impacts to geomorphology are addressed in section 3.7. Based on queries of the Corps' revetment database (U.S. Army Corps of Engineers 2007b), existing revetment at sites SAC 8.0L, SAC 35.4L, and DC 0.9N makes up 100 percent of the bank-line length at each of these sites (Table 3.7-2). However, the cobble materials exposed along the banks of DC 0.9N have been deposited through natural fluvial processes, not by bank revetment actions. Existing revetment at erosion sites SAC 10.8L, SAC 26.0L, SAC 41.9R, SAC 78.8L, SAC 87.0L, and SAC 130.0L range from 10 percent to 88 percent of their individual bank-line length. Existing revetment at the remaining erosion sites—SAC 71.3R, SAC 73.5R, SAC 93.7R, SAC 114.5R, SAC 136.7R, SAC 136.9R, SAC 157.7R, FR 1.0L, FR 3.7L, FR 5.5L, FR 7.0L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC 3.4L, and SBP 0.4E—occupies less than 10 percent of their individual bank-line length.

The cumulative impacts of bank revetment in the SRBPP area are primarily related to limiting bank erosion. The arrest of continued bank erosion results in secondary impacts on sediment recruitment, meander migration, point bar formation, and the development of off-channel water bodies, such as oxbow lakes and sloughs (Larsen et al. 1997, 2004; Larsen and Greco 2002). Restricting these processes also limits IWM recruitment and future riparian forest succession by limiting point bar formation for future riparian vegetation colonization. Numerous reviews and studies over the last three decades have illustrated the key physical and biological roles IWM plays in rivers of all sizes for habitat formation, sediment and organic-matter storage, and bank stability, as well as in maintaining a high degree of spatial heterogeneity (i.e., habitat complexity) in stream channels (Harmon et al. 1986, Bisson et al. 1987, Hicks et al. 1991, Reeves et al. 1991, Lassettre and Harris 2001).

Site designs for the 22 erosion sites that would receive waterside levee repair were developed in an iterative manner intended to minimize changes in local hydraulic conditions. However, armoring banks can alter local hydraulics, which can affect channel morphology and aquatic habitat by increasing nearshore velocities and depths, promoting channel incision and channel narrowing, and increasing sediment transport (Binns and Eiserman 1979, California Department of Fish and Game 1983, California Department of Water Resources 1994, Nunally and Sotir 1994, Shields and Hoover 1991).

Construction of setback levees at three of the 25 erosion sites—CC 2.8L, CC 3.4L, and DC 0.9N—would allow for continued bank erosion of the existing streambanks and levees within the immediate vicinity of the repair (i.e., 50–200 feet landward from the current channel position), thereby promoting potential future sediment recruitment, meander migration, point bar formation, IWM recruitment, and riparian vegetation colonization on the existing banks and the reconnected floodplain areas. However, the existing rock revetment at the outer channel bend situated immediately upstream of DC 0.9N would potentially continue to inhibit lateral migration into the floodplain.

The proposed erosion repair sites—with the exception of DC 0.9N—are located adjacent to high, historical SRFCP levees and do not have any adjacent floodplain habitat. For this reason, the cumulative effect of the proposed action on floodplain habitat would be less than

significant. Erosion repair sites CC 2.8L, CC 3.4L, and DC 0.9N would benefit by the creation and/or reconnection of floodplain areas.

Implementation of the proposed action is not anticipated to contribute to increased development or growth on adjacent lands beyond what could be expected under existing conditions. The proposed action's contribution to cumulative geomorphic effects would be further reduced by the use of proposed project elements, such as increasing SRA and instream structure cover values and riparian habitat area. With installation of IWM, revegetation of the sites with native riparian plant species, and implementation of the mitigation measures identified in section 3.7; the incremental effect of the proposed action on geomorphology is not cumulatively considerable and is therefore less than significant.

4.1.8. Air Quality

As described in section 3.8, the proposed action would have construction-related effects on air quality as a result of the equipment needed to complete the substantial amount of earth-moving activity that would be required. Existing air quality thresholds for ozone and particulate matter are already exceeded and in violation of state and federal standards in all of the affected air basins. Therefore, any additional contributions of pollutants would be potentially significant and cumulative.

Mitigation for the proposed action consists of BMPs and the implementation of on- and offsite mitigation measures, including control of dust, proper maintenance of construction equipment, and payment of an off-site mitigation fee of approximately $473,492.00 for an estimated exceedance of 28.2 tons of NO_x from equipment exhaust. Although some air quality thresholds would be exceeded, implementation of the mitigation measures identified in section 3.8 would reduce impacts to a less-than-significant level. With the implementation of the mitigation measures, the incremental effect of the proposed action on air quality is not cumulatively considerable and is therefore less than significant.

4.1.9. Traffic

As described in section 3.9, the proposed action would result in increased traffic levels and traffic delays on the surrounding roadways during project construction. Implementation of the mitigation measures identified in section 3.9 would reduce potential impacts to a less-than-significant level. Given that impacts to traffic resulting from the proposed action would be temporary (i.e., only during project construction), the incremental effect of the proposed action on traffic is not cumulatively considerable and is therefore less than significant.

4.1.10. Noise

As described in section 3.10, the proposed action would result in increased ambient noise during project construction. Implementation of the mitigation measures identified in section 3.10 would reduce potential impacts to a less-than-significant level. Given that impacts to noise resulting from the proposed action would be temporary (i.e., only during project construction), the incremental effect of the proposed action on noise is not cumulatively considerable and is therefore less than significant.

4.1.11. Hazardous, Toxic, and Radioactive Waste

The potential impacts of the proposed action related to hazardous materials are addressed in section 3.11. During construction activities, fuels, lubricants, and other potentially hazardous materials have the potential to be released into the environment and result in environmental and/or human exposure to these hazards. There is also a potential for undocumented hazardous materials or contamination to be discovered during site clearing. When completed, the proposed action would not generate any hazardous, toxic, or radioactive waste. Mitigation measures, including implementation of a contamination prevention plan and evaluation and treatment of undocumented hazardous materials, have been incorporated into the proposed action. With implementation of the mitigation measures identified in section 3.11, the incremental effect of the proposed action related to hazardous materials is not cumulatively considerable and is therefore less than significant.

4.1.12. Socioeconomics and Environmental Justice

As described in section 3.12, the proposed action consists of the repair of existing levees and would not result in substantial population growth in the project area, the construction of additional housing, or the removal of obstacles to population growth. The proposed action would reduce the potential for levee failure and flooding, and is not anticipated to result in any long-term adverse socioeconomic impacts. The erosion sites to be repaired were selected based on the severity of erosion and the threat of levee failure, not on the demographics of the communities in which they occur. Contractors would be hired following standard Corps procedures and would not be disadvantaged by such factors as race or national origin. The proposed action would not result in adverse impacts as they relate to environmental justice. The incremental effect of the proposed action on socioeconomics and environmental justice is not cumulatively considerable and is therefore less than significant.

4.2. Other Local Projects

Local projects in the Sacramento River watershed that may have impacts similar to those of the proposed action are identified below.

4.2.1. Folsom Dam Safety and Flood Damage Reduction Action

The Folsom Dam Safety and Flood Damage Reduction Action Project, portions of which are currently under construction, seeks to improve public safety downstream of Folsom Dam through modification of the dam and its appurtenant structures. Previously identified features, including dam safety, flood damage reduction, and hydrologic, seismic, and static issues, are being addressed through construction improvements. Modifications include, but are not limited to, construction of an auxiliary spillway, dam and embankment raising, and seismic retrofitting of structures. The lead federal agency on the project is the Central Valley Flood Protection Board (CVFPB), with the Corps acting as a cooperating federal agency.

4.2.2. Folsom Dam Joint Federal Project

The Folsom Dam Joint Federal Project is an ongoing, multi-phase flood control project intended to improve the storage capacity of Folsom Lake through the construction of a new auxiliary spillway that would be capable of allowing safe releases of the Probable Maximum Flood without jeopardizing the integrity of Folsom Dam. Improvements to American River levees would complement the intent of the project, which is to provide for safe peak stormwater releases. The project consists of a six-gated control structure; a 2,100-foot spillway with a stilling basin; and an approach channel in the reservoir that leads to the control structure. Phase 1 (excavation) has been completed. The remaining two phases are expected to be completed in 2015.

4.2.3. American River Common Features Project

The American River Common Features Project is designed to strengthen the American River levee so that it is capable of withstanding flows up to 160,000 cfs. This project involves the installation of roughly 23 miles of slurry wall (up to depths of 80 feet), which would raise the levee height and increase freeboard while also addressing existing slope stability and some erosion problems. To date, a majority of the project has been completed. Work yet to be completed on several reaches of the levee include the proposed projects along the North Levee upstream of Howe Avenue, the North Levee between the Natomas East Main Drainage Canal and Interstate 80, and approximately 18 “remaining sites” located along the levee. The American River Common Features Project is anticipated to be completed in 2010.

4.2.4. South Sacramento City Streams Project

The City of Sacramento has begun implementing a series of stream upgrade projects intended to protect the city from high water events in the Delta and from flooding associated with Morrison Creek, Florin Creek, Elder Creek, and Unionhouse Creek. The levee that currently protects the city from flooding from the Delta and these four creeks would be raised, a floodwall would be constructed, and the channel would be improved to afford flood protection capable of withstanding a greater than 100-year flood event. Much of the construction has been completed, with three reaches yet to be constructed (from Franklin Boulevard to Center Parkway; the Union Pacific Railroad between Unionhouse Creek and Morrision Creek; and upstream of Franklin Boulevard for Morrison Creek, Florin Creek, and Elder Creek). The South Sacramento City Streams Project is anticipated to be completed in 2012.

4.2.5. The Sacramento River Bank Protection Project

The SRBPP, of which the proposed action is a part, is intended to provide long-term erosion protection and increase flood safety along the Sacramento River and its tributaries. The ongoing SRBPP is being implemented over time in a series of proposed actions, the timing of which is determined by assessments of levee conditions and prioritization conducted by the Corps and CVFPB.

4.2.6. Delta Levees Special Flood Control Projects

The Delta Levees Special Flood Control Projects provide financial assistance to local levee-maintaining agencies implementing flood control projects and related habitat projects for eight western Delta islands—Bethel, Bradford, Holland, Hotchkiss, Jersey, Sherman, Twitchell and Webb Islands—and the towns of Thornton and Walnut Grove. DWR oversees funding of these projects.

4.2.7. Docks Riverside Parkway Promenade Project

The Docks Riverside Parkway Promenade Project consists of a proposed high-density, mixed-use neighborhood with housing and retail. The project design includes a promenade and parkway, as well as related levee improvements. The project fronts the Sacramento River and is located near Pioneer Bridge, west of Front Street in downtown Sacramento. The Redevelopment Agency of the City of Sacramento issued a Draft EIR for the proposed project in August 2008.

4.2.8. The River District Redevelopment Project

The River District Specific Plan Area occupies approximately 748 acres in downtown Sacramento, adjacent to the confluence of the American River, which forms the northern District boundary, and the Sacramento River, which forms the western District boundary. The entire river frontage of lands included in this project extends 2.6 miles in length. Redevelopment would occur via implementation of several individual projects within the District boundary. To date, the City of Sacramento Development Services Department is moving ahead with development of a Specific Plan for the District (City of Sacramento Development Services 2009).

4.3. Growth-Inducing Effects

Repair of the levee system within the SRBPP action area would not directly encourage or facilitate growth. Erosion repairs would have a less-than-significant effect on regional population increases, since such repairs would not remove any existing obstacles to growth. All new development must be consistent with existing city and county general plan policies and zoning ordinances related to land use, open space, conservation, flood protection, and public health and safety. In addition, all future development would need to comply with applicable environmental laws and regulations and would require approval by local, and in some cases, state and federal authorities (e.g., projects requiring the discharge of fill into waters protected under the CWA). Therefore, the proposed action would not significantly contribute to any cumulative growth-inducing impacts in the SRBPP action area.

4.4. Effects of the Proposed Action on Federally Listed Species, Critical Habitat, and Essential Fish Habitat

This section summarizes the direct, indirect, and cumulative effects of the proposed action on federally listed species, as defined by the ESA, and effects of the proposed action on critical habitat and essential fish habitat (EFH).

4.4.1. Direct and Indirect Effects

4.4.1.1. Federally Listed Plant Species

No federally listed plant species occur within the action area. Therefore, the proposed action would not affect any federally listed plant species.

4.4.1.2. Federally Listed Fish Species

Federally listed fish species that occur within the action area include green sturgeon, delta smelt, Central Valley steelhead, Central Valley spring-run Chinook salmon, and Sacramento River winter-run Chinook salmon. Construction activities at all erosion sites with waterside repairs could generate noise, suspended sediment, turbidity, and sediment deposition. These disturbances could result in localized and temporary displacement, or impairment of feeding, migration, or other essential behaviors, of adult and juvenile federally listed fish species. Effects to federally listed fish species could also occur in areas downstream of the erosion sites, since noise and sediment may be propagated downstream.

Accidental discharge of toxic substances during construction could cause physiological impairment or mortality of listed fish and other aquatic species at or immediately downstream of the erosion sites. The potential also exists for injury or mortality of federally listed fish if individuals are unable to readily move away from channel or nearshore areas directly affected by in-water construction activities. For juvenile fish that are able to readily move away from areas directly affected by in-water construction activities, the potential exists for increased mortality due to predation in deeper habitats away from shore.

Long-term effects of the proposed action on the habitat of federally listed fish species include alteration of river hydraulics, in-stream and overhead cover, and substrate conditions along the seasonal low- and high-flow shorelines of the erosion sites. Implementation of the proposed action would result in temporary losses of riparian vegetation and in-stream cover along the summer/fall and winter/spring shorelines. However, the establishment and growth of riparian vegetation on the riparian benches and/or upper banks at all sites is expected to increase habitat values by increasing the extent of available instream and overhead cover. Based on the SAM modeling, which indicates that on-site project design features at the 22 waterside-repair sites in Regions 1a, 1b, 2, and 3 (see section 3.5) would not fully mitigate for losses of juvenile rearing and smolt outmigration lifestages during summer and fall, the Corps would purchase or develop suitable compensation mitigation within 50 miles of the sites.

The SAM modeling indicates a loss of summer spawning, incubation, and rearing habitat values for delta smelt at all sites in Regions 1a and 1b due to loss of shallow water habitat (i.e., steeper bank slope), coarsening of bank substrate size, initial removal of instream cover during construction, and long-term loss of aquatic vegetation. These changes would not be offset by the planned installation of increased IWM cover in all seasons. Combined SAM model results for delta smelt at the 10 erosion sites in Regions 1a and 1b indicate that initial habitat losses in all seasons for all modeled life stages would be regained by Year 1 in winter and spring, but persist and would not be regained until after Year 50 in summer. As identified in section 3.5, habitat compensation requirements for delta smelt would be met by applying the habitat created in the

Cache Slough/Yolo Bypass Mitigation Area (U.S. Army Corps of Engineers 2008a, 2008e). Although some spawning, incubation, and rearing may occur during summer, the majority of the activity periods for these life history stages occur in winter and spring, and the actual effect of these losses on delta smelt is unlikely to be substantial because delta smelt do not typically occur upstream of RM 20 (Moyle 2002). Therefore, no long-term adverse effects are expected for delta smelt spawning, incubation, or rearing at these sites.

4.4.1.3. Federally Listed Wildlife Species

Federally listed wildlife species that could occur within the action area include valley elderberry longhorn beetle and giant garter snake.

Valley Elderberry Longhorn Beetle

Suitable habitat for the valley elderberry longhorn beetle (i.e., elderberry shrubs) occurs within 10 of the erosion sites: SAC 41.9R, FR 1.0L, FR 3.7L, FR 5.5L, LAR 10.0L, LAR 10.6L, CC 2.8L, CC3.4L, SAC 73.5L, and SAC 157.7R. Additionally, elderberry shrubs occur within 100 feet of the construction easement of SAC 10.8L and SAC 130.0L.

Elderberry shrubs located at SAC 10.8L, SAC 130.0L, CC 2.8L, and CC 3.4L would not be directly affected by construction activities. The elderberry shrubs at SAC 10.8L and SAC 130.0L are not located within the construction easement and would not be disturbed by construction activities. The elderberry shrubs at CC 2.8L and CC 3.4L are located on the waterside of the existing levee and would not be disturbed by construction of the setback levees.

Approximately 42 individual elderberry shrubs and shrub clusters, with a total of 215 elderberry stems 1 inch or greater in diameter, occur at LAR 10.0L and LAR 10.6L. These elderberry shrubs would be preserved during construction activities by building plywood enclosures (or other protective measures approved by the USFWS) around the shrubs and shrub clusters. A biological monitor would be present during construction of the plywood enclosures to ensure that all elderberry shrubs intended to be preserved are identified and adequately protected prior to vegetation clearing. For the remaining sites, all elderberry shrubs are anticipated to be removed and transplanted to a USFWS-approved mitigation bank or offsite mitigation area. Approximately 33 individual elderberry shrubs and shrub clusters, with a total of 147 elderberry stems 1 inch or greater in diameter, are anticipated to be removed and transplanted. In the event that some of these shrubs are located outside of the final footprint of the repairs, they would be avoided and preserved in place.

Direct effects on the valley elderberry longhorn beetle could result from the removal of or damage to elderberry shrubs during construction activities. Such removal or damage could result in direct mortality of adults or larvae occupying the shrubs. Reproduction and foraging could be impaired because valley elderberry longhorn beetles rely on elderberry foliage for food and lay their eggs on elderberry stems. Noise and other construction-related disturbance (e.g., dust generated during vegetation clearing and placement of revetment) could also result in direct effects.

Indirect effects on the valley elderberry longhorn beetle could result from temporal loss of habitat value (i.e., time between initiation of revegetation and maturation of the riparian

vegetation community) due to removal of adjacent riparian vegetation where elderberry shrubs are preserved in place. Temporal loss of habitat value could also occur during removal and transplanting of shrubs; elderberry shrubs are typically pruned during transplantation efforts, which could reduce habitat suitability. The erosion sites where elderberry shrubs are preserved would be revegetated with riparian species, and riparian vegetation would be planted within the offsite mitigation area concurrently with transplantation of the removed elderberry shrubs. However, revegetated areas require time to mature and replace lost habitat values. Temporal loss of habitat could reduce the amount of habitat available for beetles, fragment suitable habitat, and isolate subpopulations. Where elderberry shrubs are preserved in place (i.e., LAR 10.0L and LAR 10.6L), indirect effects on the valley elderberry longhorn beetle (e.g., disturbance from human activity) could result from activities associated with monitoring the revegetated areas, including maintenance of irrigation, removal of invasive plant species, and replacement of any dead plantings.

Prior to any construction activities, exclusionary fencing (e.g., 4-foot-tall plastic orange mesh) would be erected around all elderberry shrubs located outside of the final footprint of the repairs, but within the construction easement. The fencing would be placed under the supervision of a qualified biologist, and signage prohibiting disturbance would be installed along the fencing. Worker environmental awareness training would be conducted at all erosion sites where elderberry shrubs are to be preserved. Following completion of the levee repairs at all sites containing elderberry shrubs to be preserved, a post-construction evaluation would be conducted by a qualified biologist to determine if any shrubs had been damaged by construction activities. If damage to elderberry shrubs intended to be preserved is identified, the USFWS would be consulted to determine appropriate compensatory measures, and the compensatory measures (if necessary) determined in consultation with the USFWS would be implemented.

All elderberry shrubs to be removed from the footprint of the levee repairs would be transplanted to an off-site location approved by the USFWS. Timing, transplant techniques, and ratios for plantings of additional elderberry shrubs and associated native plant species would be approved by the USFWS. A qualified biologist would monitor the transplanting of all elderberry shrubs to ensure that all requirements of the USFWS are fulfilled.

Giant Garter Snake

Suitable habitat for the giant garter snake within the 25 erosion sites is limited to SBP 0.4E. The proposed action has the potential to result in direct and indirect effects to this species if it is present within SBP 0.4E.

Direct effects could include mortality or injury of individuals during construction activities (e.g., vegetation clearing and placement of revetment); displacing individuals into areas where they are exposed to a greater risk of predation; temporary reduction in the availability of prey; disturbance from construction-related noise, vibration, and human presence; and degradation of water quality from increases in turbidity and/or release of hazardous materials (e.g., fuel, lubricants).

Indirect effects could include removal of emergent wetland vegetation that provides escape cover and foraging opportunities; removal of upland habitat for basking, cover, and retreat sites; and disturbance from human activity associated with monitoring the revegetated

areas (e.g., maintenance of irrigation, removal of invasive plant species, replacement of dead plantings).

Unless otherwise approved by the USFWS, construction activities at SBP 0.4E would be initiated only during the giant garter snake active period (May 1 to October 1), when individuals are active on the surface and able to move away from disturbance. Prior to initiation of construction activities, workers would participate in USFWS-approved worker environmental awareness training provided by a qualified biologist. The training would instruct workers on how to identify the snake and its habitats, what to do if a snake is encountered during construction activities, and how to contact the designated biological monitor. Within 24 hours prior to commencement of construction activities, the site would be inspected for the presence of giant garter snake by a qualified biologist. If a giant garter snake is encountered, all construction activities with a potential to disturb the snake would be stopped, the USFWS would be notified, and the snake would be allowed to leave the area on its own.

Giant garter snake habitat that can be avoided would be clearly identified on construction plans, and these locations would be clearly identified as avoidance areas. Exclusionary fencing and signage would be erected to delineate avoidance areas, and no construction disturbance would be allowed within the avoidance areas. Appropriate BMPs would be implemented to minimize the potential for soil, sediment, or hazardous materials (e.g., fuel, oil) from entering the aquatic habitat.

4.4.2. Cumulative Effects

Under the ESA, cumulative effects are defined as “those effects of future state, tribal, local, or private actions, not involving federal activities that are reasonably certain to occur within the action area” (50 C.F.R. § 402.02). Future federal actions are not included in the definition of cumulative effects because they require separate consultation pursuant to section 7 of the ESA. For the purposes of this cumulative effects assessment, the action area is defined as the Sacramento River watershed.

A number of future commercial and private activities, including hatchery operations, timber harvest, recreation, and urban and rural development, could potentially affect federally listed species in the Sacramento River watershed. Cumulative effects may also result from non-federal rock revetment projects. Some non-federal rock revetment projects carried out by state or local agencies (e.g., reclamation districts) that do not fill wetlands or occur below the ordinary high water mark would not need CWA section 404 permits from the Corps and resulting section 7 (ESA) consultations. These types of actions are possible at many locations throughout the action area, but are not included as part of the proposed action. Future levee maintenance activities by state agencies and local reclamation districts are likely to be implemented at intensities similar to those of recent years.

Potential cumulative effects on all federally listed species addressed in this EA/IS could result from wave action in the water channel caused by boats that may degrade riparian and wetland habitat and erode banks; recreational activities that could disturb species or damage suitable habitats; dumping of domestic and industrial garbage; land uses that result in increased

discharges of pesticides, herbicides, oil, and other contaminants; and conversion of riparian areas for urban development.

Potential cumulative effects on federally listed fish species could result from any future non-federal diversions of water that may entrain adult or larval fish or that may incrementally decrease outflows, thus changing the position of habitat for these species. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses and power production. Several new diversions are in various stages of completion.

Future population growth in the Sacramento River watershed is expected to drive the development of housing and commercial and industrial land uses; conversion or development of agricultural land uses; and expansion of transportation and water resource infrastructure. Some of these developments may not require federal involvement (e.g., permits, funding) and thus not be subject to section 7 consultation under the ESA. Cumulative effects on the valley elderberry longhorn beetle and giant garter snake could result from loss, degradation, or fragmentation of riparian and other habitats where the species occur (e.g., removal of elderberry shrubs, conversion of rice fields to alternate land uses).

Future non-federal agricultural and levee maintenance activities that could result in cumulative effects on valley elderberry longhorn beetle and giant garter snake include fluctuations in aquatic habitat due to water management; dredging and clearing of vegetation from irrigation canals; use of burrow fumigants on levees and other upland refugia; armoring canals and stream banks; fluctuations in acreages of rice production due to market conditions or water availability; routine maintenance of upland habitat; and degradation of water quality from contaminated run-off.

Cumulative effects on federally listed species (notably fish) could also result from the effects of climate change. A number of climate models show that there will be changes in snowfall timing, pattern, and snowpack depth associated with climate change, accompanied by altered runoff patterns as a result of earlier snowmelt. The most likely shift would be for the highest runoff to shift to wintertime, rather than in the spring (Hanak and Lund 2008). While the actual change in snowfall timing, pattern, and snowmelt patterns as a consequence of climate change are not known with certainty, evidence indicates that changes will occur (Stewart et al. 2004, Maurer 2007, Hanak and Lund 2008, Lund et al. 2008). Changes in runoff patterns are likely to affect the timing of adult upstream spawning migration, spawning, juvenile rearing, and downstream migration of juveniles for federally listed fish species. Alteration of prey dynamics and feeding behavior is likely to occur as well. The actual effects of climate change on federally listed fish species are uncertain but are likely to be profound (Healy et al. 2008). Sea-level rise as a consequence of climate change is already under way, and is likely occur at an increasing rate over time (Intergovernmental Panel on Climate Change 2007, Cayan et al. 2008, Healy et al. 2008, Lund et al. 2008). The effects of sea level rise would be most pronounced in Reach 1a and would likely have the most immediate effect on delta smelt foraging and rearing habitat in the Delta (Healy et al. 2008). Juvenile salmonid smolts frequently spend a variable period of time holding and foraging in tidal areas of the Delta before completing their migration to sea (Allen

and Hassler 1986, Healey 1991, MacFarlane and Norton 2002). The full range of effects of sea level rise on foraging and rearing habitat for juvenile salmonids is unknown, but currently available evidence indicates that effects are highly likely. Undetermined effects on all life stages of green sturgeon are also likely as the sea level rises over time. Climate change effects are an ongoing background condition and are not likely to be exacerbated by the proposed action.

4.4.3. Critical Habitat

Federally listed species that may occur within the 25 erosion sites addressed in this EA/IS include green sturgeon, delta smelt, Central Valley steelhead, Central Valley spring-run Chinook salmon, winter-run Chinook salmon, valley elderberry longhorn beetle, and giant garter snake. Critical habitat has not been proposed or designated for giant garter snake. Critical habitat has been designated for the valley elderberry longhorn beetle, but none of the 25 erosion sites occur within designated critical habitat for this species. The proposed action does occur within designated critical habitat for delta smelt, Central Valley steelhead, Central Valley spring-run Chinook, and Sacramento River winter-run Chinook salmon, and proposed critical habitat for green sturgeon.

Standards for determining adverse modification or destruction of critical habitat are set forth in Section 7(a)(2) of the ESA. Destruction or adverse modification of critical habitat is defined as “a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species” (U.S. Fish and Wildlife Service 1986).

Based on implementation of the conservation elements of the proposed action (e.g., installation of IWM, revegetation with native riparian plant species) and implementation of the mitigation measures identified in section 3.7; the Corps and CVFPB do not anticipate that the proposed action would result in the destruction or adverse modification of designated or proposed critical habitat for any federally listed species.

4.4.4. Essential Fish Habitat

EFH includes all waters and substrate necessary for use by covered fish species for spawning, breeding, feeding, or growth to maturity. The proposed action includes areas that have been designated as EFH for Chinook salmon, a major contributor to Pacific Coast salmon fisheries. The Pacific Coast salmon fishery EFH extends along the Pacific Coast from Washington to Point Conception in California. Freshwater EFH within the action area includes all habitats currently and historically accessible to Chinook salmon. The EFH excludes areas above naturally occurring barriers such as waterfalls, which have been present for several hundred years, and impassible dams identified on large rivers (67 CFR 2343, January 17, 2002).

Effects of the proposed project on EFH are identified in section 3.5 of this EA/IS. The Corps and CVFPB have determined that the proposed action may adversely affect EFH for Chinook salmon at the erosion sites and downstream channel reaches. This EA/IS serves as the EFH assessment and will be submitted to NMFS in accordance with required consultation under the Magnuson-Stevens Fishery Conservation and Management Act. It is anticipated that EFH consultation will be integrated with section 7 ESA consultation.

4.4.5. Determination

Based on information presented in this EA/IS, the Corps has determined that the proposed action:

- may affect, and is likely to adversely affect, green sturgeon, delta smelt, Central Valley steelhead, Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, valley elderberry longhorn beetle, and giant garter snake;
- may affect, but would not result in the destruction or adverse modification of, designated or proposed critical habitat for green sturgeon, delta smelt, Central Valley steelhead, Central Valley spring-run Chinook salmon, and Sacramento River winter-run Chinook salmon;
- would not affect designated critical habitat for valley elderberry longhorn beetle; and,
- may adversely affect essential fish habitat for Chinook salmon.

A programmatic biological assessment has been prepared for Phase II of the SRBPP (U.S. Army Corps of Engineers 2007a). Therefore, a separate biological assessment for the proposed action is not required. The Corps requests that the proposed action be appended to the programmatic consultations for Phase II of the SRBPP (National Marine Fisheries Service 2008, U.S. Fish and Wildlife Service 2008b).

CHAPTER 5

Compliance with Environmental Laws and Regulations

5. COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

5.1. Federal Requirements

5.1.1. National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies to identify and disclose the potential environmental effects of their proposed actions. The act and the associated Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Requirements of NEPA establish a process for considering the environmental effects of a proposed action and alternatives in federal decision making. NEPA is an "umbrella" act, under which agencies also comply with other environmental laws.

Under NEPA, agencies prepare an EA to determine whether a proposed action would significantly affect the environment. If the effects could be significant, then an environmental impact statement (EIS) is prepared. If the proposed action would not result in significant impacts, then the federal agency issues a finding of no significant impact (FONSI). The FONSI may address measures that the lead agency will take to reduce (mitigate) potentially significant impacts.

This draft EA/IS serves as public notification of the proposed action. The draft EA/IS provides evidence that the proposed action, including the incorporated mitigation measures, would not significantly affect the environment. The draft EA/IS will be circulated for public review and comment. After the public review period, assuming that no significant effects are identified, the Corps will prepare a final EA/IS and issue a FONSI. This will complete the NEPA documentation required for the proposed action.

5.1.2. Federal Endangered Species Act

A programmatic biological assessment (BA) was completed by the Corps in 2007 to address continued levee repair actions under the remaining Phase II authority (U.S. Army Corps of Engineers 2007). In response, NMFS and USFWS issued programmatic biological opinions (BOs) in June and July of 2008 (National Marine Fisheries Service 2008, U.S. Fish and Wildlife Service 2008). Coordination with NMFS and USFWS has been ongoing throughout the planning process for the proposed repairs.

This EA/IS serves as the BA that will be submitted to NMFS and USFWS requesting formal Section 7 consultation and requesting that the proposed action be appended to the programmatic BOs for Phase II. Based on the findings of this EA/IS, the Corps has determined that the proposed action is likely to adversely affect, but not jeopardize or appreciably reduce the likelihood of either the survival or the recovery of, seven federally listed species, including delta smelt, green sturgeon, Central Valley spring-run Chinook salmon, Central Valley steelhead, Sacramento winter-run Chinook salmon, valley elderberry longhorn beetle, and giant garter snake.

5.1.3. National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires a federal agency to consider the effects of federal undertakings on historical and archaeological resources. The implementing regulations for Section 106 are codified at 36 CFR Part 800, as amended, "Protection of Historic Properties," which requires federal agencies to give the State Historic Preservation Officer (SHPO) an opportunity to advise and assist with projects potentially affecting cultural resources. Historic properties that meet specified criteria may be found to be eligible for inclusion on the National Register of Historic Places.

Multiple archeological investigations have been prepared for the proposed action (SWCA Environmental Consultants, Inc. 2008a, 2008b; North State Resources, Inc. 2009; Panamerican Consultants, Inc. 2009). These reports document the findings of the cultural and historic archival research and field investigations. Prior to implementation of any activities affecting potentially significant cultural or historic resources, consultation with the SHPO will be completed in compliance with Section 106 of the NHPA.

5.1.4. Clean Air Act

The Corps has completed an analysis of air quality effects of the proposed action. The proposed action would potentially exceed local air quality standards; however, the proposed action would not exceed the federal de minimus criteria. Payments of $171,398 to the SMAQMD and $302,095 to the FRAQMD (current estimates) would be made to offset future emissions. Air quality emissions data are included in Appendix I.

5.1.5. Clean Water Act

The proposed action involves the discharge of fill material (i.e., quarry stone) into waters of the United States. Placement of these materials is also likely to temporarily increase turbidity from the re-suspension of sediments on the bottom of the waterbody. A Section 401 Water Quality Certification application addressing the proposed activities is included as Appendix G. A Section 404(b)(1) Alternatives Analysis is included as Appendix H. Section 401 Water Quality Certification shall be obtained prior to the discharge of fill material into waters of the United States.

Prior to any construction activities, construction contractors shall obtain authorization under the State General Construction Activity Stormwater Permit (General Permit) adopted by the State Water Resources Control Board. Compliance with the General Permit will require that appropriate BMPs are implemented to ensure that impacts to water quality are minimized.

5.1.6. Magnuson-Stevens Fishery Conservation and Management Act

Consultation with NMFS is required for all projects having the potential to affect Essential Fish Habitat (EFH) for any species covered under the Magnuson-Stevens Fishery Conservation Management Act. The Corps has determined that the proposed action would adversely affect EFH for Chinook salmon. This EA/IS serves as the EFH assessment that will be

submitted to NMFS. The Corps will complete the required consultation with NMFS prior to implementation of the proposed action.

5.1.7. Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, as amended, requires federal agencies to consult with the USFWS and state fish and wildlife agencies during project planning. Under the act, this coordination is intended to foster consideration of fish and wildlife conservation, including for projects where waters are proposed, authorized, permitted, or licensed to be impounded, diverted, or otherwise controlled by any agency under the federal permit or license. A Fish and Wildlife Coordination Act Report from USFWS is expected in July 2009.

5.1.8. Wild and Scenic Rivers Act

The Lower American River from Nimbus Dam to its confluence with the Sacramento River is designated as Recreational under the Wild and Scenic Rivers Act. The proposed action would neither adversely affect the resources for which the river was designated nor adversely affect the river's free-flowing status.

5.1.9. Bald and Golden Eagle Protection Act

This law provides for the protection of the bald eagle and golden eagle by prohibiting take, possession, sale, purchase, barter, transport, export, or import, or offer to trade any bald or golden eagle, alive or dead, including any part, nest, or egg unless authorized by permit. The proposed action includes the implementation of mitigation measures to minimize the potential for adverse effects to nesting raptors.

5.1.10. Migratory Bird Treaty Act

Most of the birds found in the proposed action area are protected under the MBTA. Project construction has the potential to directly take nests, eggs, young, or individuals of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. The proposed action incorporates measures that will minimize the potential for adverse effects to migratory birds.

5.1.11. Executive Order 13186, Protection of Migratory Birds

Executive Order 13186 emphasizes conservation and management of migratory bird species that are not necessarily protected under the Endangered Species Act, but are protected under the Migratory Bird Treaty Act. This order directs federal agencies whose activities will likely result in take of migratory birds to develop and implement a Memorandum of Understanding with the USFWS to promote bird conservation

5.1.12. Executive Order 13112, Invasive Species

Executive Order 13112, adopted in 1999, requires federal agencies to use relevant programs and authorities to prevent the introduction of invasive plant species; detect and control populations in a cost-effective and environmentally sound manner; provide for restoration of

native plant species; promote public education on invasive plant species; and not authorize, fund or carry out actions to cause or promote the spread or introduction of invasive plant species. Executive Order 13112 includes provisions of NEPA, the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (as amended (16 U.S.C. 4701 *et seq.*), the Lacey Act (as amended (18 U.S.C. 42)), the Federal Plant Pest Act (7 U.S.C. 150aa *et seq.*), the Federal Noxious Weed Act of 1974 (as amended (7 U.S.C. 2801 *et seq.*), the Endangered Species Act of 1973 (as amended (16 U.S.C. 1531 *et seq.*), and other pertinent statutes to prevent the introduction of invasive plant species and provide for their control; and to minimize the economic, ecological, and human health impacts of invasive species. Executive Order 13112 also requires federal agencies to coordinate with state and local agencies in the management of undesirable plants.

The proposed action includes measures to inhibit the introduction, spread, or reestablishment of invasive plant species. Invasive plants would be removed in their entirety and revegetation of disturbed areas with native plant species would be initiated after completion of construction activities. The revegetated areas will be monitored for 3 years following completion of construction.

5.1.13. Executive Order 11988, Flood Plain Management

Executive Order 11988 requires federal agencies to avoid, to the extent possible, adverse effects associated with human occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative. Under this executive order, the Corps provides leadership and takes action to: (1) avoid development in the base (100-year) floodplain; (2) reduce the hazards and risk associated with floods; (3) minimize the effect of floods on human safety, health, and welfare; and (4) restore and preserve the natural and beneficial values of the base floodplain. The proposed action is in compliance with this executive order.

5.1.14. Executive Order 11990, Protection of Wetlands

Executive Order 11990 prescribes wetlands policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. The order requires federal agencies to follow “avoidance-mitigation-preservation” procedures and provides the opportunity for public input before proposing new construction in wetlands. It also requires federal agencies to avoid impacts on wetlands where practicable.

Executive Order 11990 directs the Corps to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in implementing civil works. The proposed action would not result in the long-term loss or degradation of any wetlands and is in compliance with this executive order.

5.1.15. Executive Order 12898, Environmental Justice

The Executive Order on Environmental Justice requires federal agencies to identify and address disproportionately high and adverse human health and environmental effects of the

agencies' programs, policies, and activities on minority populations and low-income populations. The proposed action would not have a disproportionally adverse effect on any minority or low-income communities and is in compliance with this executive order.

5.1.16. Farmland Protection Policy Act

The Farmland Protection Policy Act is contained in the Agriculture and Food Act of 1981. Associated rules and regulations were promulgated in 1994. The act is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. The USDA Natural Resources Conservation Service is charged with oversight of the act.

Construction of setback levees at sites CC 2.8L, CC 3.4L, and DC 0.9N would result in the loss of approximately 8 acres of orchard (designated as prime and unique farmland) and 2 acres of pasture. These areas represent a small proportion of the agricultural land in active use in the adjacent landscape, and the intent of the setback levees is to provide flood protection to the surrounding agricultural lands. Therefore, the loss of agricultural land required to construct the setback levees would not significantly contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.

5.2. State of California Requirements

5.2.1. California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires state and local agencies to evaluate and reduce significant environmental impacts associated with discretionary projects proposed to be carried out or approved by state or local agencies that could have an adverse effect on the physical environment. For this project, CEQA requirements are jointly addressed with NEPA requirements in this document. The draft EA/IS will be circulated for public review and comment. After the public review period, the CVFPB expects to adopt a mitigated negative declaration and prepare a Notice of Determination (NOD), which will complete the CEQA documentation required for the proposed action.

5.2.2. California State Lands Commission

The California State Lands Commission has exclusive jurisdiction over all ungranted tidelands and submerged lands retained in state ownership, including the beds of navigable rivers, sloughs, and lakes. A project is not authorized on these state lands unless a lease is first obtained from the State Lands Commission. The SRBPP has a Master Lease approved by the State Lands Commission in May 1988 for bank protection work. Each new bank protection project requires an amendment to this lease. An amendment to the lease will be obtained prior to placement of materials in state lands.

5.2.3. California Regional Water Quality Control Board

The proposed action involves the discharge of fill material (i.e., quarry stone) into waters of the United States. Placement of these materials is also likely to temporarily increase turbidity

from the re-suspension of sediments on the bottom of the waterbody. Section 401 of the Clean Water Act requires that applicants affecting waters of the United States obtain a Water Quality Certification from the applicable Regional Water Quality Control Board. A Water Quality Certification application addressing the proposed activities is included as Appendix G. Section 401 Water Quality Certification shall be obtained prior to the discharge of fill material into waters of the United States.

Prior to any construction activities, construction contractors shall obtain authorization under the State General Construction Activity Stormwater Permit (General Permit) adopted by the State Water Resources Control Board. Compliance with the General Permit will require that appropriate BMPs are implemented to ensure that impacts to water quality are minimized.

5.2.4. California Endangered Species Act

Pursuant to the California Endangered Species Act (CESA), an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the proposed project could have a significant impact on such species. Rare plants are also protected under the Native Plant Protection Act (NPPA). The DFG is the agency responsible for maintaining the list of endangered, threatened and rare species afforded protection under the CESA and NPPA. The DFG also maintains a list of "species of special concern" that serves as a watch list of sensitive species. The proposed action would implement the mitigation measures identified in the Biological Resources section of the EA/IS to minimize the potential for adverse effects to state-listed species and species of special concern.

5.2.5. Streambed Alteration Agreement

DFG is responsible for conserving, protecting, and managing the state's fish, wildlife, and native plant resources. Fish and Game Code (Section 1602) requires an entity to notify DFG of any proposed activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake. If DFG determines that the activity may substantially and adversely affect fish and wildlife resources a Streambed Alteration Agreement is prepared, and the entity may proceed with activity accordingly. Because the SRBPP is a federal project, a Streambed Alteration Agreement is not required.

5.2.6. Delta Protection Act

The Delta Protection Act created the Delta Protection Commission (DPC) and charged the DPC with the preparation and adoption of a Land Use and Resource Management Plan for the Primary Zone of the Delta. Local government general plans are required to be consistent with the Management Plan.

Five of the erosion sites (SAC 8.0L, SAC 10.8L, SAC 26.0L, SAC 35.4L, and SAC 41.9R), are located in the Primary Zone of the Delta. The proposed action conforms to the Management Plan, by providing flood protection; prioritizing levee maintenance, rehabilitation, and upgrading; and maintaining of an inventory of levee conditions in the Delta.

5.2.7. Williamson Act

The California Land Conservation Act, commonly known as the Williamson Act, enables local governments to enter into contracts with private land owners for the purpose of restricting specific parcels of land to agricultural or open space use. In return, landowners receive tax assessments that are lower than full market value. Contracts run for a rolling term of 10 years with automatic renewals, unless either party files a notice of nonrenewal.

Construction of setback levees at sites CC 2.8L, CC 3.4L, and DC 0.9N would result in the loss of approximately 8 acres of orchard (designated as prime and unique farmland) and 2 acres of pasture. These areas represent a small proportion of the agricultural land in active use in the adjacent landscape. Some of the land to be used for construction of the setback levees is currently under Williamson Act contract. Obtaining easements and constructing setback levees would not affect the status of the Williamson Act contracts.

5.3. Local Compliance

5.3.1. Sacramento Metropolitan Air Quality Management District

Project-related emissions exceeding daily thresholds for NOx would be offset by a fee payment of $171,398.00 to the SMAQMD. Air quality emissions data is included in Appendix I. BMPs for ozone and particulate matter would be implemented during construction to minimize project effects on ambient air quality. Implementation of fee payment and BMPs would ensure project compliance with the local air district regulations.

5.3.2. Yolo-Solano Air Quality Management District

Project-related emissions would exceed the daily threshold for NOx; however, the YSAQMD does not require the payment of fees to offset such exceedances. Air quality emissions data are included in Appendix I. BMPs for ozone and particulate matter would be implemented during construction to minimize project effects on ambient air quality. Implementation of BMPs would ensure project compliance with the local air district regulations.

5.3.3. Feather River Air Quality Management District

Project-related emissions exceeding daily thresholds for NOx would be offset by a fee payment of $302,095.00 to the FRAQMD. Air quality emissions data is included in Appendix I. BMPs for ozone and particulate matter would be implemented during construction to minimize project effects on ambient air quality. Implementation of fee payment and BMPs would ensure project compliance with the local air district regulations.

CHAPTER 6

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CHAPTER 7

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